



Joint Annual Convention of the State Board of Horticulture and State Horticultural Society, Held at Grand Junction, Colorado, December 17-18, 1912.  
Courtesy of The Intermountain Fruit Journal.

Annual Report  
of the  
State Board of Horticulture

And the Proceedings of the Joint Convention of  
The State Board of Horticulture  
The State Horticultural Society

Held at Grand Junction, Colorado  
December 17 and 18, 1912

Edited by Albert E. Mauff, Secretary

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Annual Report  
of the  
State Entomologist  
1912

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Report of the  
State Bee-Keepers' Association

State of Colorado, for the Year 1912

The Twenty-Fourth Volume



DENVER, COLORADO  
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1913

LETTER OF TRANSMITTAL

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To His Excellency,  
HON. ELIAS M. AMMONS,  
Governor of Colorado.

Sir: In accordance with the law, we have the honor to transmit to you the twenty-fourth annual report of the State Board of Horticulture, including the proceedings of the annual horticultural convention and reports from the county horticultural inspectors; also the fourth annual report of the State Entomologist, and the report of the thirty-third annual convention of the State Bee-Keepers' Association.

In horticulture, conditions are constantly changing, and new emergencies have to be met. It has been the earnest desire of this board to assist in determining these matters in a manner that would best promote the interests of this great industry in our state. We hope that our efforts have not been in vain, and that they will meet with your approval.

Respectfully submitted,

STATE BOARD OF HORTICULTURE,

ALBERT E. MAUFF,  
Secretary.

COLORADO STATE BOARD OF HORTICULTURE  
Capitol Building, Denver

IRA B. CLINE, President.....Paonia  
DR. W. W. TICHENOR, Vice-President.....Rifle  
C. E. PARFET.....Golden  
D. R. STOTLER.....Fort Lupton  
JOHN HARBERT.....Manzanola  
ALBERT E. MAUFF, Secretary.....Denver

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STATE HORTICULTURAL SOCIETY

HON. JOHN H. CROWLEY, President.....Rocky Ford  
DR. W. W. TICHENOR, Vice-President.....Rifle  
W. S. HASWELL, Treasurer.....Denver  
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EXECUTIVE COMMITTEE

MRS. LUTE WILCOX.....Denver  
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B. F. ROCKAFELLOW.....Canon City



# PROCEEDINGS

OF THE

## Annual State Horticultural Convention

GRAND JUNCTION, COLORADO,  
DECEMBER 17-18, 1912

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DECEMBER 17, 10:30 A. M.

Joint convention of the State Board of Horticulture and the State Horticultural Society, by invitation of the Grand Junction Chamber of Commerce.

The convention was called to order by Mr. L. Antles, secretary of the Grand Junction Chamber of Commerce.

Mr. Antles: We will first have the invocation by Rev. Mr. Smith.

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### INVOCATION

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REV. F. C. SMITH, GRAND JUNCTION, COLORADO

Most gracious God, our Heavenly Father, we pray that Thou wilt be with this assemblage this morning. We offer up our thanks to Thee for the yearly return of the seed-time and the harvest, and for the fulness of the earth and the blessings thereof; and for all other blessings which Thou hast so richly bestowed upon us we give Thee thanks; and may this land of ours continue to pour forth its great bounty upon us—through Jesus Christ, our Lord. Amen.

Mr. Antles: One of the chief industries of our state is that of horticulture; and we have in our state a State Board of Horticulture and a State Horticultural Society, which, as you know, hold an annual convention. A year ago Mr. Shaffer, then secretary of our Chamber of Commerce, and representing the people of Grand Junction, invited these two bodies to meet here this year for their annual convention. Of course, he had no thought then that the mountain passes of Colorado would be blocked, as they are at this time, making it difficult for the people on the eastern slope to attend. I presume, also, he thought the valley would respond even more strongly than it has this morning. I wish to assure you, however, that we are glad to have you with us, and I have no doubt that great good will come out of this convention. In behalf of Grand Junction, Mayor Todd will bid you welcome.

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### ADDRESS OF WELCOME

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MAYOR THOMAS M. TODD, GRAND JUNCTION, COLORADO

Mr. Chairman, Ladies and Gentlemen: It is not the immensity of the audience which gives me inspiration in making the address of welcome this morning, but it is the fact that you are all here to determine

important questions that confront us, and that we have some with us in this convention who have come a considerable distance. They certainly should be commended for their zeal in the matter, and they are welcome to the city of Grand Junction on account of their interest in the cause we have before us.

The main question before this convention will be the distribution of the fruit product. This problem is one of the most important, if not the most important, to our section, and a great many other sections of our land. It is not only important to the State of Colorado, but it extends over the entire United States. We have been going along with our fruit-raising, feeling that the main thing we had to do was to produce the goods, make a proper pack, ship them out, put the money in our pocket, and spend our winters in the South. Some of you here have done this; but the time has arrived now when we have to do more than that. We have produced the fruit—we can produce it; but we have found out this year that we can also let it fall on the ground and rot, and spend our time at home struggling to live until the next crop.

So the one great question that is up before us now is the question of the distribution of that which we do produce. I don't know that I can make any suggestions along that line; I have not studied it very thoroughly; I don't know what ought to be done about it. But I do know that we have got to get together in these conventions, and we have got to study these questions, and we have got to map out some plan whereby this fruit can be distributed in a better manner, so that we can get better returns. At the present time there is no doubt but what there are thousands—hundreds of thousands—of people in the United States who have not even tasted a peach or a pear; and yet we have hundreds of thousands of boxes fall on the ground every year and rot. What is the trouble? That is the question for you to decide; and I feel certain that, when you all get together, and you enter into a broad-minded discussion of this matter, and in an unprejudiced manner thresh out this question, great good may come of it. I hope so at least.

Now, it is hard for me to talk, and I am not going to do very much along this line; but I hope great good will come of this meeting. I hope you will conduct your deliberations in an unprejudiced and unbiased manner. I hope you will listen to all that may be said by others, and, putting it all together in one lump, solve the question. The question resolves itself into just one: How are we going to get away from the proposition that we have produced so much fruit that we are hungry? Now, if the farmer who raises wheat produces so much of it that he is hungry, and if the horticulturist produces so much fruit that he is hungry, we know that there is something wrong. Where that wrong is, is the first thing to find out. We are the doctors to diagnose this case, this disease, if you want to call it so. It is a wrong system; somewhere there is something wrong. You must find out where that wrong is, and then apply the remedy.

Ladies and gentlemen, I am pleased to welcome you here. I commend you for your energy in getting here, and I hope the meeting will be so enthusiastic that those who have come from a distance will feel encouraged in their work.

I want to say that anything you see in Grand Junction is yours; anything you don't see, ask for it—ask for it, and, if it is within our power, we will grant it to you. I thank you. (Applause.)

Mr. Antles: Gentlemen, we have with us this morning, from our neighboring city of Paonia, the president of the State Board of Horticulture, who will speak on behalf of the board.

## RESPONSE

IRA B. CLINE, PRESIDENT STATE BOARD OF HORTICULTURE, PAONIA, COLORADO

Mr. Chairman, Ladies and Gentlemen: This was certainly unexpected to me; as I was not down on the program. The vice-president of our board, Dr. Tichenor, was on the program on behalf of our board, and he is a very good speaker on occasions such as this; but, as he has not yet arrived, I will just say for the board that we are glad to be with you: I know we shall all profit by the results of this convention.

I am not a public speaker; I am a fruit-grower. I believe I know what we fruit-growers want, and now we want to determine the question of how we are going to get it. I believe that will be the main issue here at this meeting, and the discussion of these problems will probably be somewhat spirited. I hope that we may all feel that what is good for one of us is good for all, when we take up the questions we have before us.

I am sorry that more of my near-by neighbors are not with us; but it takes about four days' time to come down from our country to attend this convention and get back again, and that probably accounts for the small attendance from my section.

As I am brim-full of the subject of fruit distribution—a subject that comes up later on the program—and as you will hear from me then, I feel that I had better give up the time to the program which has been prepared, and which is a long and interesting one.

On behalf of the board, I wish to express my hearty appreciation of the good-will that prompted the several speakers on this program to give to their time and effort to make this convention a success. Ladies and gentlemen, I thank you. (Applause.)

Mr. Antles: Despite the blockade on the Colorado passes, we have with us this morning some gentlemen from the eastern slope. I take pleasure in introducing to you Senator Crowley, of Rocky Ford, president of the State Horticultural Society, whom, I know, you will like to hear, and who will preside over this body during the rest of this session. (Applause.)

## RESPONSE.

SENATOR JOHN H. CROWLEY PRESIDENT STATE HORTICULTURAL SOCIETY,  
ROCKY FORD, COLORADO

Senator J. H. Crowley: (Applause.) They always do that, you know (meaning the applause), and I don't care how much noise you make. One time I remember making what I thought was a good speech, and a baby started to cry, while everyone else was still, and I said: "There's one fellow that knows a good thing when he hears it." (Laughter.)

The mayor here spoke about the main thing to determine being what to do with the fruit after you grow it. I have spent about twenty-six years attending these kind of meetings, and in those twenty-six years I have been trying to find out how to grow the very best fruit in the world. We meet every year, and we discuss it pro and con—how to grow the best fruit. Now, then, you say the main problem is how to distribute it, how to sell it; that is quite a question, and there is no doubt about it. I came here to this convention, after spraying fruit trees for about twenty years, to find out how to spray properly, and I am going to ask lots of questions before I get through. I came here to find out just the right kind of material to be used, and the best machine that is in use to apply it.

Now, fellow-horticulturists, don't get careless because prices are down, and think it is not worth the while to go to all this trouble. Grow the goods, and pack them right—and, I tell you, they have got to buy our



product. They didn't this year, but this is the first year this happened, and there is something wrong.

I attended the meeting at Canon City when the invitation to meet here was presented, and the people in attendance there seemed to jump at the idea that this was the proper place to hold our convention. I believe today that it is, and I believe you people will wake up to the fact that it is well that we did meet in your beautiful city. I attended a meeting at Canon City a few years ago, where there were seven hundred fruit-growers and business men. It seems to be different there from any other place I have been. The mayor of Canon City, every banker, every merchant, and their wives and their children, and all the fruit-growers, met there in joint session. Captain Rockafellow was there—that staunch friend whom we made an honorary member of the Horticultural Society last year. He is the most liberal man; he can never do enough for an outsider, or any person who seems to be a little bit backward. It was at this meeting that these seven hundred people stood up on their feet and gave me a vote of thanks for introducing to them the arsenate-of-lead spray; I was the first one to introduce it. Horticulturists used that spray, and the next year they used a carload; and they claim that that carload was the means of saving three hundred carloads of fruit—three hundred carloads more than was saved by the old-style spray which had been used. Those are things that go to make good; and that is the reason why I was given the vote of thanks.

Don't forget, when you leave this hall, to get together and talk. These questions are of just as much interest to men and women in this town and vicinity as they are to the Canon City people. The fruit business is of interest to every man in this state, whether he be a horticulturist or not. That is something the people of Canon City realize; the people of Canon City are in sympathy with the fruit-growers and their business, and for that reason they turn out and support them.

I will not take up your time in making any response. I am used to getting into the fight and trying to do things; and I hope everyone here will do his utmost to make this meeting a success by assisting in determining the matters confronting us. I can say that I am going to do my best to make it a success; and that is what we all should do—that is what makes these meetings.

By the way, I want to say to those of you who are a little blue over the low prices of fruit this season, that we have been growing cantaloupes at Rocky Ford for twenty years, and we have been growing the best cantaloupes, we think, in the world. Of course, we understand you people advertised that you beat us to it on growing cantaloupes and all that, but we stand on our record. (Laughter.) We have the goods.

Here is an illustration that I want to present to you on how successes can be made by close application and study. One of my young friends at Rocky Ford—in fact, my friends are nearly all young fellows—because the old fellows get grouchy—but a young fellow up there, by the name of Sam Matthews, rented 350 acres of land, paying fifteen dollars an acre, cash rent. He grew 220 acres of cantaloupes, and he shipped off the 220 acres 161 carloads of cantaloupes. They netted him, after all expenses, \$1.42 a crate; in other words, his total net earnings are between forty-four and forty-five thousand dollars. Now, I am **not giving** you any big stories; that is an absolute fact. That man also had forty-five carloads that were frozen, and he sold them to a man who had a government seed contract, at twelve cents; he sold those frozen melons for seed at twelve cents a pound; and, in fact, they are worth more than that; it is better seed than the government could get at that price.

In twenty years I cannot remember that this price for cantaloupes has ever been realized. I think the average of our association this year was about \$1.22; maybe \$1.20—something like that; and in twenty years I doubt if there have been—well, I will say, seven successful years in cantaloupes. I do not grow cantaloupes myself, but many of my neighbors

do; and our people never get discouraged, and they never quit. We have tried every way to figure out how to handle this fruit. This year, as a matter of fact, the commission men all over the United States organized themselves into a great body for the handling of cantaloupes. And that is one great trouble with our fruit associations: We hear of a good market, and we all ship into that market, and just cut each others throats. There is a lot to consider, gentlemen; and don't get discouraged for the reason that this year you have not had the best prices. We in our county are used to it now.

Now, gentlemen, you have been very attentive to what has been said, and I hope you will take part in the discussions to follow. We have a big program here, and it is going to take every minute of our time to get through. We shall have to dispose of the long-winded speeches and give the man who knows a chance. Let us push through with the program, and without unnecessary delay. I came here from Rocky Ford because I am interested in these meetings, and I know I shall get full value for the trip. I believe, when this convention is adjourned, you will all agree that it was well for you to be here.

Ladies and gentlemen, I thank you for your attention and attendance at this convention. We will now proceed with the program.

Senator Crowley (continuing): Well, ladies and gentlemen, as I am to act as chairman, I will now call on Mr. Mauff, and we will hear his report as secretary of the State Board of Horticulture.

Mr. Mauff: Mr. Chairman, Ladies and Gentlemen, and Fellow-Horticulturists: At Canon City last year the fruit-growers turned out in good style, and we had a most enthusiastic convention, as Mr. Crowley has told you; and when Mr. Shaffer invited us to your city, we knew our meeting this year would be a success, and, as Mr. Crowley has said, it is up to all of us to help make it so. I hope everyone here will take some part and feel that this meeting is for each and all of you, so that we may have an enthusiastic convention that will be of benefit to all.

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#### SECRETARY'S REPORT FOR 1912

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ALBERT E. MAUFF, SECRETARY STATE BOARD OF HORTICULTURE, DENVER, COLO.

The year 1912 was a most bounteous one with the horticulturists in most sections of the state, although there were failures in certain crops in a few localities. Failures in the fruit crops of Colorado were mostly on the eastern slope. In the Arkansas Valley the cherry crop was an almost total failure. The apple crop in this locality was also very small. The failure of the fruit crop in that section of the state was mostly due to the hard freeze in November, 1911, which was so severe that many large trees, both cherry and apple, were completely killed, and the fruit buds in nearly all instances destroyed.

There was also considerable loss in the fruit crop in this section, and also in the Montezuma Valley, through the ravages of the leaf-roller, which has been very injurious, especially of the upper Arkansas Valley, in the years of 1911 and 1912. Our ever-willing and industrious professors in the Department of Entomology at the State Agricultural College are extending every assistance possible in order to determine the best methods of combatting this persistent pest, and have obtained very good results in their investigations. More will be heard on this subject in the program before this convention.

The success of the fruit crops of the state this year is due to the very favorable spring, with the absence of the usual frosts and the very generous rainfall throughout the early part of the season. However, considerable injury to the fruit crop is attributed to the late cold rains on the western slope, some growers contending that this latter condition was in

a great measure responsible for the undersized peaches and apples in this section of the state.

Orchardists from the western slope report most excellent crops; but, as a rule, the fruit has been undersized. There are many growers who have made a success, financially and otherwise, of this year's crop, and we shall have further information in this regard later on in the program. From information so far received by this department, this season has, however, not been so profitable to the growers as was hoped for. We shall also hear more in this connection before this convention adjourns.

Extension and field work, under the supervision of the Agricultural College, has been of greater benefit to the fruit-growers than any of us individually can realize. Experiments carefully outlined, and results noted, have been carried on continuously to as great an extent as the appropriations of this department have permitted. The results of these investigations are imparted to the growers in a way easily understood, and it is up to the horticulturists themselves to take the benefits of these observations and put them into practical operation.

With the valuable assistance of the several county horticulturists and the Department of Entomology, the growers are given the benefit of years of research as to the best methods of eradicating and keeping down the insect pests. They have learned the necessity of thinning the fruit, so that which is produced is of the best quality. They also demonstrated at the apple show at Denver last year that they know how fruit should be packed to look its best. But this season, more than ever before, they have realized that there is still another problem in the fruit industry that must be solved in order to make it a success and one of profit to the growers, and that is the proper distribution and sale of the product. This is, I believe, the one all-important matter at this time.

At our convention in Canon City last year a paper was read by Mr. Pickett, of Lakewood, Colorado, the title of which was "What the Grower Gets." If that paper was to be presented by some of the fruit-growers this year, there is a chance that the title would be changed; for it has been reported that, for large quantities of fruit marketed this season, the grower received practically nothing. Mr. Pickett, in presenting his paper last year, remarked that he expected to receive severe criticism for stating the facts from a grower's standpoint; but this season's experiences of the majority of growers show that Mr. Pickett was on the right track when he criticised the present system of marketing, distribution, and the food-trust combinations.

The fruit-growers, together with the fruit associations, should get together and organize a distributing agency, to the end that a more proper distribution of the fruit may be attained, to get it into the best markets at the proper time, which would mean better prices. I believe the experiences of this season have demonstrated the fact that the marketing of the fruit is the greatest problem which confronts the growers of this state at the present time. It is not for me to criticise anyone, nor to condemn; you are all doing the best you can under the present plan of selling and distributing. But, from what information has come to me, I am convinced that the system should be changed, a great deal of the middle expense cut out, and, if possible, have one head to manage the distributing of Colorado's fruit crop.

Unless this condition is changed, land values will not advance as they should, since it is only the earning capacity of the land which really establishes its value. With the proper marketing of the fruit, so as to bring increased profits to the growers, the value of the land will be certain to advance to as great an extent as its earnings will justify. In order to make a complete success of the fruit industry, the grower must raise only the best of fruit—which we all know Colorado can produce. By having the best fruit, we are able to meet any competition in the open market.

It has been demonstrated that you must not only have the best fruit, but you must have the proper varieties, in order to secure the best returns.

Trees of the poorer varieties, that do not bring good returns, should be top-worked with varieties that are more in demand. There is no room in your orchard for trees that do not bring you good returns for the space they occupy and the labor expended in caring for them. The results of this season have shown that there is no room in the orchard for poor varieties. Being far from large markets and storage facilities, the poorer varieties are, in a great majority of cases, sold in bulk and bring meager returns to the growers.

There is also great need of canning and evaporating plants to take care of the excess and small fruit in seasons such as we have just passed through; and the management of the orchard should be so arranged that nothing is wasted, but that the whole product of the orchard is utilized and manufactured into by-products.

It is only by the best of management, and close attention to every detail, that the best success can be attained; and this does not apply only to the orchard, but to the small fruits as well. With horticulture it is the same as in any other business—it is often the smallest things that count the most in the final results.

Another matter that was discussed at the last convention held by this body was "The Forecast of the Fruit Crop." I believe that this is an all-important matter, and one which should receive more consideration and support from all fruit-producing sections. A reliable forecast of the fruit crop, given the proper publicity, will in a great measure aid the proper distribution of the crop and keep other fruit districts from shipping into our markets, when our forecast would show that we had sufficient to supply our near-by territory.

This is especially true of the peach crop, and also of the early apples, as these must be marketed without delay, owing to their perishable nature. With the winter varieties of apples the grower has a better chance, as they can be stored and kept until good prices can be secured for them. More attention should be paid to the storing of the winter varieties of apples, as at the present time too many growers try to dispose of their product as soon as it is harvested, which has a tendency to force the prices down.

It has been argued by some that a forecast of the crop, and especially if it showed a large crop, would be detrimental to the growers, in that they would be offered only a small price for their product. But this is not true, as the fruit industry has grown beyond that of a few years ago, when the buyers would come to your orchards and purchase the crop on the trees at a good price, and pack and ship it themselves. The orchards have so increased in number that this method has changed, and it has come to the point where we must have our light shine—when we must give publicity to every branch of this great industry.

It is only by having reliable information as to the probable crop that its proper distribution can be made. We must not think that it is only the crop for our own orchard or our immediate neighborhood that we have to consider, but it is the crop of the whole world that must be figured in the final analysis. If one country in Europe, South America, or Asia should have a short apple crop, perhaps it is the crop of the United States that must be utilized to supply that shortage, and you indirectly will participate in supplying this demand.

You all know how this forecast is made in other products, such as wheat, oats, corn, and beef; and it is more important that it be done in the fruit industry than in any of these I have mentioned, for fruit is of a more perishable nature than any of these, and a market must be more quickly found for it. It is not a very difficult matter to prepare this forecast or estimate of the probable fruit crop, if the growers in the various counties will each help a little; and, by perhaps giving the horticultural inspector of their county an idea of what their crops would be, the in-

spector can, by comparing with shipments of former years, get a pretty close estimate of the probable crop.

These returns, made to this department or the Horticultural Department at the Agricultural College, would give a very good idea of the probable crop of the state; barring, of course, future damage by hail, or other damage which might occur.

Last year this department compiled a forecast of the fruit crop from information given by the several county horticultural inspectors and other reliable sources. This forecast was published in July, 1911, and I was informed by the secretary of the International Apple Jobbers' Association that it had added not less than \$100,000 to the returns paid the growers of Colorado for the apples shipped that year; for, having had that information, it could be better calculated how and where to place this crop, to get it into favorable markets.

However, the figures given in this forecast and sent out by this department were for some reason changed when published in certain papers in the several counties of the state—whether intentionally or not, I do not know; but this department was subjected to severe criticism by residents in some counties who thought their county had been discriminated against, or had been underestimated and other counties overestimated.

I wish to say that the figures, as given out in July, 1911, by this department, were substantiated when the final shipments of fruit were made from the several counties. If the press of the state will do its share, by giving reliable information regarding this industry, it will assist greatly in the upbuilding of horticulture.

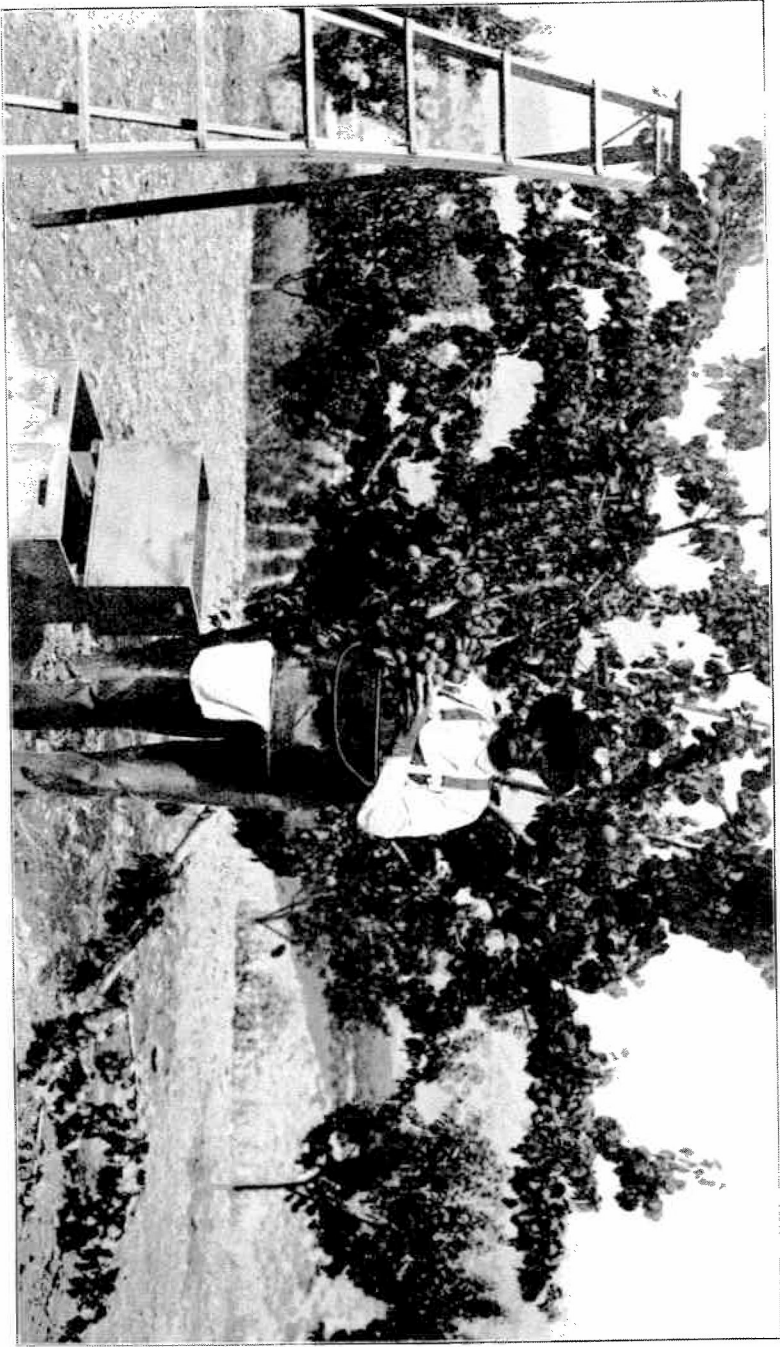
The forecast of the crop made by this department on August 1 of this year showed an increase of 20 per cent on apples and 100 per cent on peaches over the crop of 1911.

As I have mentioned before, the fruit crop this year was a little undersized, owing, as I believe, from information gained from reliable sources, to the climatic conditions in the later part of the season. While the cherry crop of the eastern slope was almost a total failure, the crop in the western counties was very abundant. This section of the state is rapidly coming to the front as a producer of the finest grade of sweet cherries, as well as the sour varieties. Considering the scarcity of this fruit this season, the prices secured were not what they should have been, especially the latter part of the crop. Only the very best apples are bringing what one would call a fair price, the poorer and medium grades having given very poor returns.

The exhibit of fruit at the Pueblo State Fair this year was a great disappointment to all, considering the fact that this year's crop was the greatest that Colorado has ever produced. Following upon the most excellent exhibit of 1911, which was the best in the history of the State Fair, the exhibit this year was anything but a creditable one to this great industry.

It was, however, not in horticulture alone that the State Fair was a disappointment, but in the majority of the departments it was not up to that of a year ago. Probably this was due to the fact that the premiums for 1911 had not been paid. But whatever hardship the non-payment of these premium moneys might visit upon the exhibitors, it should not dampen the enthusiasm of any progressive grower. These exhibitions should be given every assistance possible, and each county should show, for the advertising given it, the products it is capable of producing.

Of course, the labor of getting up these exhibitions always falls on the shoulders of a few; but these should not stop or hesitate on account of any disappointment of one season, but should only be spurred on to greater efforts for another. I am convinced that the officials of the State Fair and the citizens of Pueblo are doing all in their power to maintain and further this fair, and I believe that all back premiums will be settled at some not far distant date. However, I hope that, even if this is not



Apricot Tree in J. A. Rowart Orchard, 1911. Adjoining Paonia, Colorado.—Limbs Broken Down with Weight of Fruit.



done, the fruit-growers of the state will put forth greater efforts next year to make the exhibitions at the State Fair a credit to this great industry and their several districts.

It is also the desire of this board that each county in the state send an exhibit of its fruit products to the exhibit maintained by this board at the State Capitol in Denver. During the entire year the board rooms are thronged with visitors from all over the country, viewing the display, and an exhibit from each county would give a great deal of publicity as to its resources. It would involve very little trouble for each county to do this, and its advertising value would be of untold benefit to the several counties accepting this great opportunity.

As to legislation relating to horticulture, there is still room for improvement. We want laws that can be enforced, and that will protect and promote this great industry. As the legislature will be in session this winter, I hope those interested in horticulture will ask the members from their respective sections to consider favorably any bill looking to the advancement and upbuilding of horticulture. We should also urge larger appropriations from the state for the extension work and the Department of Entomology at the State Agricultural College, as these departments have certainly done a vast amount of work and given excellent results with the appropriations at their command. Let each of us try to help do something that will tend to advance the interests of horticulture in our state.

Senator Crowley: The next thing in order will be the appointment of a Committee on Resolutions, but I think we had better pass over the appointment of that committee for a while, if it meets with the approval of this convention. The next thing, then, on the program is a paper by Professor Bennett on "Cultivation, Intercropping, and Cover Crops." Professor Bennett has not yet arrived, however; so we will take up the paper "Orchards for the High Altitudes," by Edgar Buchanan. This paper will be read by Mr. W. S. Wallace.

Mr. W. S. Wallace: I have here, ladies and gentlemen, a paper by Mr. Edgar Buchanan, of Durango, on the subject of "Orchards for the High Altitudes." I wish to say here that I have been living in Colorado for a good many years, and I am not prepared to accept every statement made here. This paper that I am to read is Mr. Buchanan's statement and not mine.

## ORCHARDS FOR THE HIGH ALTITUDES

BY EDGAR BUCHANAN, DURANGO, COLORADO

The problems involved in this subject are of great importance to the State of Colorado, and afford a fruitful and interesting field for investigation on the part of the horticulturist.

The apple crop of the United States this year amounts to about 41,000,000 barrels. This is not an unusual crop under the present condition of our population, and, if other conditions were right—with reference to the varieties and quality, and the movement of the crop at the proper time—the prices received by the grower in all parts of the country should be sufficient to afford a good profit. Yet we hear many complaints from different districts about the small prices obtained and the sluggish movement of the crop.

It is quite possible that here in Colorado we are producing too many late fall and early winter apples, that must be forced on the market during the early part of the marketing season. If this be true, it is time for us to begin to consider the growing of later crops, that may be held and put upon the market at later dates than we can now do under present conditions.



The same conditions apply to the production of the Bartlett pear. If our Bartletts are forced upon the market at the same time that other large crops are competing, we cannot hope to obtain the prices that can be procured later in the season when the market is less congested.

If we can prolong these seasons, we can prevent the flooding of the market, and afford the consumer a longer and more satisfactory season to enjoy the best of fruits in prime condition.

If all the strawberries in the United States were grown in the same month, the growers would receive very meager remuneration for their efforts and investments, and the consumers would enjoy very little of this delicious fruit; but, owing to the fact that there are many climatic conditions in the United States, this crop is grown and placed on the market from February to November, thus preventing a congested market, and affording the grower better returns, and the consumer a longer and continual use of the strawberry.

In Colorado we have a great diversity of climatic conditions. We are today growing the most of our apples and pears under practically the same climatic conditions. In other words, we have narrowed our range of climate as to these fruits, and have not availed ourselves of the wide range of climate that nature has bestowed upon Colorado in greater measure than can be found in any other part of the United States.

If it can be made to appear that there is now in Colorado as large an area capable of producing fruits of the finest quality, flavor, and keeping qualities in the higher altitudes as is known to exist in the lower, it can readily be seen how vastly the fruit products can be increased and, at the same time, distribute them over a longer period of time as to marketing and consumption. Such conditions would add very materially to the wealth of the state, and the convenience and comforts of its inhabitants and the consumers in outside markets.

The term "high altitude" must be considered with reference to the latitude. What would be considered a high altitude in the northern portion of the state might not be so considered in the southern portion.

I have been engaged in growing fruits at Hermosa, in La Plata County, for a number of years, at an altitude of 6,700 feet. This is considered, in La Plata County, a high altitude. There have been no failures of fruit in the Animas Valley for twenty-five years; and we have raised a great many different varieties of fruits, including such tender fruits as peaches, Satsumma plums, and Royal Ann cherries. There are extensive areas in Colorado where conditions similar to ours exist, and where fruits of numerous kinds can be produced of very desirable quality.

Let us now consider some of the advantages of high altitudes. The first and most important is frost immunity. This is a question of vital importance to every horticulturist, inasmuch as in many localities great losses are sustained nearly every year from the frosts occurring in the late spring. In many localities the great expense attending the smudge-pot must be incurred, and the results are not always satisfactory.

In the higher altitudes the fruit buds are delayed in the spring until many of the severe cold snaps have passed by. It seems to be a very general rule that killing frosts do not occur later in the higher altitudes than they do in the lower. The cold wave sweeps down from the mountains, and frequently does its damage in the lower places while the higher altitudes escape injury.

So far as we have produced fruits in Colorado in the higher altitudes, it has been pretty generally demonstrated that this delay in the blossoming period is of vital importance, and very frequently crops are produced when failure occurs elsewhere.

There is another point involved in this question of frost immunity, and that is that, as a rule, fruits will stand a lower temperature at the higher altitudes than they will in the lower. The atmosphere contains less moisture during all seasons of the year; and we know that, as a rule,

a dry freeze is less destructive than a damp freeze. A frost that occurs where heavy dews prevail is more destructive than it is where the moisture is carried away and dews are prevented.

We frequently find the wild fruits growing in the mountains all the way to timber-line, where we know that frosts occur quite severely every morning in the year; and yet some of these wild fruits are quite prolific, and are of splendid flavor, and produce uniformly good crops nearly every year.

I have known, in the vicinity of my orchard, ice to be formed on numerous occasions during the month of May, when the fruit trees were in full blossom and most susceptible, and no injury resulted from such low condition of the temperature.

In the second place, the fruits grown in the higher altitudes, such as the apple and the pear, possess better flavor, have finer texture, and will keep longer than similar varieties grown at the lower altitudes.

The date of maturity is also set back, so that these fruits may be marketed later than those grown lower down. We also find that the trees begin bearing earlier and are more prolific than the trees in the lower altitudes. The wood-growth is very much retarded; the trees are more dwarfish in their nature, and can therefore be planted closer together than in climates where the tendency is to produce a greater growth of wood.

We have nothing to say against the fine orchards that are growing throughout Colorado in the lower altitudes, but we do claim that there are certain advantages in the higher altitudes, as heretofore suggested, that they do not possess.

Our apples are sought for their fine texture, good flavor, and keeping qualities. Our Bartlett pears are sought because they come after all of the California and the main crop of Bartletts are gone. They fill a desirable place in the markets—a place that is not now filled; and it will require a number of years before we can equip the higher altitudes in Colorado to supply this vacant place that now exists in the market with reference to the Bartlett pear.

We do not have to sell our Bartletts in a congested market. There is a sharp demand for them, and a scramble on the part of the buyers to get them at fair prices.

We have never had any pear blights in this part of Colorado. We are satisfied that the pear blight can be controlled better in the higher altitudes than it can in the lower. The wood-growth is more retarded, and the trees are not so susceptible to the blight as they are under conditions where the wood-growth is more vigorous.

We have now seen some of the advantages of the higher altitudes. It will now be proper for us to consider the selection of the site, the varieties, and the planting of the orchard.

From my experience, I am led to conclude that a southeastern slope is the best. In any event, a slope is better than the level ground. The orchard should be planted where there may be plenty of sunshine through the entire day. We must remember that we have a shorter season of growth, and therefore we must make up for this in having as long a day as possible at the place where the orchard site is selected. The early morning sun lessens the chances of freezing. It shortens the coldest part of the cold part of the day, which occurs just about sunrise; and by having a late afternoon we are given a long sunshiny day that will make up for the short season and give us a fruit of good size, splendid color, and fine texture and flavor.

The preparation of the ground for the orchard should be thorough and on the same principle as applied to the successful planting of orchards in other localities.

In selecting varieties, we must be governed to a considerable extent by what the market demands. In the apple line it is very essential that

we select the red apple, as the American market demands an apple that has a beautiful color. The American consumer is sometimes more particular about the color of the apple than about its flavor and texture. The consumer will not always consider the color alone, but will become more critical in the future with reference to the other qualities that the apple must possess, aside from the color. We can, however, select red apples with all the other good qualities just as well, but we must pay more attention to the quality of the apples that we plant in the future; otherwise we may be doing what the pioneers of this country are doing today—cutting out undesirable fruits to give place to those that are more salable.

The Wagener, Northern Spy, and Delicious are apples that obtain a fine red color in the higher altitudes. The flavor and texture of these apples cannot be excelled, when properly grown. The Delicious is a splendid table apple, but will be somewhat limited in its use, for the reason that it is not a good all-round apple like the other two. The Wagener and Northern Spy are splendid eating apples. They are good to cook in every way imaginable.

The Wagener is a tree of dwarfish habits, bears early, and overloads. It requires considerable more work than the ordinary apples to have it attain its highest state of perfection. It must be properly pruned and vigorously thinned to get the best results. If it is allowed to grow its own way, it will be loaded up like grapes on the limbs. Under these conditions it is not of good quality and is not desirable; but, when properly grown, high up in the mountains, it is an apple that will always sell for about twenty-five cents per box higher than any other variety. When grown properly at the high altitudes, it will keep with the Ben Davis, holding up its texture and flavor until the month of July.

The Northern Spy has different habits. It is a more vigorously growing tree, later to come into bearing; but, notwithstanding the objection of its lateness in coming into bearing, it will bear soon enough to produce a crop for commercial purposes, as a tree has got to have a certain growth and a certain age before it will have a sufficient bearing surface to produce a paying crop. In the higher altitudes this variety attains a fine texture, flavor, good color and size, and will keep fairly well, but not quite so well as the Wagener.

Either of these apples, the Wagener or the Northern Spy, is of such a class that, if we grow them properly, we need have no fear upon the subject as to whether or not we shall have a market; the consumer will always be ready and willing to buy them at a higher price than other varieties that do not possess their high qualities.

Now, it is not a sufficient answer to our line of argument that some of the growers in this state have tried these varieties and they have not proved satisfactory. The trouble has been that your season is too long. The apples become fall apples in your vicinity, while, if you were growing them under proper climatic conditions—the conditions that existed where these varieties originated—you would secure very much better results.

My ideal apple orchard in the higher altitudes would be five acres of apples, planted with Northern Spy and Wagener, alternating the rows; and, if I desired a third variety, it would be Delicious.

The Jonathan and Grimes Golden do not attain their highest state of perfection with us. While they have good texture and flavor, and keep well, they do not attain the size that the market demands.

The Rome Beauty is not a high-quality apple to grow at any place. Aside from its color and handsome appearance, it has very little to recommend it.

The Northwestern Greening, the Maiden Blush, MacMahon White, and Wealthy all do well in the higher altitudes, but the market conditions are not such in Colorado as would justify their extensive planting.

The Black Ben Davis does well in our vicinity, but it is not high in quality; therefore it is not recommended.

I would also select five acres for pears, and plant them to Bartletts. They would all be Bartletts, except a few Seckels or other varieties for cross-fertilization.

My experience leads me to the conclusion that Bartlett pears are more profitable than apples. There are many reasons for the apple to take an off-year and rest. We frequently go through the apple orchard and see a fine tree that has no fruit upon it. It has taken a year off to rest. It may be that it had too heavy a load on the preceding year, and the result was that it put forth no blossoms in the spring-time.

The pear tree is quite different. It seems more vigorous. It does not take its off-years for rest, but will stand a load each and every year. My Bartlett pear trees have been loaded down with fruit every year for the past twelve years, and show no sign of any exhausted condition or desire to take a year off for rest and recuperation. These trees, however, have not been making any wood-growth during that period. The Bartlett trees now appear to be no larger than they were twelve years ago. The Bartlett pear tree does not require so much pruning or thinning. It does not require so much spraying. It is not pestered with so many insects as the apples. The fruit is picked, sorted, wrapped, and boxed while it is hard and firm; goes into the market in good condition; and, when it goes into the market, it is not competing with a great mass of Bartletts from California and other large producing countries. They are sold rapidly and easily for fair prices, and the buyers are always glad to get these late pears, produced in the higher altitudes—to toll the Bartlett pear season over for a later period.

Ten or fifteen acres of an orchard in the high altitudes, planted as I have indicated, would furnish plenty to do through the season and bring in handsome profits to the grower. While these trees are growing to the bearing age, other crops and fruits may be grown between the rows. We are growing strawberries, raspberries, potatoes, and vegetables between the rows of the orchard.

Our strawberries come when others are out of the way. We have a local market all our own, without competition. We frequently pick of the Dunlop variety five weeks in June and July. Our raspberries also come at a time when others are not competing. They can generally all be sold in local markets. If these small fruits are properly taken care of, they will produce a certain and abundant yield every season at a fair profit.

We can also grow cherries, including the Royal Ann, and plums, including the Satsumma. Peaches of the earlier varieties can be produced in our vicinity every year without failure from the late spring frosts.

The horticulturist of Colorado need have no fear to move his orchard up the mountain-side to a reasonable limit. There are many things that will grow there just as well as they will lower down. There are many varieties of fruit that will do far better. But if we decide to move the orchard up the mountain-side, we must not expect to grow the same varieties that are successfully grown lower down. We must select varieties with reference to their seasons, and must take into consideration, and be governed by, the experience of others who have dealt with this subject of the orchard in high altitudes. We must be mindful of the fact that the Creator of the universe never intended that all forms of plant life should be grown and cultivated under the same climatic conditions, but that there is a place for everything; and that, if we select the proper varieties for the proper place, high up in the mountains, we may expect to have our efforts crowned with success. I am satisfied that, if we use good judgment in planting the orchards at the higher altitudes, and plant them extensively over the entire mountain district

of the state, we shall do much to increase the land values in Colorado, and add very materially to the annual products of the orchard. I am satisfied that, if we increase this area, and handle these high altitudes judiciously, we shall have a demand for high-altitude fruit, on account of its texture, flavor, and keeping quality, that cannot be surpassed in any other part of the United States.

Senator Crowley: I want to say, ladies and gentlemen, that I see Professors Gillette, Bennett, and Weldon have arrived. After dinner Professor Bennett's paper on "Cultivation, Intercropping, and Cover Crops" will be taken up; but this forenoon, if you wish to ask Mr. Wallace any questions on the paper he has just read, or the pear business, which I understand is Mr. Wallace's strong suit, the meeting is now open to discussion.

A Voice: Mr. Wallace raised some objection to the paper he read. I should like to hear his objections, if he doesn't mind telling us.

Mr. Wallace: As I went through the paper hurriedly this morning, it struck me that they had taken up the question of frost, immunity from frost, in the spring, but had failed to touch on a subject of even greater importance; and that is, early freezes in the fall. There, in my judgment, is the great danger of high-altitude orchards—the fall frosts. It is one thing for a man to lose his crop in the blossom in the spring; it is another thing to have him grow the apples and have them ready to pack, and the night before picking begins, have a frost come along and spoil the crop, after the labor of growing that crop has been expended during the entire season. That is the criticism I have to offer with regard to high-altitude orchards. My observation has been that a man must pick his locality carefully in planting a high-altitude orchard. And high altitudes are not necessarily measured in feet. I don't believe there are two separate valleys or mountain-sides in Colorado that have the same climatic conditions. In one place orchards will grow at eight thousand feet, while they will be an absolute failure at six thousand feet in another. A certain variety of fruit may be a success at six thousand feet, while it will be an absolute failure at five thousand in another; and so it goes. The person who starts in to grow a high-altitude orchard had better spend a few years prospecting.

A Voice: Are there any successful orchards as high as eight thousand feet?

Mr. Wallace: I cannot tell you that there are any successful orchards. There are orchards planted as high as eight thousand feet, however, and there are several as high as seven thousand.

A Voice: What would you say as to blight in high altitudes?

Mr. Wallace: Our experience has been against that. We have to assume that the difference in the blight problem in this valley, and higher up the river, either way from here, is due entirely to the difference in the elevation. That may be entirely wrong, but that has been our assumption. While we have been able to control blight here, I understand that both up the Grand and the Gunnison they have practically abandoned their pear trees.

Mr. Fletcher: You speak of the planting of some orchards at seven thousand feet. That depends entirely upon the latitude, doesn't it?

Mr. Wallace: Yes. For example, there is only about one hundred miles, as the crow flies, between here and Durango.

Mr. Fletcher: A thousand feet is based on your latitude. I think the ratio is one thousand feet of elevation to one degree of latitude.

Mr. Wallace: Yes; six thousand feet at Durango would be the same as forty-five hundred here.

Mr. Fletcher: That is about what it is.

Senator Crowley: Does anyone else care to take part in the discussion? If not, right after dinner, at 1:30 sharp (and when we say "1:30."

we mean we will be here at 1:30), Professor Bennett will read his paper. I hope we shall see you all here on time, because we are going to make it worth your while this afternoon. We have an excellent program, and we are going to push it right along. Now, if anyone wants any information on any subject that has been, or will be, discussed, he is at liberty to ask questions. We don't want anyone, young or old, to be backward about asking questions. If there is no further discussion, we will take a recess until 1:30. In the meantime, if anyone has the Session Laws of 1911 handy, I wish he would bring a copy when he comes to the convention this afternoon. In the report of the secretary, Mr. Mauff made mention of the premiums not being paid at Pueblo. Now, gentlemen, don't be too severe on the State Fair Association; the State Fair Association never offered you a premium on the fruit. A bill was passed, and I helped pass it, appropriating \$20,000 to pay premiums. The State of Colorado owes you those premiums, and if you will bring a copy of the Session Laws, I think I can show you that this is the fact.

Mr. Newton: There was one point in the report of Secretary Mauff—in regard to estimating the crop. There are few orchardists who know how to estimate their crop. Nobody can tell how many boxes of apples he is going to have.

Senator Crowley: Mr. Mauff, will you please answer the question?

Secretary Mauff: All I can say in this regard is that a man can generally tell by the appearance of his orchard whether he is going to have as good a crop as he had the year before. You can always figure the crop of the year before by what was packed and sold; and if your crop is not set quite so heavy, you will know that you will not have so much fruit, and, if you are observant, you can very nearly tell what per cent decrease or increase to figure.

Mr. Newton: Your point is, he ought to do it for the benefit of his own crop. But a great many don't understand it. They ought to estimate their own crop.

Mr. Mauff: If the growers—and it would not have to be all the growers, but just a number from each county—would make this estimate, an average could be arrived at by taking the total crop of the county the previous year. They can give these estimates to the horticultural inspector, and he can do the figuring on the whole county. We have received some good reports from the horticultural inspectors in some counties, although in others they were a little off in their estimates; but in the main they were good. In some other counties, where they did not give this department the data, we asked some other well-informed horticulturists to do so, and they made a very good estimate. You can always tell by the year before how much you marketed, and, by the condition of your orchard this year, whether you are going to have 20 per cent less or 20 per cent more, as the case may be. The man who watches his orchard closely can tell pretty nearly how much of a crop he is going to have by comparison with the previous year. I know in the two years that we have compiled the data we made a very good report; in fact, I was very much surprised to find how closely it figured out when the final shipments were made and totaled. They are now starting to make this forecast in a great many other states, and I think, if it was taken up in this state, we could exchange with other states, and we could find out about what the world's crop would be. The Apple Jobbers' Association has for several years been making a fairly accurate report of what the apple crop of the world is going to be; and they lay their plans accordingly, as to how they will market and distribute the fruit when it is harvested.

Mr. Devine: At Palisade they estimated the peach crop at all the way from two thousand to twenty-five hundred cars. This year we had a late season; the peach trees were twenty-four days later in blooming than the year before, and the peaches were very small; so you can't always tell beforehand what the crop is to be. You can't tell what the weather is

going to be. This year the weather was cold, and the peaches didn't mature. I think there were thousands of bushels of mine that I didn't pick at all because they didn't mature, and they were uncolored. Now, it is impossible to average your orchard one year with another, unless you know these conditions. Another point: When we boom our land and the crop, the newspapers will get the story, and they will say we are going to have the biggest crop in history. This is just simply buncombe; but they will do it spring after spring.

Mr. Newton: What I meant was that point exactly. The horticultural inspector is the best man to estimate the fruit. Where the growers of the fruit don't know anything about it, it is mere guesswork, and it is a good deal of guesswork on the part of the inspector. Conditions change during the season. I feel that we should give a more careful study to the figures in estimating the crop. It can be done by a good deal of study. A man must study his trees and his orchard before he can give an estimate of the crop.

Mr. Mauff: I wish to say that I don't believe you can make an estimate of the crop until after the spring drop—until June or July. As far as this year's condition of the peaches is concerned, it is very unusual. I went over the weather reports with Mr. Nichols yesterday, and these conditions mentioned by Mr. Devine have occurred only once in this section for the past twenty years. This year was a very unusual season in regard to the temperatures. Of course, I said in my report: "barring hail" or other accidents that may happen. But, as far as estimating the fruit crop is concerned, I should not think anyone would try to do so until after the spring drop. That would be plenty of time. You can give your estimate in the middle of the summer, and that is far enough in advance of the crop to help in its distribution.

Mr. Cline: I can tell you how we get at the crop at Paonia, where I live; and I believe we have the reputation of getting as nearly right as anywhere. We make an early report for the benefit of the railroad company—so they may calculate the number of cars it will be necessary to provide—as well as for our own benefit. We make that report from year to year, and the railroad company—the Denver & Rio Grande—says we figure very closely to it, and we can always bank on it barring accident. Of course, we fell down on the peaches this year, as every other section of the state did. We keep up an association of growers and business men, and we appoint a committee of three men, prominent growers, and divide the district. Sometimes we make five or six divisions, and we give a certain district to each man. We do this for the benefit of the fruit associations also. We give an estimate of how many boxes we shall need to pack our fruit; and if you take the Denver & Rio Grande reports that we submitted to them, you will see we figure very closely to it. Some will make it too high, if you leave it altogether to the orchardists, and some will make it too low; so we generally try to choose men who know, and can give a pretty good estimate of another man's orchard as well as of his own.

If we start out and boom up the crop, the newspaper reports make it double and triple. That hurts us, and there is no use in doing that; the truth is generally good enough in Colorado; and we would better have it under- than over-estimated. Our board has had considerable difficulty in getting these reports, because some of our horticultural inspectors would file a report and others would not.

Professor Bennett: I should like to ask you what you know of some association back in Rochester, New York, that makes an estimate of the fruit crops throughout the United States, and along about July and August sends those out to jobbers mostly. They have sent some to me, and have also asked for a report of the state. It always struck me that it was a jobbers' proposition, and was very much overestimated for the purpose of breaking down the price of fruit. I should like to know what

you people here know about that—whether it is on the square, or whether it is to make it appear that the United States has much more fruit than it actually has.

A Voice: It is the International Apple Shippers' Association.

Senator Crowley: Is there anyone who wishes any further information on these matters? If there is no further discussion, we will take a recess until 1:30.

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DECEMBER 17, 1912, 1:30 P. M.

Mr. Cline: The meeting will now come to order, and we will proceed with the program, as our time will probably be short. As was announced before adjournment, the first paper on the program will be by Professor Bennett, "Cultivation, Intercropping, and Cover Crops."

Professor Bennett: Mr. Chairman and Fellow-Horticulturists: We have so many things on our program that I shall make my talk short. Not that this is not an important subject, but it seems to me that we have many more just as important subjects that should be discussed before we leave this convention. I believe that there has not been a time when we were in as good shape to get together to do business as we are at the present. Four or five years ago, when I was devoting most of my time to potato investigation, I made the statement, somewhere on the western slope, that there would come a time when we should have a far more difficult problem to solve than orchard frosts. I told the growers that the time would come when we should have a fine crop of fruit and not be able to market it. I was laughed at, and they said I was crazy. They said the Colorado fruit was so good that we never should be able to supply the market.

Now, you know what the result has been this season. And that is the problem that we have to take up at this convention; it is the life-or-death problem of the fruit-growers of Colorado—and of the United States, for that matter—as to whether we are going to get the value out of our product, or whether the middleman is going to get it. Now, this is not a local problem, so I will not take up much time, but will pass to the subject assigned to me, that of "Cultivation, Intercropping, and Cover Crops."

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## CULTIVATION, INTERCROPPING, AND COVER CROPS FOR THE ORCHARD

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PROFESSOR E. R. BENNETT, FORT COLLINS, COLORADO

In a way, this subject is so generally well understood that little need be said concerning it; yet there is a possibility that we do not understand all the factors in the case sufficiently well always to handle the work to the best advantage. I think all of our growers will agree with me that cultivation is essential. Primarily, this is not for the purpose of destroying or preventing weed-growth, nor, in fact, to prevent a loss of moisture, but to make the conditions of air and warmth right for the development in our soils of the soil flora that makes available the locked-up plant foods contained in it.

We can have too much of the best of things, and this is probably true of our system of cultivation. We all understand that our orchard plants are artificial products; that is, in domesticating them we have changed the object for which the plant grows, from its natural trend to one which is more subservient to our wants. In nature the ultimate object of the apple tree is to grow to maturity and produce seed, that the species may be disseminated. In its growth from a seedling in its natural habitat it has had to fight for its life; for the competition of other plants



was keen. Consequently, it was only the hardy apple that came to maturity, and, unfortunately, extreme hardiness is correlative with poor quality. With this struggle for existence, no energy was wasted in the useless development of fruit tissue. We have bred and selected the fruit, not for its seed, but for the fruit tissue which surrounds this seed.

In changing any plant or animal from the natural development, we certainly must weaken the vitality of that organism. In doing our work, we have not only selected to accomplish this object, but we have avoided the struggle for existence by eliminating the competition for the plant food, light, moisture, etc., which are necessary for the development of the plant. As a result, we have secured an unbalanced organism. We may go farther in an analysis of the proposition and say that we in the arid climates have given our plants a great excess of the various elements that tend to bring about rapid development in them. In other words—if I may be allowed the simile—we have changed them from the working-man's bill-of-fare to the luxuries of the millionaire; and in so doing we may carry our simile farther and find similar results. Our soils are naturally richer than those of the East. We all understand why this is so, so that it is not necessary to go into the discussion of that phase of the problem. We give constant cultivation to aerate the soil; we give water when it is needed to make the moisture right; and we have the warmth and sunlight; which all together give us an abnormal growth.

We must expect from these conditions that our trees are necessarily going to be shorter-lived and subject to more troubles than those grown under more adverse conditions. I believe that these principles are the real explanation of some of the troubles with which we are contending today in our orchards of Colorado. Even with the best conditions, in the New England orchard the tree does not get a great quantity of plant food; for even though the best cultivation be given and fertilizer be added, the excessive moisture leeches these from the soil, and the various plant growths that are native to those soils continually tend to rob the orchard tree of part of its food. With these principles before us, then, how shall we cultivate the orchard?

I believe that clean cultivation should be practiced during the early part of the season, particularly in the young orchard. The great temptation, however, with our orchardists is to continue this cultivation, and, consequently, continue the plant growth too late in the season. In nature the normal plant growth comes from April or May till early July, at which time the rains of the humid districts usually become less abundant, and more plants are growing to take up the plant food. As a result, the tree stops making growth, terminal buds for the next season are formed, and the tree has from sixty to ninety days in which to mature and harden its wood preparatory for the dormant season. This maturing process—or, as you might call it, the "digesting process"—of the plant food that has been taken in in the early part of the season is absolutely essential to the good of the orchard plant. Without this, we are sure to have a soft, coarse-celled growth that is more subject to winter killing and is naturally shorter-lived. This principle is frequently ignored by our growers, and we have seen many orchardists, particularly in the cherry districts, who did not consider it essential to prevent the cherry slug from eating the leaves from the trees in July and August, as the fruit had already been gathered, and who thought the leaves were not necessary for the good of the tree.

While it is true that the tree should not be making growth at that time, it should be elaborating and storing plant food, and developing buds for the succeeding year. Then, if we are to follow nature's methods, we should cultivate during the early part of the season and make all the conditions congenial for all the growth possible. For the growing orchard we should have some crop growing from late June or July on through the latter part of the season, to utilize the plant food that will

necessarily be made available through the bacterial action of the soil, and to prevent its stimulating the trees into further growth.

Some of you will probably say: "What about the apple tree that is producing fruit?" By the time a tree is sufficiently developed to produce fruit, its root system is extensive enough so that it can pretty well take care of itself. Its head is also large enough, so that it will overshadow ordinary plant growth on the ground, and really has the advantage in whatever struggle for plant food may be taking place. Of course, in the heavily bearing orchard we can use a somewhat different system of cultivation from that of the young growing orchard. In detail, I believe that the best system of cultivation for the orchard is to plow, either in late fall or early spring, to sufficient depth to prevent the tree from forming roots close to the surface—that is, from six to ten inches—in the middle of the spaces between the trees, running shallower close to the trees. Harrow frequently during May and June; then sow to some crop that will cover the ground the latter part of the season. This system is easy for the grower who does not need to depend on the same land to produce other crops.

Unfortunately, many of our orchardists cannot afford to grow the orchard plant for its sake alone, but must grow some crop between the rows to help produce the food for the family, or to help pay for the work of maintaining the orchard. What may be grown between the trees will depend a great deal on the location of the orchard, character of soil, and how the work is done. If there is sufficient vegetable fiber in the soil, which has been added by plowing in alfalfa, clover, or the addition of stable compost, the problem is simple. These will give a surplus of plant food to the soil and put it in an available form, so that we may have little fear of robbing our orchard plant, and at the same time give fertility sufficient to make the growing of an intensive crop profitable. Of these, for certain districts, the early potato is probably one of the best intercrops. While the trees are very young, onions may be grown satisfactorily. In fact, any of the early-maturing crops may be grown without danger of injury to the orchard trees. Where trees are planted on raw soil, however, and stable compost is not available, we have a different problem. This precludes the possibility of growing onions, celery, or any of those crops that require a high labor cost per acre; for a sufficient yield cannot be obtained to make the growing profitable. Under these conditions, such crops as the bean, pea, and cantaloupe will be found more reliable. The great danger in all this work is in getting crops that require late cultivation and late water, and bring about the condition which we have previously mentioned of preventing the maturing of the wood of our trees. From this standpoint, the cereal crops might be considered; but these are not to be recommended, as it is not possible to cultivate the soil, and they are too heavy feeders to allow the trees to compete with them profitably. In fact, we would not recommend the sowing of any of the hay crops other than the leguminous, and none of the cereals, in the orchard. We have on all sides of us plenty of examples of the effect of sowing wheat, oats, or rye in the orchards, and I do not believe that a case can be found where the practice has not been detrimental to the orchard—and this to a much greater extent than the value of the grain taken from the field.

We doubt if it is advisable to try any great amount of intercropping in the orchard after the trees are six or eight years of age. By this time it is probable that it will be necessary to get through the orchard frequently to spray and do other work around the trees, in which case the intercropping will necessarily be in the way. By this time, too, the trees are of sufficient size to shade the crop, being grown so as materially to cut down its yield and make it unprofitable. We have been very much pleased with the results of growing clover in the mature orchard. This we could hardly call a cover crop, as it is usually planted in spring and left on the ground for one, two, or even three years. Many of our growers are advocating, and some are planting, alfalfa in their orchards.

I do not know that I am prepared to condemn the practice, although theoretically it would seem that it should be recommended with caution. There are plenty of examples to which we can point where orchards, that have had the appearance of going to pieces, have been decidedly improved and brought back to a good condition of thrift and bearing, apparently by the use of clover in the orchards. One orchard, in particular, that we have in mind had been cultivated by shallow plowing and continuous harrowing for several years, and was getting in a condition where some of our experts had practically abandoned the hope of its ever becoming a profitable orchard. This orchard was sown to clover, and plowed deeply after the clover had been left for a year; and this practice was followed for a few years, till this year, when the writer saw the orchard, it was in a good state of thrift, notwithstanding the fact that it was producing somewhere between 800 and 1,000 picking-boxes of apples per acre.

As our fruit-growing industry becomes older and more systematized, I believe that we shall come more to utilize our orchard lands for pasturing hogs and poultry. There is no question that many of our insect troubles may be very materially decreased by the use of poultry in the orchard. Hogs are also beneficial, providing due care is given to prevent injury to the trees by the animals. This is, not usually serious, but sometimes more or less mature hogs will get in the habit of barking trees, or, by rooting near them, injure the trees.

The probabilities are that many of our farms, now devoted entirely to orcharding, in a few years will be diversified more, so that the place will not only produce fruit, but will also produce more or less stock, grains, alfalfa, vegetables, etc. I believe in this way our growers in general would be more prosperous than where, as is now the case in many places, all the land owned by the individual is devoted strictly to fruit-growing.

Another practice that I believe is to be condemned is the growing and cutting of clover or alfalfa in the orchard for hay. No doubt there are times when this may be removed without injury to the orchard, but I believe that for the most part the cover crop in the orchard should be grown for the benefit of the orchard and not for the cover-crop product.

Mr. Cline: The paper is open for discussion, if any of you desire to ask any questions of Professor Bennett.

A Voice: I should like to ask, if cover crops are desirable in the middle of the rows, what distance they should be from the trees.

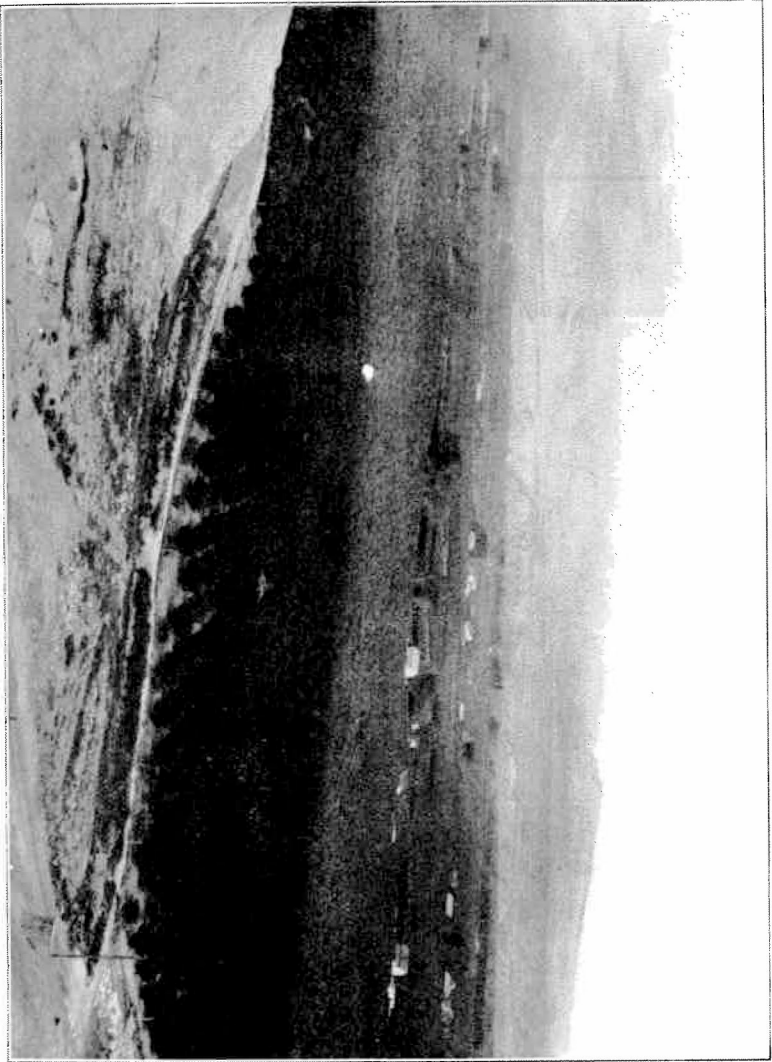
Professor Bennett: I would not extend it up to the trees.

A Voice: Why not cover the entire space?

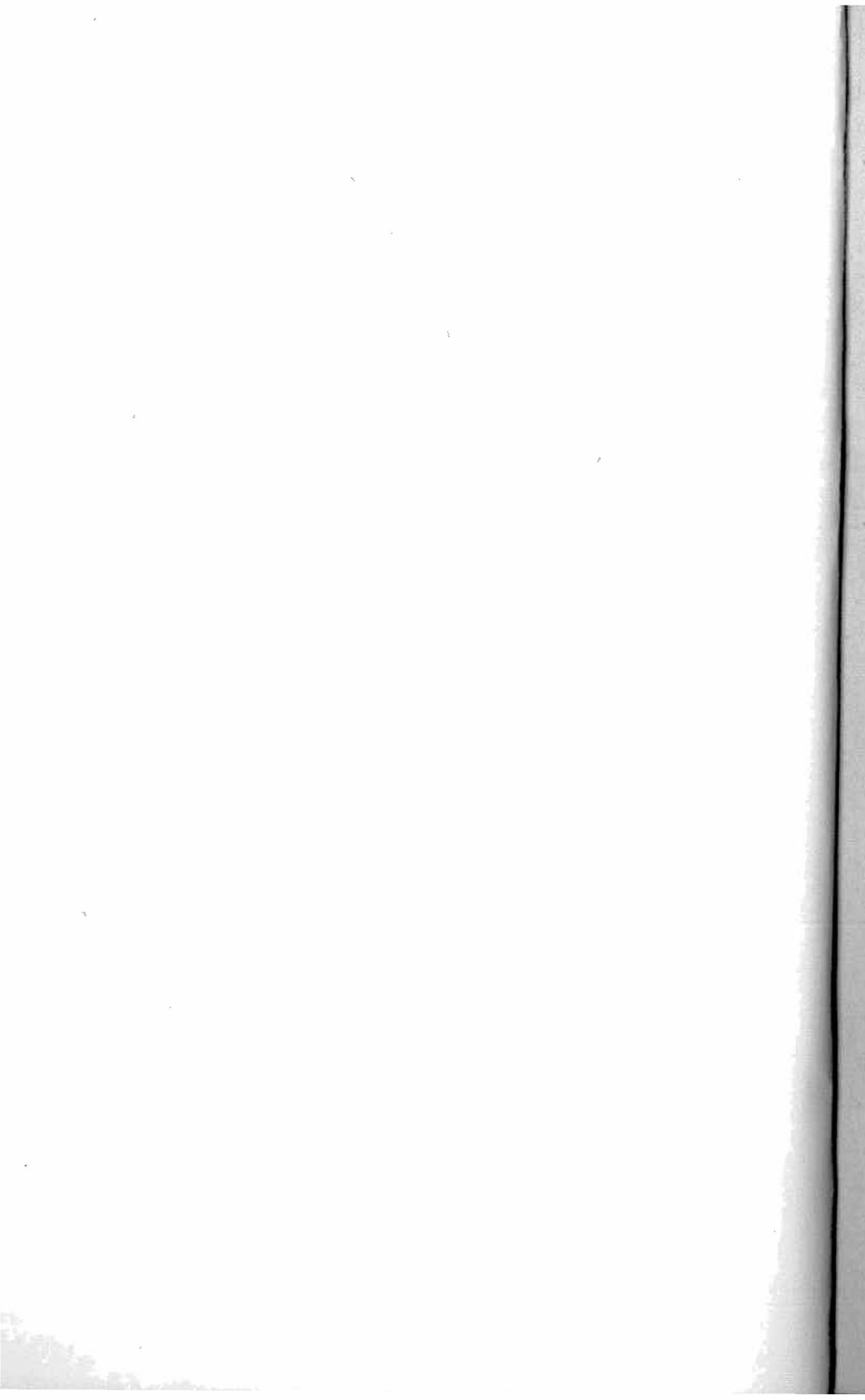
Professor Bennett: There are a few objections to that. First, you want the plant food available for the young trees; and, particularly if you have alfalfa, it will be hard to plow it. I think you will get the most benefit by having it in the middle of the rows and not robbing the trees in having it planted too closely. That is a matter of personal opinion, but I think it is necessary. I should like to say right here that I don't like sugar beets as a cover crop. I think it is objectionable in many cases, because it necessitates too late cultivation.

A Voice: How about cover crops being left on the ground—or would you cut them off?

Professor Bennett: That, I think, is a thing we should leave on the ground. I think it is a mistake to cut our cover crop for hay, and yet it is a thing most of us do. I suppose it is quite a temptation to cut it off for hay. I don't know that in some cases it does any damage, but I believe the cover crops should be grown for the benefit of the orchard, and not for the benefit of the crop itself; and while it is better to grow clover, and cut it for hay, than not at all, I believe it is much better to leave it on the ground to be used as a fertilizer.



Partial View of the Peach Orchards, Embracing Thousands of Acres, Palisade, Colorado.



A Voice: Is there anything in the report that peach trees will not stand over three years in red clover?

Professor Bennett: I would not put clover in a peach orchard and leave it there very long. I maintain that a peach tree is cultivated just the same as corn, and the peach is one thing that will not stand other crops close to it. I have never seen a peach orchard amount to anything with a cultivated crop between the trees; in fact, they are very susceptible of any robbing of the soil, and I would not recommend clover for a peach orchard being left there for more than one year.

A Voice: I have been told that clover would kill a peach orchard in three years. If it has that effect on the peach tree, why would it be so good for the apple tree?

Professor Bennett: The apple roots will grow further from the tree and will stand more. I have seen elegant apple orchards in plowed grass for years and years—never fertilized. Of course, it was in the rain belt. But a peach orchard inside of three years would go to the bad under these conditions. Of course, a peach orchard is shorter-lived and needs less of cover crops than the apple orchard.

A Voice: What about a crop of rye planted in the fall, or, say, the latter part of July or August?

Professor Bennett: Rye is all right, if you can get it in; but don't let it mature. Leave it for the winter, for winter protection. That is another point that may become essential to us; that is, fall plowing as against spring plowing. In Michigan, in 1898, we had a freeze that cut out several thousand peach trees. It is a peculiar thing, but where the trees were in sod they did fairly well, but where they were in clean cultivation every one died. Our professor of horticulture in the western fruit belt told them they might as well pull the trees out, because they were killed. One man pulled them out, but another man was too lazy and left them until next year, and he got a fine crop of peaches. Needless to say, that professor didn't go back in that part of the country again.

A Voice: What is the effect of deep cultivation on roots?

Professor Bennett: If the roots are where they belong, it will not have any effect. I believe, if you start in when the tree is young, you can plow ten inches deep. If you let your orchard grow four or five years with shallow cultivation, you will cut off a great many roots. I would not want to cultivate or plow deeply close to the trees, because in that case you will injure the roots very much. You will find, as a general proposition, that most of the roots are closer to the surface than you think. Most of the trees are not rooted over eighteen inches or two feet deep.

Professor Taylor: I didn't hear the first of Professor Bennett's discussion on this question, so possibly he said something about improved apparatus for cultivation. I want to ask the experience of the growers who are present, and also what experience Professor Bennett has had with the Kimball cultivator, for instance, for soil cultivation. We have seen a great deal of it in the way of advertising, and if there are other cultivators, that have been introduced in the past years, that are really taking the place of the cultivators we have used before, I should like to hear about it. What is your experience with the Clark cultivator harrow and the straight disk harrow. I am interested in the problem of cultivating young orchards, and I should like to have your experience.

Professor Bennett: I have had no experience with either of the disk harrows, the Campbell and the Acme. I have one proposition in young orchards that we are starting over at Fort Collins, and one thing we have to contend with is the moon glory—a poverty weed. The only thing I have found that will do anything with the moon glory is the Campbell cultivator. It does not go in any depth, but it cuts them off. We have

not killed them, and I don't know that we shall; they stay right by us, and we have to go over the orchard from time to time. I don't like the looks of this weed, and people who have seen this orchard say that is a pretty hard-looking orchard for a college. If you do not keep constantly after this weed, it will overrun the orchard in a short time. Whether it does any serious damage or not, I am not prepared to say; I doubt if it will in the orchards, but I should like to eradicate it.

Professor Taylor: Will two horses pull this cultivator?

Professor Bennett: I presume so. The Campbell cultivator will cultivate about two inches deep, and make a light dust mulch on top.

Professor Taylor: What is the width of the space covered?

Professor Bennett: I think about eleven feet; I am not sure.

Mr. Rupp: They vary in width from six to twelve feet.

Professor Taylor: How many of them are in use in the Grand Valley at present?

Mr. Rupp: I think there are very few in use. We have some in use at the present time.

Professor Taylor: Is there any objection to them?

Mr. Rupp: The soil was too hard for this cultivator to penetrate.

Professor Bennett: Was this trial made on ground plowed deeply this spring?

Mr. Rupp: It was on soil that had been well taken care of—not any particular plowing. A great many orchardists neglect plowing, which should be done every spring and fall.

Professor Bennett: You cannot do anything with this cultivator on land that is not plowed. The Campbell is simply a plank, with a bent arm and a knife three or four inches wide, and it goes under the soil and cuts off everything just under the surface. It is no good at all unless the ground had been plowed.

A Voice: I think it would be a good thing if you would discuss the soil first. When it comes to breaking soil, or penetrating, the cultivator has no value for that purpose whatever.

Professor Taylor: How is the Campbell cultivator as compared with the Acme—is it the same?

Mr. Rupp: I am not acquainted with the Acme.

Professor Bennett: The Acme would not go in the ground over an inch at the most.

Professor Taylor: The ground was too hard, evidently.

Professor Bennett: No. It is nice for harrowing the soil right after you plow it. I hardly think it is as good as the Campbell, anyway.

Professor Devine: Did you ever dig down at the roots of the trees to see where the roots were in the soil? Several years ago I had the curiosity to see where the roots went. I dug down by some of the trees, and found the roots ran right up by the first irrigating ditch, and some of them clear beyond the next tree. But very few of those roots were beyond the first irrigating ditch. I think, as a general rule, if you dig down half-way between the trees, you will not find any roots at all. They don't run in the center of the rows.

Now, in regard to cover crops: A few years ago our professors recommended that we sow alfalfa among our trees, and red clover; and some of our orchardists at Palisade have done that. They sowed quite close to the trees, and those trees look abominable. The leaves are yellow, and they look as if the alfalfa was doing the trees a great deal of damage. I think it is the intention to turn it all under next spring.

Professor Bennett: How long has it been in alfalfa?

Professor Devine: Two years. A gentleman in the audience here spoke about red clover. There are two rows of red clover that have stood there between the trees for two years, and the trees are looking fine now—at least, much better than the trees where the alfalfa was put in; the trees are not injured at all. I believe now, if I were going to put in cover crops, I should put in red clover instead of alfalfa. It is hard to get rid of the alfalfa.

Professor Bennett: Can you get the red clover started all right here?

Professor Devine: Yes, sir. I think, if you get it started once, and get some bacteria in your soil, the next year you put it on you will do better, and I think in the course of two or three years you will do very well.

Professor Bennett: I have more or less the same feeling in regard to the alfalfa that you have. I was wondering if you could get the clover started all right without starting it early in the season.

Professor Devine: I think you will find it difficult in the Grand Valley to get it started. Our climate is dry and hot, and it is difficult to get a stand.

Senator Crowley: There is a great deal to be said about these two implements under discussion. I think a great deal more is to be said in regard to the tools you use in the orchard than some people think. I have a neighbor who came to me to find out what was the matter with his orchard. I said: "How do you cultivate it? What do you use?" He told me he used an Acme harrow. "How long have you used it?" "Seven years." I looked at the soil in his orchard, and within four inches of the surface you couldn't stick a shovel in it to save your life.

Professor Bennett: Never plowed it?

Senator Crowley: You could hardly dig a hole in it. Now, the difference between the Acme cultivator and the Campbell is that the Campbell cuts the weeds off. In my experience, the Acme will push around them. I went over the orchard the year before with the Acme, and apparently I never touched a weed; but the next time I went over the ground they were all killed. The Campbell just cuts them off; it doesn't bear down like the Acme. I think we should discuss that part of the subject a little more. I don't believe any orchard will do well unless it is plowed once a year, and plowed good and deep. We have had the same experience in our orchards in the Arkansas Valley that you have had here. We grow crops between the rows and irrigate every thirty inches all the season through. Keep plowing every year, and even though you cut a few roots off, it won't hurt any worse than cutting a few limbs off. Don't be afraid of hurting your trees by cutting off a few roots. Peaches are a different proposition. I am told that a peach is the most sensitive tree in the world—so sensitive that, if you let the fox tail grow under the tree, the leaf of the peach tree will drop off the same time as the fox tail; if the fox tail stays green until late in the fall, the leaves of the peach tree will stay on all right. I am not a peach-grower, but I am telling what some people tell me. I don't know, personally, how sensitive it is.

Professor Bennett: In regard to the roots of the apple tree following the irrigation row, it would strike me that that would indicate that the distribution of the irrigating water in that soil is very good. The one object of the roots in following the ditches would be for plant food and moisture, and roots will go a long way to get moisture. I think the water should be distributed in the middle of the rows, because in a great many cases we are not careful enough in seeing that the water is percolating to all points, so that the roots will be equally distributed. Of course, another thing you might find is the intercropping taking the plant food, which would tend to send the roots in different directions.

A Voice: What is the proper distance in setting an orchard out?



Professor Bennett: It depends on what kind you are setting out. For standard apples I would advocate thirty-two feet. The tendency in Colorado is too close planting at the present time.

A Voice: I know of an orchard where the setting is forty foot square.

Professor Bennett: Not in this country?

A Voice: No, sir; sixteen miles west of Niagara Falls, in Canada.

Professor Bennett: Forty feet is close enough. Our trees are bearing from four to eight years, where their trees are bearing from eight to fifteen years. They have a big tree, and a more normal growth than we have; and we have an artificial condition. We have in the past expected to get our crops off while the trees were young, and then expecting them to die. Many of the trees are getting old and are crowding each other. The heroic thing would be to take out a diagonal row, and then they would not have any too much room. That is a thing we shall have to come to. We have got to grow the best fruit in the United States, in order to make it pay.

A Voice: There are trees in this valley sixteen foot square.

Professor Bennett: Over at Fort Collins there is an orchard where the trees are planted fifteen feet apart, and they have grown so tall that you would have to shoot off most of the apples, if you got them at all.

Mr. Cline: If there are no further remarks or questions, we will proceed with the program. Before we proceed, however, I should like to answer one question that was asked, because I can answer it. The question was: "Would clover three years in a peach orchard kill it?" I suppose it would depend on where your orchard is located; but where I live at Paonia, it would not, because I have a peach orchard that has been in clover four years, without being plowed up. This peach orchard is thirteen years old. Right over the fence there is another orchard, about as old, which has always been cleanly cultivated; same land—rich sandy land; and I grow better peaches every year than my neighbor ever since I put the clover in. Red clover, where it will thrive, will bring you three crops a year. After it is once established it will reset itself. My peach orchard is a small one, and I just left the clover in for an experiment. I believe that in our country clover is the thing for the peach orchard. Those who have tried it in my locality believe as I do—that it is a benefit.

A Voice: How do you and your neighbors regulate your irrigation where you have alfalfa and clover? They take the water so much more rapidly; they keep the ground saturated. The trouble with the alfalfa and clover is that they irrigate too long to get results. That is the trouble at Palisade in the peach orchards—the leaves turn yellow. They use too much water; they have the peaches too close, and they don't watch the water closely.

Mr. Cline: I think I irrigate a little more than my neighbors. I watch my clover, and when the clover shows the want of water I irrigate it, but I run it through. I never let it run more than twelve hours; and, as I have stated, my soil is a sandy loam.

Mr. Cline: Is there anybody else who desires to ask any question? I believe that there is too much irrigation in orchards, and I know that everybody irrigates too much where they have plenty of water. I believe that roots will go a great distance for water.

If there is no further discussion on this matter, we will proceed with the program. The next paper on the program is by Professor E. P. Taylor, "Efficiency and Economy in Orchard Management."

Professor Taylor: Mr. Chairman, and Ladies and Gentlemen: It certainly affords me much pleasure to be able to appear upon the program of the State Board of Horticulture and the State Horticultural Society, and especially so since the meeting is held at Grand Junction, the territory surrounding Grand Junction being that where I have received

my principal schooling in practical horticulture. I count among the people in this section some of my best friends. I am, therefore, especially glad to be able at this time to appear upon this program. I want to say that, in coming before you now, I do not bring any message to Garcia; I do not believe that I am going to tell you a thing, perhaps, that you do not know. I have selected a subject that is very broad, and it is merely for the sake of the suggestion of some of the things that we might apply in marketing, or in reducing the cost of the production of the fruit, because I believe that this is something which is largely within our control. I presume that one of the chief topics, the most important topic, for the discussion before this meeting, would be the marketing and improvements in the marketing and selecting of our fruit. I know that we can adopt many economies that will cheapen the cost of the production of our fruit, and it is for that reason that I have suggested, and adopted, this topic. I have brought with me a very dry paper to read on it, but I hope I shall be pardoned for doing so, because I come from a pretty wet town. (Laughter.)

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## EFFICIENCY AND ECONOMY IN ORCHARD MANAGEMENT

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PROFESSOR ESTES P. TAYLOR, RIFLE, COLORADO

The financial success of the fruit-grower's business is wholly dependent upon the relation between cost of production and amount of income from his crop. This statement is so fundamentally true that it seems almost unnecessary to repeat; yet it must be the starting-point, as well as the last word, in any discussion of orchard management.

This is a day of progress in efficiency and economy in all manufacturing and commercial enterprises. We read in magazines and publications of all classes of the advances made in efficiency of labor, time, materials, and management of all lines of business. A manufacturing plant is failing to yield satisfactory profits, and the adoption of certain economies or corrections of service puts it upon a paying basis. A public-service corporation fails to yield satisfactory dividends, and an engineer, known as an "efficiency engineer" these days, is consulted, who, after studying the management and conditions, saves waste in the purchasing of materials, eliminates expenditures which do not pay, augments those that do pay, until the system is upon a profitable footing. We have read in *The World's Work* and other publications how, by carefully studying the simple movements of the brick mason in laying his brick in the wall, another, with efficiency of energy in mind, nearly doubled the number of bricks laid per day; or of the enormous waste of energy and money represented in nothing more than the thoughtless waste of unnecessary matches burned. Is it not time that fruit-growing and farming, too, were subjected to a similar scrutiny? It is quite as essential to apply cost analysis to the production of apples as to axle-grease.

In order to be able to analyze all operations as to cost and income, it is necessary for the fruit-grower to keep a better system of records. I believe that fruit-growers keep better accounts than average owners of small farms, but less accurate accounts than the owners of large orchard enterprises. A few moments spent each day upon such records will pay better than an equal amount of time devoted to any other orchard work.

Such an account should show the amount of increase or decrease in capital, profit, or loss on different varieties or kinds of fruits, and the distribution of expenses and receipts for the various varieties and blocks of fruit, live stock, and household charges; what the fruit-grower's labor income has been, if any; and the exact distribution of all cost and income. This will be found more simple than one would at first suppose. A careful inventory should be regularly taken, and all acreages and num-

bers of trees should be carefully determined. With such records the grower at the end of the year will not only know his gain or loss, but the items responsible for the same.

This year has been one of low market price. Improved selling arrangements and marketing conditions are to be discussed in detail, I understand, at this meeting. That is probably the most important topic of the hour, and embraced with it is the matter of proper distribution of fruit and transportation. Here, too, application of the principles of efficiency is what is needed. However, it shall be the purpose of the writer to confine this paper rather to fruit production than to selling. If we cannot cope with the fruit commission men and there make a gain, we can at least make some gain in a saving here and there in the cost of production; and, as has been said, ten cents per box saved in the cost of growing fruit is a lot surer than an increase of ten cents per box *promised* by the commission man at the other end.

Economy in fruit production does not necessarily mean elimination of every possible expense, or discontinuance of improved apparatus and up-to-date methods. Efficiency calls for a wise economy, and not the kind which could be said to "save at the spigot, but leave the bung knocked in."

The costs of fruit production may be divided into three groups: (1) the fixed charges, which include interest on land investment, taxes, insurance, depreciation of buildings, fences and equipment, interest on equipment investment, and water assessment; (2) the labor and material incident to the growing and harvesting of the crop; (3) the cost of getting the fruit to market.

The following estimate has been placed as the cost of growing apples in full-bearing apple orchards in the Grand Valley, per box:

	Cents
Pruning and disposing of brush.....	2
Cultivation .....	$\frac{3}{4}$
Thinning .....	$1\frac{3}{4}$
Spraying .....	3
Irrigation .....	$\frac{3}{4}$
Interest on investment .....	10
Water assessment .....	1
Taxes and insurance .....	1
Repairs and depreciation .....	$\frac{1}{2}$
<b>Total .....</b>	<b><math>20\frac{3}{4}</math></b>

The following additional has been ordinarily taken as a basis for the cost of harvesting a crop in a similar apple orchard per box, with a full yield:

	Cents
Box and making .....	$1\frac{3}{4}$
Picking .....	4
Packing .....	5
Sorting .....	2
Paper .....	2
Nailing boxes and extra help in packing-shed.....	3
Hauling to cars, loading, and bracing.....	2
Hauling, orchard to packing-shed.....	1
<b>Total .....</b>	<b>32</b>

Total growing and harvesting.....  $52\frac{3}{4}$

It is interesting to study these figures. How many fruit-growers have records definite enough to make a similar estimate from their own experiences? Doubtless many growers average much more than the above, and some with varieties of apples of such poor grade that in years like the

present one they will certainly not pay expenses. On the other hand, are there not many fruit-growers present who can, by means of their efficient equipment and efficient management of labor, materially reduce many of the individual items in the above? We are growing very few apples, too, that would not bring growers more than this figure, with all grades included, even in a year of low prices, like this one.

But you will ask: "What are some of the ways we can reduce our cost of production?" There are, in fact, such great possibilities in this line that one becomes at once enthusiastic in anticipating them. Perhaps some economies will at first seem like extravagances.

As an example, take the purchase of labor-saving machinery for the orchard. The purchase of a gasoline power sprayer, costing, say, \$400, to supplant a \$35 hand pump, is an economy that any owner of twenty acres of bearing apples cannot afford to postpone. Growers have found that increased efficiency in the control of the codling moth has been one of their greatest achievements, and the power sprayer has played an important part in this.

Among other equipment, increasing efficiency, we may cite the extension Planer Jr., Acme, and Kimball cultivators, as compared with the ordinary tools first used, which could not be made to clean up weeds close to the tree trunks, necessitating expensive hand weeding. We may also cite the improved box-presses; the new apple-grading machines being developed; the apple-wiping machines now being used in the Northwest; our common nail-strippers for the boxmaker and nailer; our improved pruning equipment; orchard-heaters; picking-ladders, and picking-sacks and baskets; our two-way plows and cutaway extension disks; the convenience of arrangement of our packing-sheds, with elevators for moving fruit and boxes from one floor to another; even the little rubber thumb stalls to enable the packer more quickly to pick up fruit-wrapping paper; the simple, but effective, paper weights for holding the papers from blowing, and the stencils for labeling boxes. All these are labor-saving devices to facilitate speed, banish drudgery, and add an economic gain.

The wrapping of grafts in modernly equipped nurseries, by small boys operating electric graft-wrapping machines, and doing the work of many men formerly; and the machines used for stripping leaves from trees at fall tree digging, are other examples of efficiency for horticultural equipment.

In the hauling of fruit to market, the fruit-grower is saving in time and condition of fruit moved. Where the fruit was formerly jostled over rough, stony roads, it is now, in many cases, being moved from orchard to shipping station over smooth, well-graded highways, kept dragged, and even sprinkled through the summer, as in the Grand Valley, to abate dust; drawn in especially built, spring-equipped fruit wagons, or in some cases in auto trucks; or by means of electric interurban service, as some Grand Junction-Fruita growers enjoy. A Virginia fruit district, where hauling of fruit by means of a small wagon drawn by horses cost three and one-third cents per barrel per mile, a steam tractor with trailer moved 202 barrels at a trip, at a cost of one-half cent per barrel per mile.

We are advancing in the use of improved orchard equipment, but at best, from the delicate nature of our product, we must always expect to have to do much hand labor. In an address by President Taft before the National Conservation Congress at Kansas City last year, he stated that between the years 1830 and 1896, by means of improved machinery, the time of human labor required for the production of a bushel of corn had been reduced from four hours thirty-four minutes to forty-one minutes, and for a bushel of wheat from three hours to ten minutes. Granting that many labor-saving devices will be adopted in fruit-growing, we can surely never hope for a reduction in hand labor required to a point approaching that for grains.

One of the greatest needs for a saving in the cost of production of fruits is in the direction of labor of teams and men. Picking and packing foremen in larger and well-organized orchards adopt a method of checking the work of each picker and packer, even when this work is being paid for by the hour or day. At Horatio, Arkansas, this year, in a 2,250-acre peach orchard shipping 500 cars of peaches and employing 2,500 persons to harvest the crop, a record of the number of baskets of peaches picked by each picker was kept, the total number picked by each gang being posted each evening to encourage competitive effort by other picking gangs. The manager estimated that by this method one-third more work was done by each man.

Fruit-growers of smaller acreages, as here in Colorado, have a more even distribution of labor than in large orchards, but there would be great economic benefit if fruit help could be retained and kept employed more continuously. It would be a far more efficient arrangement if one were able to employ six men for six months' fruit work, than eighteen men for two months. The necessary rush of work during spraying and harvesting times will always require much extra and inexperienced help at these times, but the more extra work that can be provided profitably to hold some help over through the dull season, the better. An orchard of several good varieties can be handled more efficiently from a labor standpoint than the same orchard of a single variety requiring spraying and harvesting at the same time.

How many peaches, pears, and apples of worthless varieties are we supporting in our orchards, without in any year getting returns enough to pay expenses? Individual records should be kept, and the poor varieties weeded out by budding, top-grafting, or the planting of new trees in their places. The dairyman with his Babcock test is able to discover the cow in his herd that is yielding him but 3 per cent butter fat, and supplants her with one testing 5 per cent. The poultry man by means of his trap-nest records eliminates the hen which lays him but fifty eggs per year, and feeds a 200-egg hen instead. The potato-grower by hill selection chooses smooth, even-sized, marketable potatoes for his seed, and secures a yield of 200 sacks per acre; while his neighbor by indiscriminate seed selection gets but seventy-five sacks. These are typical examples of increased efficiency. A crop or an animal of low grade costs almost as much to grow or keep as one of high market value. While the Wolf River and the Walbridge sell for fifty cents per box, the Jonathan, Delicious, and Winter Banana bring from \$1.25 to \$2.50 per box.

Efficient spraying for codling-moth control will save fruit-growers many thousands of dollars. An expenditure of three cents per box for spraying will raise the price from twenty cents for unsprayed cider stock to \$1.50 for extra fancy apples. Similarly, we are making an economic saving in our control of our aphids, mites, spiders, peach mildew, and leaf-rollers.

Almost as great a difference as this is to be secured by proper pruning and thinning. These operations must be kept up religiously; for undersized fruit was the rule this year.

Professor Van Deman, the great national fruit authority, is quoted as saying: "The history of the apple (the whole country included) shows that only 14 or 15 per cent of the orchard is of salable kind, the remainder being only fit for stock-feeding or for cider." This is certainly a startling condition, if it is correct.

We must recognize that, with the most perfect care and under the most ideal conditions, the fruit-grower will always have a certain percentage of low-grade fruit, which should be worked up locally into manufactured orchard products. To the credit of economy it may be said that we are getting new cider and vinegar plants, evaporators, canning factories, jelly, jam, and fruit-butter plants, for the handling of this low-grade stock. We must never forget, however, that our chief profits, considering our distance from market, must lie in our extra fancy fruit. Even

under the improved grading rules as adopted on the western slope the last year, we should be able to pack out at least 80 per cent extra fancy (it is not unusual to secure much better than this), 10 per cent fancy, and 10 per cent choice and culls.

An enormous amount of fruit has gone to waste in our orchards. Peaches and pears are allowed to become too ripe for shipment, and have rotted by the ton upon our hands, or have brought only meager returns when sold. Some varieties, from neglect of picking at the proper time, have cracked open at the calyx; others have been left too long and gone down to waste as windfall; while others, in our higher locations, have been left so long that they have been caught by the early freezes of the fall. Much of this will be avoidable in average seasons under proper management. Wastes are common from improper picking and bruising in handling, delay in hauling in out of the sun, delayed packing, poor transportation facilities, shortage of cars, and faulty icing.

The wastes of citrus fruits in California and Florida, it is reported, have been reduced 15 to 40 per cent since the growers have taken up the improvements in picking, packing, precooling, and storage. This season has called to our attention the inadequacy of our home storage facilities. Many growers need better storage houses on their own places, and local cold storage plants may expect increased patronage in the future.

Waste of water is common upon our ranches. Some have made distinct progress in this respect in the installation of concrete laterals and concrete-lined ditches, and the replacing of leaky wooden flumes with galvanized ones. Too much water has been used by some, to the detriment of their own crops and to the permanent injury of their lands. Level contour ditches at the lower ends of irrigation rows have been employed with good results where water is scarce and where danger of flooding low spots is experienced. Underground ditches; permanent head ditches, with holes or spouts for the simple management of the water flow into the irrigation corrugations; small lath conduits, to prevent the washing of the loose earth at division points, and checks and boxes in ditches where the fall is too great, are improvements that are coming into practice more and more to increase service and reduce waste.

We cannot go on indefinitely taking crops from our orchard lands and practicing clean cultivation, without adding plant food to make up the deficiency. It has been determined by the Illinois station that a 600-box apple crop, together with the leaf and wood-growth, in such an orchard takes 112 pounds of nitrogen, fourteen pounds of phosphorus, and 109 pounds of potash from each acre in one year, with a total fertilizing value of \$25.02. This loss must occasionally be compensated with a cover crop of clover, alfalfa, cow-peas, or grain crops plowed under as green manure. The physical condition of the soil is at the same time greatly improved by cover crops. Manure should be utilized wherever available, in cases even where a reasonable charge and cost of hauling is necessary. For tracts of farming land in connection with the orchard, and even with the secondary crops grown between the rows, a definite idea of crop rotation should be followed. Soil conservation is a prime necessity in orchard as well as farm efficiency.

The number of details connected with orchard management in which there is opportunity for direct savings and economies in cost of fruit production is limitless. The care of the spray pump; the housing of all implements and tools; the lack of oil on machinery used; the use of more paint to preserve buildings, fences, and gates, to say nothing of the added attractiveness; the treatment with preservations of fence posts; lack of proper tools to do work; lack of telephone or of a good kitchen garden; the more complete utilization of all ground by filling missing spaces with trees, or planting waste corners now yielding nothing, or the planting along roadways and fence lines; inconvenient location of buildings; repair of machinery, fences, gates, buildings, tools, harness, etc., during the dull season of the fruitman's calendar; the loss of young trees from

rabbits, prairie dogs, loose stock in orchards, weeds—all of which can be prevented a great deal more than they are—all enter into the great field of orchard efficiency.

Lastly, is it not also quite as essential, in the purchase of labor-saving machinery and conveniences upon the fruit ranch, to include modern appliances to save steps and increase the efficiency of the home and its routine duties? We may never standardize all housework, but household conveniences should be installed in proportion to the modern tools of the ranch.

Co-operation of fruit-growers has been a boon to their progress in economy. Through our fruit-growers' associations we are enjoying many of the benefits of practical efficiency in fruit-marketing, and we must through these organizations make the progress in fruit-selling which is sure to come.

All improvements in orchard economy, whether in production or marketing, will result in advanced land values upon a sound footing. If we can produce fruit 40 per cent cheaper, it can still be sold to the consumer 20 per cent cheaper, and we shall increase our profits 20 per cent, plus the benefit resulting from increased consumption.

Mr. Cline: Are there any questions or remarks? If there are no other remarks, we will proceed with the program. The next paper on the program is "Top-Working Apple Trees," by George M. List, of Grand Junction, Colorado.

## TOP-WORKING THE APPLE TREE

BY GEORGE M. LIST, GRAND JUNCTION, COLORADO

All fruit-growing sections must pass through the experimental stage. It takes some time to find just what fruits and varieties are adapted to certain localities. It is being found that only certain varieties are peculiarly adapted to certain soils and climates. Commercial fruit-growing sections are making their reputation by being able to grow only a few varieties, or even one, well.

There has been an experimental stage for most fruit-growing sections of Colorado. Dozens and dozens of varieties of apples have been set in an effort to determine those varieties best adapted to our climate and conditions. Then, too, we have the overenthusiasm of the inexperienced fruit-grower in these new sections, who fondly gathers all the old varieties known in his boyhood, as well as all new varieties advertised by the nursery men, many of whom are ever ready to put something new and phenomenal on the market.

As a result of all this, we have thousands of unprofitable, and therefore undesirable, trees in many sections. This is brought more forcibly home to us in a season like this. In a season of scarcity of fruit, many unknown and even undesirable varieties of apples can be placed on some markets to good advantage. But let us have an abundant crop, and the consumer becomes more particular; he can get all the standard varieties he wants at a fair price, and will not be satisfied with something he does not know as a substitute.

I think, if it was put to a vote today as to the varieties of apples for this section, no one grower present would name over three or four varieties. The different localities might disagree somewhat as to these varieties, but I feel certain there would not be named more than eight or ten varieties, at the most. Yet I know of one orchard alone that has forty-two varieties. The manifests of the cars from one branch shipping station in this valley show 112 varieties shipped to date; and I could name

many other varieties that I know to be in that section. One car of fruit from this station contained thirty-seven varieties, and it is needless to say that it did not go out on an order. At one time there were as high as sixty-three varieties on this one shipping platform. One grower delivered a load of fifty-two boxes, having in it eleven varieties, and three grades of each.

Now, let us consider the position of a grower who has one of these mixtures. You will all admit that he is at an additional expense for spraying, pruning, and all work of producing the crop. Before he is even through spraying, he finds he must drop all his other work, get out his picking-ladders, picking-bags, packing-tables, and box-press for two trees of Red Junes or Yellow Transparents; then make a special trip to the shipping platform with his eight boxes of fruit; only to find that the next week he must do the same for his three trees of Red Astrachans or Duchess. He sends his hired man out to pick the Jonathan tree at the far side of the orchard, but finds, when he comes in with a sled-load, that he made a mistake and picked the Gano. The man with the eleven varieties on one load must keep eleven lots separate in picking, and must clear his packing-table eleven times in packing the fifty-two boxes. Now, what profit did he have left? Any practical grower present will admit there was none.

Just over the fence his neighbor has an orchard of Jonathan, Rome Beauty, and Winesap. While one is stopping every few days all season to harvest a few boxes of some odd variety, the other is working his bands for the codling-moth, thinning a tree here and there, and doing the many little things that lead to the production of fancy fruit. When the Jonathan season opens, he has his boxes all made up, and with only a small amount of help is able to get them off in carload lots. From the Jonathan he goes on to his Romes and Winesaps. I believe that fruit from this orchard can be produced and marketed for one-fourth less than that from the mixed orchard, and sell for one-third more.

When an orchard becomes unprofitable, it is time we were solving the problem as to what to do with the undesirable varieties. Shall we pull them up, or graft them over to better varieties? Systems of grafting have long been practiced, and it has been found to bring quicker returns than the replanting of young trees. New wood grafted into an older stock will take on some of the characteristics of the older part. Apples bear in two or five years earlier on scions in bearing trees than they do on nursery-propagated trees of the same varieties. It is not uncommon to see a fair-sized crop on a three-year-old top of a top-worked tree.

There is a balance between the roots and the top of a tree; each part has a strong influence on the vigor of the other. The pear, when grafted onto the slow-growing quince root, gives us the dwarf. All strong-growing varieties of apples tend to develop a vigorous root system in the stocks on which they are worked. In a similar way, a strong-growing root system and trunk will add vigor to the top.

The Rome Beauty, when on its own roots, is, on the best soil, an indifferent grower; while the Jonathan, although thrifty, is of slender growth; but when top-worked to a strong-growing stump, both take on some of the vigor of the stock.

Some varieties seem to be resistant to the root rot, while others, especially the Northern Spy, are free from the attacks of the woolly aphid. Such varieties are often set and later worked over to other varieties. In sections where certain varieties are subject to sun-scalding this is overcome by working them onto other stock. But what concerns us most is the working-over of our undesirable varieties.

To understand the principles of top-working, one should understand something of the manner in which a tree grows. He should understand that growth takes place only in the cambium layer—the very small region between the bark and the sap wood. A split or cut in the wood can grow



together only as a growth from the cambium may grow over it. So the important point in grafting is to see that the cambium of the scion and stock is matched at some point.

Any tree that is not making a thrifty growth, as a rule, is not worth the time it takes to graft it; but, with only a few exceptions, all of our varieties can be successfully worked over. It has been found that the Yellow Transparent and Wagner grow a very poor head, as do the Missouri Pippin and the Crabs.

Different methods of grafting are used in working over the old trees, but there are only two that we should consider—cleft grafting and kerf grafting. In the cleft grafting, the older of these two, the limb is sawed off squarely, leaving a smooth, solid stub. The stub is split two or three inches with a grafting chisel or knife, and held open with a small wedge while the scion, which has previously had the lower end cut to a wedge, is inserted into the opening and driven firmly into place, with the lower bud to the outside and a little above the top of the cleft; being sure to have the cambium layer of the outside of the scion in contact with that of the stock. As was said before, it is between these parts that the union takes place.

The scion should be cut to have three buds, and should be of strong, well-matured wood of the previous season's growth. When the lower end is trimmed to a wedge, the first bud should be a little above the top of the wedge, and the side of the wedge opposite the bud a little thinner than the other.

It is well, especially for the inexperienced person, to set the scion at a little slant, to insure a contact of the cambium layers where they cross. A point of contact is sufficient for a good union. When a scion is thus set on each side, providing the stub is large enough, the wedge is removed, allowing the cleft to tighten, thus holding the scions in place. The greater thickness of the outer edge of the wedge of the scion insures the greatest pressure at this point. Wax should now be applied to all cut surfaces, even to the tip of the scion; being careful to see that the top of the cleft between the scions, as well as the sides, as far as it extends down the stub, are well waxed. This prevents the drying-out of the cut parts.

A good wax is made by melting together one part tallow, two parts beeswax, and four parts resin. Pour this into cold water and, when sufficiently cooled to handle, pull like taffy until it becomes of a buff color. This can be kept from season to season by immersing in water.

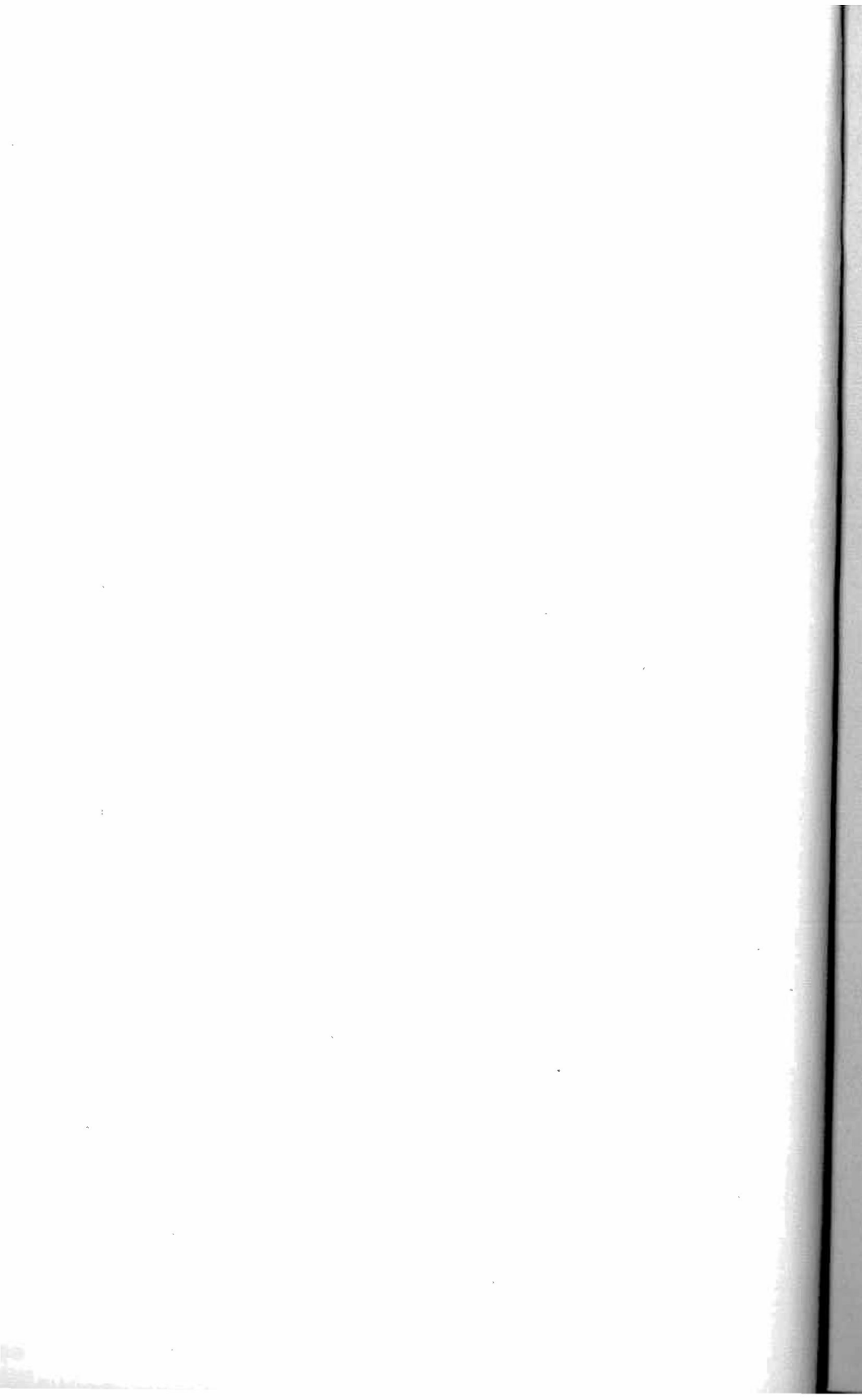
The system of kerf grafting is little different from that just described. The stub is prepared as for cleft grafting, but, instead of splitting, cuts are made with an ordinary pruning-saw on opposite edges of the stub, and trimmed to a thin V-shaped groove with a saddler's knife. The scion is then trimmed to a fit and driven firmly into place, and waxed as in cleft grafting. This is much faster than the cleft grafting, and, with a little experience, the scions can be set as firmly as in cleft grafting. If large stubs are being grafted, more scions can be set by this method, and thus hasten the healing process. The same care should be used in setting the scions, to insure a union of the cambium layers.

Of later years the kerf method is being used the most. It is thought a stronger union can be gotten by this method, as the splitting of the stub for the cleft method weakens it to a certain extent.

Too much emphasis cannot be laid on the selection of the stubs into which the scions are to be set. The head of the tree should be kept as near the trunk of the tree as possible; but it is often better to have it a little higher than to graft too large a stub. It is doubtful whether it is practical to graft a limb more than three inches in diameter, but many good unions have been made on stubs four and five inches in diameter. The most vigorous limbs that will give the best-balanced tree should be



**An Apple Tree in a Paonia, Delta County, Orchard**  
**The Leaves Have Been Stripped from the Branches to Show More Fully the Great Burden of Fruit**



selected. The number to be worked will depend somewhat upon the shape of the tree, but, as a rule, five or six will be sufficient to form the head. Large wounds, from removing large limbs, are to be avoided, but they are not so objectionable as grafts on large stubs.

The method of removing all the limbs and grafting only the stubs wanted has been tried, with varying results; but, as a rule, this has proved too much of a shock to the tree, and poor growths have been obtained on the scions. This is not only a shock to the tree itself, but the roots may even be starved from the lack of leaves to manufacture food for them. With this practice sun-scald is more apt to result.

It has been found best to cut away only enough limbs to set scions for a good top. This will be about half the tree. The remaining limbs will protect scions from the wind and teams, and the trunk and stubs from sun-scald. After the scions have made one year's growth, most of the top can be removed. If on a large tree, it should not all be removed until the second year.

The ideal time for grafting is just as the buds are beginning to swell; but it may be done any time after freezing stops, until the leaves are half-grown. It is better to run late than be too early, as scions are apt to dry and be lost.

It is well to say something about the selection of scion wood for grafting. The wood used should be one year old, strong and well matured, but not overgrown. The terminal shoots from trees that have made a growth of from fourteen to eighteen inches make good scions. The so-called water sprouts, that are not too rank in growth and are well matured, may be used; but such growths with immature tips, weak buds far apart, and pithy center should never be used.

Scions should be gathered in the fall, preferably shortly after the leaves have fallen, and stored until spring. They may be stored in damp sand in a cool cellar; or probably as good a plan as any is to bury them twelve to eighteen inches deep on the north side of a building, where a fairly uniform temperature is maintained. In this way we not only avoid winter injury, but keep the scions in a dormant condition, which will insure a partial union before the buds are started into new growth.

One cannot be too particular as to the trees from which the scions are selected. We have all noticed that there is a great variation among the trees of a certain variety in productiveness, as well as in the size, color, and quality of the fruit.

Scions from trees that never bear well are very apt to produce trees very much like them. I believe that selection in the building-up of our varieties of apples is as important as it has been in establishing our breeds of live stock.

Mr. Cline: The discussion on this paper will be led by Professor Bennett.

Professor Bennett: Mr. Chairman, it strikes me that there is little left to say on this subject. It is an important subject, and most of the details of it have been covered. There is one point that I have always had in mind as being a possibility, and which we are now trying to work out at the college, and that is the matter of securing what might be called the ideal orchard. So far I have not heard anybody cursing the nurseryman; I suppose he will come later. That is a perennial question, and it always comes up. I presume there are dishonest nurserymen, and also many honest men among them; but I defy any nurseryman to be positive that he is sending you the trees you have ordered, unless he has personally superintended all the work. He may be able to know by the looks of his trees just what they are, but you cannot always be sure of that. Another thing we have to contend with is the proposition that all nurserymen, so far as I know, make a practice of swapping stock. That is essen-

tially a business proposition. Sometimes they are short on Rome Beauty apples and they are long on something else, and they have a trade list; and that is where the practice of swapping comes in. If you buy peach trees that are supposed to have been grown in the North, the chances are that those peaches have been grown in Georgia, and because you bought them in the North is no sign they were grown in the North. This is a business proposition, but it doesn't make any difference to us whether it is or not; the fact remains that, if we put in an orchard, and we think it is the Jonathan, and it is something else, we are disappointed. Consequently, we never are sure, unless we know who grafted those trees. It might be good policy for us to plant an orchard of trees of some good growing stock, resistant to insect pests, scale, woolly aphid, and that sort of thing; and to that end we, at the present time, are trying to get some nursery stock of the Northern Spy on its own roots. It is theoretically possible to produce any plant from the bud, but in practice we cannot do it. Consequently, we take our seedling roots and graft on those the scion of the variety we desire to get; but, as commonly done now, the seedling is budded, and the next year it is allowed to grow from that bud. We make root grafts from our seedling stock, and put those in the ground quite deeply, so that the last bud will be above the ground; and, in fact, last year I put them in trenches. In this way we have at the present time quite a number of Northern Spy on their own roots. After we get those Northern Spies, either the old scion or the new growth, to make root, the next year we shall have to cut off the old seedling root and set them out again. At the present time we have quite a number of trees on their own roots making a fair growth. Now, if we can do that practically, and find some method of doing it so that we can get good strong Northern Spies on their own roots, set them out and grow for three years, and then top-work them to Rome Beauties, we shall know absolutely what our top is, what our stock is, and what our roots are, and in that way we should avoid trouble. I believe in that way it is possible to get the ideal orchard. Of course, it is more expensive for you to grow your own nursery stock than it is to buy it; but if you can grow them this way, and keep up a nursery row, you can keep those trees until they are five or six, or even eight, years, and still set them in the orchard. If they are transferred every year or two, there will be no trouble, and you will have no difficulty in transferring. As far as the top-grafting is concerned, that is a simple matter, and I firmly believe in the future we shall work out some system whereby we shall be absolutely sure we have the variety and strain that we want.

A Voice: Professor Bennett referred to developing the Northern Spy on its own root, but he omitted to say why, I think. Most of you know we are pestered with woolly aphid in this country. Some few years ago I had some correspondence with apple-growers in Tasmania, and they told me whole districts were wiped out by woolly aphid. Their government granted a large sum of money to introduce all known stocks of apple culture into that country, to test them for resistance to the attack of woolly aphid; and of all this stock only one has been successful and immune, and that is the Northern Spy. Since then they passed a law making it compulsory in that country to grow their apples of Northern Spy stock, and they do it in this way: They take the yearling whips, and lay them down on the ground, and put some sand over them, and allow them to root, so that they have a lot of young seedlings of the Northern Spy stock. I think that is an important matter, and a matter that should be made public here.

Professor Bennett: How long does it take to get those cuttings before they are ready to set out in the field?

A Voice: I cannot answer that question, but I presume it is practical; otherwise they couldn't do it so successfully there. I take it that they make their seedlings the first year, and are able to bud them the second season; but I have not been able to engage in that work, so I don't know.

Senator Crowley: Before we leave that subject of varieties, I want to say, for fear the man that has the eleven varieties will get stuck on himself, that I grow 105 varieties. (Applause.)

Mr. Cline: Has anybody any further questions to ask? If not, we will proceed with the next paper. The next paper is "Extension of Weather Service in Fruit Districts of Western Colorado," by E. S. Nichols, local forecaster, United States Weather Bureau.

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## EXTENSION OF WEATHER SERVICE IN FRUIT DISTRICTS OF WESTERN COLORADO

BY E. S. NICHOLS,

LOCAL FORECASTER, UNITED STATES WEATHER BUREAU, GRAND JUNCTION

The Weather Bureau endeavors to be of the greatest possible service to the people of the United States, particularly to those whose interests are closely dependent upon atmospheric conditions. In this vicinity we have not only the regular daily forecasts and reports, like other sections, but also special lines of service, which have grown up during the past few years and are still rapidly developing. Special work began here a number of years ago, when one of my predecessors in charge of the local office of the Weather Bureau inaugurated a plan of warning the people when to light their piles of straw, manure, and other smudge material for the purpose of preventing damage to fruit from frost. Since the adoption of orchard-heating this service has developed, with co-operation of local organizations, into the system of temperature forecasts, reports, warnings, and assistance described in my article published in your last annual report.

Until the spring of 1911 the entire dependence for temperature reports from the orchard districts was placed upon private thermometers of varying degrees of accuracy—some excellent, others unreliable. That season I was supplied with a few Weather Bureau minimum recording thermometers for use in the work. They were exposed uncovered on posts generally, as is usual in the orchards, and were of much use on frost-danger nights that season and last spring. They and some of the better grade of private thermometers have been used, also, in obtaining systematic daily minimum temperature readings during the frost season, and to some extent during other parts of the year.

Last spring, after a brief trip to those districts, I recommended that our special service be extended to include other fruit districts of the western slope, and that we commence immediately, using instruments already on the ground at climatological stations already established. I was accordingly authorized to gather daily reports from Delta, Paonia, and Montrose, and to issue special local forecasts for those districts. This service was in operation last spring and part of last fall, the forecasts being distributed without charge by the Mountain States Telephone and Telegraph Company.

For the coming season Professor Willis L. Moore, chief of the Weather Bureau, has authorized a very considerable increase in our instrumental equipment and in the number of substations. Also, telegraphic reports are being received night and morning every day in the year from stations throughout the United States and southern Canada. Formerly morning reports only were received on working days during spring and fall. The most important data received are published, for the information of the people in this part of the state, in the Grand Junction daily papers, in the form of "Commercial Weather Maps," which are printed

from new stereotype plates cast at our office each night and morning. The increased work from these and other causes has necessitated an increase in our station force. Thus the Grand Junction station is now much more important than is usual in cities the size of Grand Junction. This has been done because of the magnitude of the interests depending upon the weather in this part of the state.

The special stations are being located in the Grand Valley proper, the fruit districts of Delta and Montrose Counties, and up the Grand River at Rifle. They will be equipped with recording maximum and minimum thermometers and instrument shelters. A few will also have thermographs, which continuously record temperature changes on a sheet of paper. It should be noted that the thermometers are to be exposed in instrument shelters. These shelters are so constructed as to allow free circulation of air about the thermometers, at the same time preventing superheating by direct and reflected rays of the sun during the day, and cooling by radiation, etc., below the air temperature at night. Thus true air temperatures are obtained, and shelter temperatures are universally taken as the standards for climatological purposes. They differ by varying amounts from temperatures recorded by uncovered thermometers, and from temperatures of vegetation and other exposed objects, according to atmospheric conditions (cloudiness, humidity, wind, etc.), the nature of the exposed surface (as to color, roughness, etc.), the supplying of heat from layers below the surface, the proximity and character of near-by objects, etc. On cloudy, windy nights the uncovered and sheltered thermometers may read alike; but differences amounting to several degrees are at times observed on calm, clear, dry nights.

Daily during the frost season the substations will send to Grand Junction special weather reports, which will be used, in connection with our regular weather reports received from all parts of the country, in making local forecasts for the various districts, especial attention being paid to temperature. Similar service under our Denver office is being planned for the Canon City section.

It is at once evident that it would be folly to attempt to forecast the temperature in every orchard, especially in sections where the topography is varied. Therefore the substations will be taken as standards of reference for their immediate vicinities, and forecasts should be interpreted as indicating the conditions expected at the stations. Then, by taking systematic daily readings in their own orchards, the growers can determine how their temperatures compare with those at the nearest station, and thus, upon receipt of the forecast, can tell what to expect in their orchards better than at present. For this study the grower needs at least a good minimum thermometer. The Weather Bureau will continue to co-operate closely with the Fruit-Growers' Association, the telephone company, the Chamber of Commerce, and individuals in gathering reports, disseminating warnings, and otherwise assisting fruit-growers on frost-danger nights in the vicinity of Grand Junction. In outlying districts we will co-operate, as far as practicable, in exchange of reports, etc., and will be of such assistance as is possible in organizing local weather services. However, the most important part of the Weather Bureau work is the forecasting. This has been especially emphasized the past year, and will be in the future. The bureau maintains all over the United State a double system of forecasts. First, we have the state forecasts, which give the general indications; and, second, local forecasts, giving indications for localities in the vicinities of stations in greater detail. The special service being worked out in the fruit districts is merely an extension of the general system.

It is believed that, after a season's work with the new equipment, less night watching of temperatures will be necessary during the frost season, and that the forecasts will be found of increasing benefit. I feel confident that the service during the fall will prove of much assistance

during the harvesting and shipping period. Also, it is hoped that people generally will learn to use our reports and forecasts to greater advantage during all seasons of the year, particularly in connection with general ranch work.

However, I would caution you not to expect perfection in the forecasts, particularly the first year of extension of service. We are usually successful, but occasional failures are inevitable, from the very nature of the work and the difficulties to be met. The Weather Bureau takes the public into its confidence, explaining its methods and limitations. We do not claim to be able to do the impossible for the sake of temporary popularity. In this connection, a few words on forecasting in general may not be out of place.

Weather forecasting is not the simple task it is sometimes assumed to be. We live at the bottom of a deep, boisterous sea of invisible gas, conditions existing in the mass of which are known to us only indirectly through pressure and other changes at the surface of the earth (except such assistance as is given by cloud observations and records of instruments carried up by balloons and kites). The weather at a particular place and time depends upon conditions prevailing throughout the mass of atmosphere covering a large area, hundreds or thousands of miles in diameter. Those who study the daily weather maps know that the conditions that will produce our weather tomorrow are now hundreds of miles away; while the conditions that will produce the weather far in the future—next month or next spring, for example—have not yet developed. So that, while local signs, such as wind, clouds, barometer changes, etc., indicate the weather for a few hours ahead, predictions for a day or two in advance require that reports be gathered from a large district, such as the whole United States, or, better, the entire northern hemisphere. And there is no way whatever to make accurate predictions for a month, a season, or a year ahead.

I trust, therefore, that no member of this convention will be influenced, in running his ranch or other business, by long-range forecasts found in almanacs or elsewhere. For such forecasts are either so vague as to time, place, or conditions to be expected as to be useless; or, where definite, are based upon phenomena that have no perceptible effect upon the weather—such as the phases of the moon, or the positions of the planets. But a study of past records of weather will tell you the usual conditions that prevail during the various portions of the year, and the extremes that have occurred. Thus you can tell, within reasonable limits, what to expect at the place where the records were taken. Conditions at other places, even in the immediate vicinity, will differ more or less; but from the data you can infer, with more or less accuracy, the usual weather, or the climate, at points in the vicinity. This always involves more or less uncertainty, especially in regions having variable topography. Therefore, if you have not already done so, I would suggest that you get a good thermometer (your time is too valuable to spend in accumulating erroneous data), construct or purchase an instrument shelter similar to those supplied to our weather stations, and commence the first of the year to keep a daily record of temperature and other weather conditions at your ranch. The data obtained will prove of untold value in future years.

Mr. Cline: The next paper on the program is "The Leaf-Roller Pest in Colorado," by Professor G. P. Weldon, State Agricultural College, Fort Collins.



## THE LEAF-ROLLER PEST IN COLORADO

BY PROFESSOR G. P. WELDON,

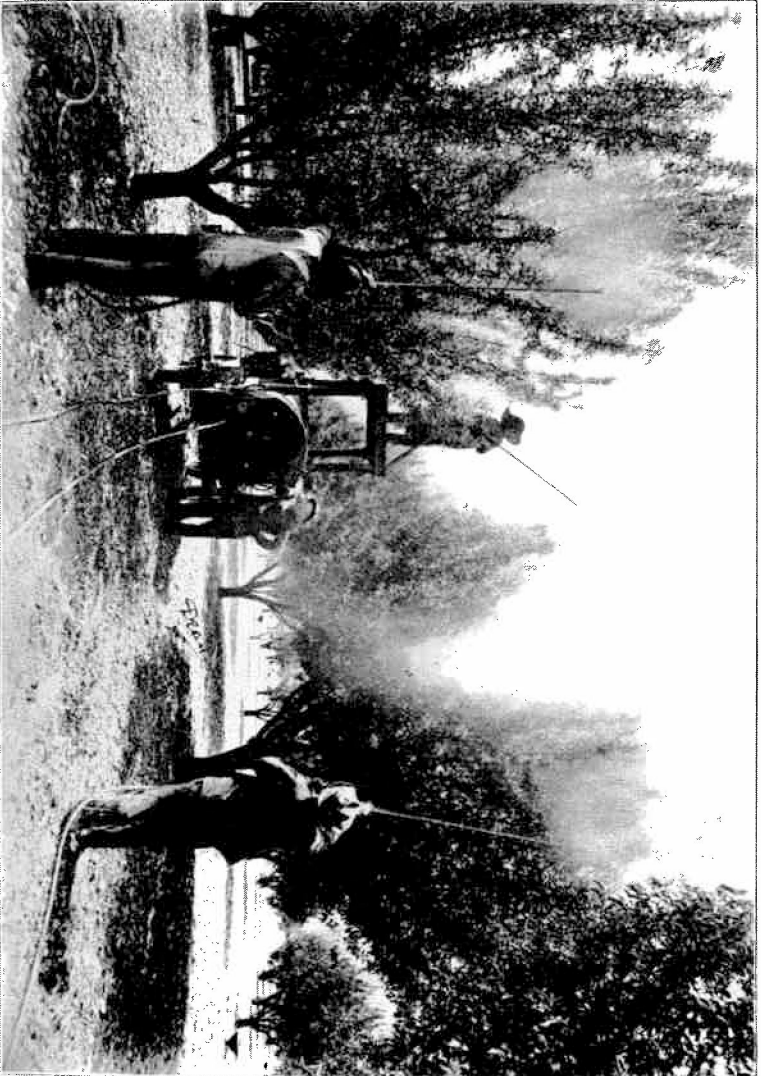
STATE AGRICULTURAL COLLEGE, FORT COLLINS, COLORADO

Mr. Chairman, Ladies and Gentlemen: The hour is getting late, and I will promise not to detain you very long. I did not choose the subject assigned to me on the program, "The Leaf-Roller Pest in Colorado," because of its importance in this section, but because it has been a pest of the greatest importance in other parts of the state. It has made its appearance in certain sections of the western slope, and it will probably be just a question of time until it appears in this section also. We hope, at least, that we shall not have the scourge of it that they have had in some other places. It has been one of the worst pests, I might say, that have ever appeared in Colorado orchards; that is, the damage done by it in certain sections in a single season is worse, I think, many times over, than the damage that has ever been done by codling-moth in a single season.

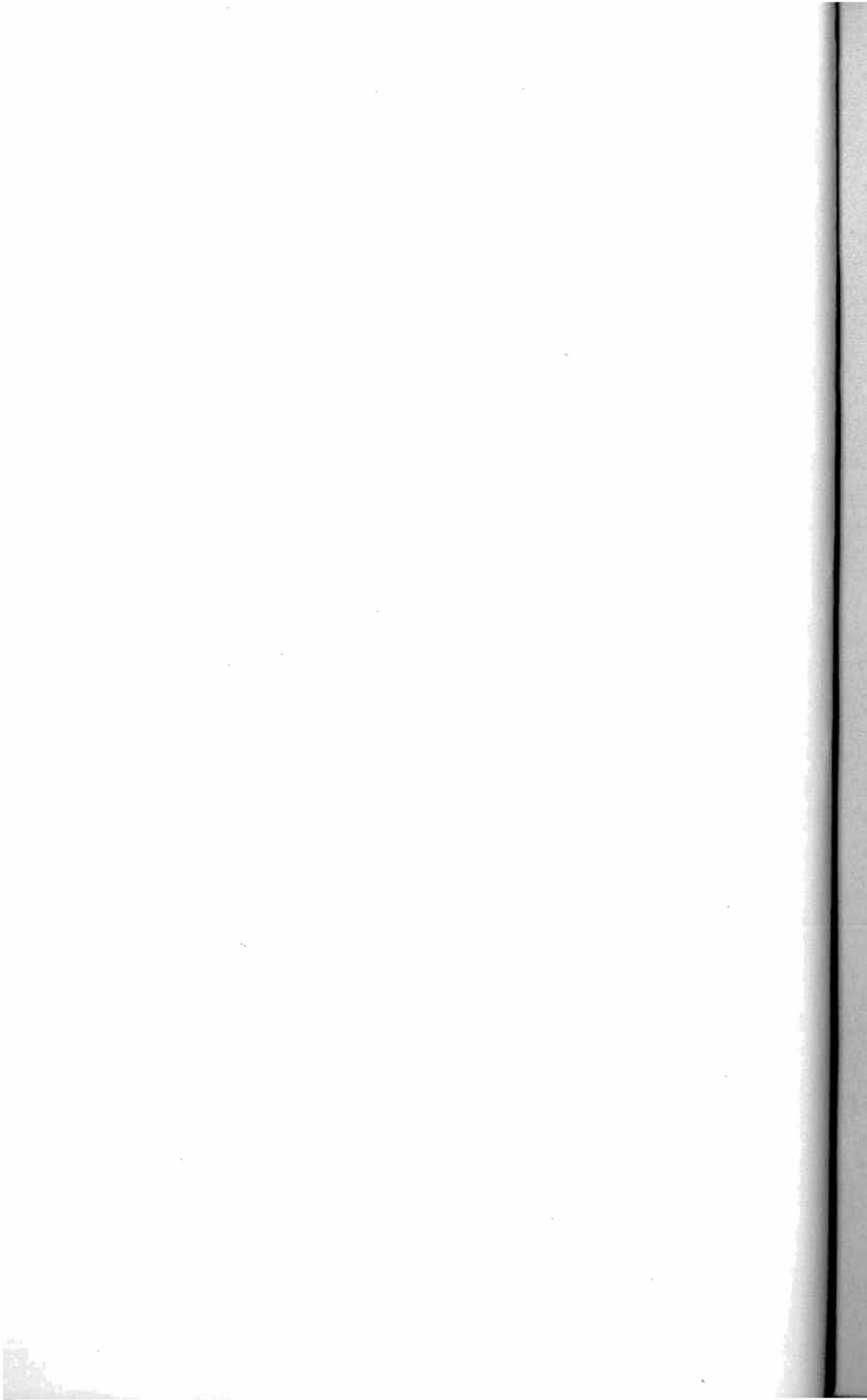
You are not familiar with the leaf-roller pest in this section, I believe, at all, and there are a great many who have no idea what it looks like. I find in my travels that a great many people are speaking of various species of aphids, that have a habit of curling the leaves of the trees upon which they feed, as leaf-rollers. These are not leaf-rollers, in the true sense of the word, at all. The leaf-roller is a pest closely related to the codling-moth. The adult insect is a little moth which lays its eggs on the fruit trees in the orchard in little masses. I have here a Riker mount in which is shown the leaf-roller pest in its different stages; also some of its injury to the foliage; and I am going to pass it around, so you can all see it.

The eggs are laid on the trunks and branches of trees. In the masses there are probably on an average about fifty eggs, and, to give you an idea of how abundant those egg-masses are on certain trees in sections where the pest has appeared, on one tree, when the egg-laying was over last summer, I counted 245 egg-masses to a height of five feet above the ground. If there are fifty eggs in one of those little masses, it means a good many little larvæ or worms on the first five feet of that tree. On another tree there were 305, and, on still another, 200. From the two trees, one having 305 egg-masses on it and the other 200, with an average of fifty-one eggs to the mass, and if all should hatch, there would be 25,755 larvæ that would come from the first five feet, not to say anything about the rest of the tree, which would have its share of eggs also. So, you see, when you get a pest that feeds upon the foliage, so abundant as that, there is sure to be trouble.

At this season of the year they are in the egg stage. The little egg-masses, when found in the orchard at the present time, indicate that the pest was present last season, and, unlike those that are in the mount that I am passing around, they will not have the little holes in them, or what appear as little indentations on the surface. Those little holes show where the little larvæ came from the egg-mass, and, if you had time, you might count the number of holes in each egg-mass, and you would be able to tell how many larvæ came from each one. Early in the spring, just as soon as there is any green foliage appearing in the orchard, or any pink portions of blossoms, the eggs begin to hatch and the little larvæ begin feeding. Many of them will go into the tiny leaf-buds or blossom buds, and there begin their feeding. Last season it was not unusual to find from three to five of those little larvæ, along in the fore part of May, feeding in a single blossom; so you can imagine for yourselves what happened. When the little larvæ first hatch, they are about the same size and look about the same as the codling-moth larvæ. There are some of those in the mount being passed, but you will not be able to see them well with



Spraying an Orchard—Showing Proper Apparatus for Doing Effective Work.



the light we have in the building. They look, however, very much like the larvæ of the codling-moth. They do not confine their feeding entirely to the foliage, but, as the apples or other fruit grow, if the fruit-grower is fortunate enough to have any fruit left on his trees, they feed on it as well as the foliage for about thirty days, on an average, until they become full-grown. Then they change to the pupal stage, and from that pupa in a couple of weeks' time the leaf-roller moth emerges. Fortunately, there is only one brood during the season. If we had two broods of this insect to contend with, we should have a much more serious pest. Those moths which come out in the early part of June, which is about the time we find them in our orchards, lay eggs about the last part of June or the first part of July. Last season the egg-laying was at its height near Canon City the first week in July. The eggs remain unhatched during the rest of the summer, fall, and winter season; and that, as I said before, is the stage in which you will find them at the present time.

This, in brief, is the life-history of the leaf-roller, which it is necessary to know in order to plan intelligently for its control. If we could kill the eggs with something, we should have the problem solved. So our first efforts were directed toward finding something that would do this; and in that effort we were at least partially successful. In fact, we were very successful in our tests last season; but it is not well to draw too many conclusions from one season's experiments. While we have published a circular giving the results of those experiments, and giving recommendations in regard to the work in the orchards where the pest is present, yet we might not be so successful in our work another season.

It seems as though the oil sprays will penetrate through the coating of the egg-mass much better than anything else, and in our tests we succeeded in killing about 99 per cent of the eggs. We made an estimate by counting hatched and unhatched egg-masses on the trees we sprayed, and we found that at least 95 per cent of them did not begin to hatch, and out of the 5 per cent that began hatching, possibly only one or two larvæ hatched in a mass; whereas on the trees that had not been sprayed at all a very large percentage of them, practically 100 per cent, hatched. That is what was accomplished with the spray of oil; and, to bear out our tests, there was a government man in the same section, who carried through a like experiment, and he had equally as good success with another soluble-oil material. One of the orchardists in that section also experimented with soluble oil, and kerosene emulsion, with equally good success. So we feel sure that we are on the right track, and that, if we can persuade the orchardists to use the soluble-oil spray in the early spring, they will have the problem solved. It should be applied before the eggs begin hatching. Last spring, the 19th of April was the date when we made the soluble-oil application. There are several brands of these oils. I am not here to tell you which is the best. I do not happen to know, and am not desirous of advertising any particular brand. There were two brands used in that section with equally good success: the Target Brand Scale Destroyer, manufactured in Philadelphia, and what is known as the Scalecide Soluble Oil, manufactured by the B. G. Pratt Company, of New York.

If for any reason the orchardist should fail in killing the eggs with the soluble-oil treatment (and we do not expect everybody to have success), two or three sprays of arsenate of lead will result in much good, and in some cases absolute control. I think we demonstrated that fact last season, also. People have been using arsenate of lead for a number of years, with more or less success, but are discouraged because they have not been able to save their fruit by its use; and their contention was that it didn't pay to apply it, simply because their fruit was destroyed anyhow. By making the sprays earlier than they were making them, it was possible to save practically the entire crop of fruit. The first spray has to be put on much earlier than the first spray for codling

moth; in fact, it is necessary to put on two sprays before the time when you ordinarily put on your first spray, the calyx spray, for the codling-moth. The first spray should be applied for the leaf-roller just as soon as the buds begin to burst and when the eggs are beginning to hatch. The idea is to kill the first larvæ that hatch, before they have had a chance to eat into the buds, and the spraying, in order to do that, has got to be very early. In our experimental work the first application was made too late for the best results. Unfortunately, they didn't have as many power sprayers in the section where the work was done as would be necessary to spray the orchards thoroughly, and there was no chance to get the use of one until it was five or six days later than I should have liked to put on the first spray. Not being able to get the sprayer at the time I wanted it, I had to spend Sunday doing that experimental work. I know some good people criticised me for doing that, and I admit I didn't like to do it myself, but the "ox was in the ditch," and we had to act. When we did get in the orchard with two power sprayers, and the spray was applied, there were many larvæ in the blossoms, and we knew we were too late to get the best results. That spray was put on when the buds in the clusters had separated one from the other. The first spray should be put on before any separation has taken place, and the second when the individual buds in a cluster have separated one from another, and before the blossoms have opened. Then the calyx spray for the codling-moth should be the third spray for leaf-roller.

Some people made the mistake last season of putting on a spray when the trees were in bloom. They were willing to take any chances. They did not think about the bee man, or anything else but the leaf-roller; and consequently they went to work and sprayed entire orchards while they were in full blossom. It was the first time I had ever seen wholesale destruction of bees from arsenical sprays used in the orchard; but they certainly were destroyed in great numbers in that section last spring, and the destruction came at the same time as the blossom-spraying for leaf-roller. While we didn't have an analysis made of the corpses of the bees to determine whether or not there was any arsenic present in their stomachs, yet we have every reason to believe that this one spray resulted in the death of a tremendous lot of bees in that section. So we would not recommend a spray when trees are in full bloom.

I had some charts made, that I was going to hang up, which illustrate the work done; but it is too late to attempt this. There was another insecticide, besides soluble oil and lead arsenate, that proved successful, and that was Black Leaf Forty, applied on the 5th of May. An application of this material resulted in almost complete control. There was no question about this material doing the work. The trees sprayed with Black Leaf Forty were alongside unsprayed trees in the orchard, and from a comparison of the two we could draw no other conclusion than that the Black Leaf Forty had controlled the pest almost perfectly. The trees so sprayed held the foliage green until the close of the season. Unfortunately, there was but little fruit in the orchard, so we could not estimate how much fruit we had saved; but we judged from the foliage that we would have saved the entire crop of fruit in many cases, had there been any to save. It seemed wonderful how the Black Leaf Forty killed the larvæ. Many times we would find them dead where it would seem impossible that the spray could reach them at all, but it was the case nevertheless; and those trees sprayed with this material held their foliage until the end of the season, while the other trees, not sprayed at all, had something like 50 per cent of their foliage destroyed.

There is an important matter I want to mention in connection with spraying, for this as well as other pests, and that is in regard to the thoroughness in making the application. There were people in the district where spraying was done who laughed at us because we used so much spray. We used on an average of ten gallons per tree to trees that were

not much taller than the average ten or twelve-year-old trees in this valley. It was hard to find anybody in that section who was using more than from three to five, or possibly seven, gallons of spray to the tree. Those same people who made fun of the heavy spraying we were doing in our experimental orchard sprayed five or six, and in some cases I think even seven, times, and met with indifferent success; while we did the work, and did it well, with two sprayings. In other words, two very heavy, thorough sprayings did better work than five or six sprayings not thoroughly done. It is hard to get people to realize that. I know that sometimes we are handicapped because we have not enough spraying-machines. We have to depend upon spraying too many acres with our power outfit, our barrel pump, or whatever it happens to be. In many cases where they failed to control the leaf-roller with arsenate of lead, they could have controlled it had they been more careful when they made the application.

Now, I don't know that there is anything else I can say. If time had permitted, I would have enlarged upon many statements I have made; but I am going to close right here, unless there are some questions you would like to ask.

A Voice: What kind of trees are affected?

Professor Weldon: Practically all kinds of fruit trees. The peach, however, is one that does not seem to be troubled, or it was not, at least, in the sections where the leaf-roller has been at work for several seasons past. The apple, pear, plum, and cherry were attacked about alike, but I don't think I saw a single peach tree that had been attacked by it. While the peach may not be immune, the indications are that it is little troubled by the pest.

A Voice: How about the cherry?

Professor Weldon: The cherry is susceptible; they will injure the cherry practically as much as the apple.

A Voice: Have they any preference for any particular variety of apples?

Professor Weldon: There seems to be absolutely no preference for variety. I could not see that they troubled one variety more than another.

A Voice: What strength of soluble oil was used?

Professor Weldon: One part to nineteen of water.

A Voice: What strength of Black Leaf Forty?

Professor Weldon: One part of Black Leaf Forty to about eight hundred parts of water.

A Voice: Do you think the Black Leaf Forty could be used in combination with the arsenate of lead?

Professor Weldon: I tried that, but I did not seem to get any more benefit.

A Voice: Which is the more expensive, the Black Leaf Forty or the oil?

Professor Weldon: The Black Leaf Forty and the oil would cost about the same. What I mean to say is this, that the cost per tree of a Black Leaf Forty spray would be about the same as a soluble-oil spray. The cost of the Black Leaf Forty spray per tree would be about twenty-five cents, and the soluble oil would amount to about the same thing, counting on the application of ten gallons of spray per tree on an average. Arsenate of lead is, of course, somewhat cheaper, but you would have to make two applications to get anywhere near the results you could get with the one spray of soluble oil or the Black Leaf Forty. That was our experience, at least, last season.

I have a few leaf-roller circulars here, if any of you are interested in that pest to the extent that you would like to read them. You are welcome to a copy. It is a state bulletin, and it is not being sent out to

the regular mailing list. We have to pay postage on these, so we simply reserve them and send them out whenever we have requests for them, or send them to those who, we know, have the pest to deal with.

A Voice: The death of the bees would result when you use the arsenate of lead?

Professor Weldon: Yes, sir.

A Voice: How about the other sprays—would they affect the bees?

Professor Weldon: No, sir.

Professor Bennett: Wouldn't it catch quite a good many bees working while you were spraying with the Black Leaf Forty?

Professor Weldon: That is possibly true, but I don't believe they would work on the trees while you were spraying. I don't suppose, anyhow, that these would be killed by the small amount of Black Leaf Forty that would get on them in that way; probably there would be no bad effect from the use of this material.

Mr. Fletcher: The bees were killed by eating it.

Professor Weldon: Yes; the damage was done at the time when the bees were feeding on the nectar. At that time the arsenate of lead was also there.

A Voice: Do you think there is any danger of the excessive use of arsenate?

Professor Weldon: I think there is danger in the excessive use of any spray, but what are you going to do when a pest is abundant, and you must spray heavily or lose your crop? I would not advocate the excessive use of oils. I should hate to think we had to use them year after year. From experience in this valley, it would not be well to recommend them except when absolutely necessary, simply because they do not mix well with alkali water. We have not experienced much difficulty where the leaf-roller is bad. If soluble oil had to be used season after season, I doubt if the effect upon the trees would be the best.

Mr. Fletcher: Have you examined any trees where you applied it last year?

Professor Weldon: They are all right; there is no harm, as far as we can tell.

Professor Bennett: Did it affect the egg-laying on those trees?

Professor Weldon: The moths were in the orchard, and, while the trees that had the most eggs last season may not have so many this season, yet the orchard, I think, as a whole, has not quite so many eggs, but there are still plenty there.

Professor Bennett: Is it a native insect?

Professor Weldon: Yes, I think it is. From 1891 to 1895 this pest was a serious one in the Fort Collins section, and at that time the trees were defoliated by it; also at Greeley and Boulder, and possibly in the vicinity of Denver. The parasites got in their work after the pest had been present about four years. Since that time there have been scarcely any of them in those sections. The parasites worked on the larvæ, and in a year or two had practically destroyed all of them; and while we were hoping that such parasites would appear in the Canon City district last season, they did not do so, but they may the coming season. You can't tell about those things. We find an occasional egg, also occasional larvæ, in the orchards at Fort Collins during the summer season, but the damage has been practically nothing since the year 1895. I might say that this pest has been found on the western slope, and in one section at least it has done considerable damage. In one orchard it was very bad. In another section there was considerable of it; it was quite generally distributed. It is right at your door; and should it appear in your orchards, we should consider it a favor if you would let us know about it imme-

diately, and if there is anything to be done, we will do all in our power to help you.

Professor Taylor: As I remember it, a bulletin was issued on the insects of Colorado about ten or twelve years ago. Didn't Palisade have a little trouble with this insect?

Professor Weldon: That is possibly so.

Professor Taylor: It seems to me I have seen a record of that in this bulletin?

Professor Weldon: I don't remember seeing anything about its occurrence on the western slope. I know that egg-masses have been found here and there throughout the whole section.

Professor Taylor: I think Mr. Frank Berger, of Palisade, had some experience.

Professor Weldon: Is there anyone here who remembers an outbreak of leaf-roller in the orchards of this section? We should be glad to hear about it, and what they did to control it?

Mr. Fletcher: If it was allowed to persist during the year, what would be the effect on the health of the tree?

Professor Weldon: I saw one orchard at least that was entirely defoliated last season, and I wondered what would be the effect on the next season's crop; I wondered how the fruit-buds would develop. I have not seen that orchard this fall, but in conversation with the county inspector of that section the other day he told me he thought there was a splendid setting of buds. That is contrary—is it not, Professor Bennett?—to what is known about bud formation in the orchard.

Professor Bennett: Strange as it may seem, some trees do seem to stand more of that thing than they ought to; but it will not go on indefinitely. I should expect, theoretically, it ought to do them up probably in the first year.

Professor Weldon: Well, it will not do it in Colorado. I have seen cherry orchards, where the cherry slug had been allowed to defoliate the trees, die out from the attack, and I am sure that no trees would stand being defoliated year after year.

A Voice: In case of an outbreak, and your neighbor would not spray or do anything to handle it, what would you do?

Professor Weldon: We have a pest district law, and over at Canon City we have a pest district formed, and the people in that district (and the district includes practically the entire Canon City section) will be expected next season to spray first with a soluble oil. In some cases we shall probably have to compel that work to be done, but it has to be done for the good of the entire section. We had a very enthusiastic meeting over there the other day. I talked there last Wednesday afternoon to, I think, about three hundred fruit-growers, and I don't think there was a single person in that audience who objected at all to the idea of enforcing the law in that district; and that is what we expect to do next spring. We are going to handle the situation there by getting the people to pull together in the organized district. We shall be able to do things that would not be possible were such a district not formed.

A Voice: Do you think soluble oil better than Black Leaf Forty?

Professor Weldon: Yes. I would use the soluble oil simply because of the fact that, if you kill the eggs, then you are not going to have any worms to fight; but if you fail to kill the eggs, then you have a chance with your Black Leaf. Use soluble oil first, and in all probability that will kill the eggs; and, if it does, that settles the question for the season.

A Voice: Are those egg-masses always found on the twigs?

Professor Weldon: No; we find them on the trunks, and sometimes we find them on fence-posts, grape vines, houses and barns in the vicinity.



cottonwood trees, and almost everywhere. The question was asked at Canon City: "Shall we spray fence-posts and houses, and places like that?" I said: "No; spray your fruit trees, because very few of those that hatch on fence-posts are going to get on the fruit trees; and they do not attack the shade trees very much either. Ordinarily speaking, it is a fruit-tree pest, and if we can handle it in the orchard, we have the thing under control."

A Voice: Is it easy to detect the presence of those masses?

Professor Weldon: Very easy. If you can get a look at that mount, you can see them. Some of them will measure one quarter of an inch in length, and are about one-eighth of an inch wide.

Professor Bennett: That is, en masse?

Professor Weldon: Yes. The eggs in each mass are very close together, and, as I said before, there would be about fifty eggs in a mass. They are very easy to detect.

A Voice: The leaf-roller has some tendency to attack the box elder, hasn't it?

Professor Weldon: It is very closely related to the box-elder leaf-roller. The box-elder leaf-roller appeared over at Fort Collins, during the outbreak of leaf-roller there, about as plentifully as the apple-tree species. They are two separate species; both are very closely related and look much alike. The box-elder species does not work on fruit trees; neither does the fruit-tree species work on the box elders to any extent.

A Voice: Is there any other disease with which this could be easily confused?

Professor Weldon: No; I think you would know the leaf-roller. You might possibly find an egg-mass of some species in the orchard that would not be this particular one. If you find eggs, however, you may be pretty sure you have those of the fruit-tree leaf-roller.

A Voice: Has lime and sulfur been tried?

Professor Weldon: Yes; but it didn't prove to be of any value whatever. Strange to say, it apparently had no effect on the eggs. We used lime and sulfur stronger than we ever thought of using it for scale insects, or any other insect in the orchard. Just to illustrate: In some cases I used Rex lime and sulfur, a good grade—equal parts Rex lime and sulfur and water—and possibly killed 50 per cent of the eggs.

I believe that is all, Mr. Chairman. (Applause.)

Mr. Cline: Now, as it is getting late, we will adjourn this convention until ten o'clock tomorrow morning; and let us be prompt in convening at that hour. We have a lot of work before us yet. Tomorrow afternoon at one o'clock we will take up the question of the better distribution of our fruit product, and we shall no doubt have an interesting discussion of that question.

Before we adjourn, I will appoint the committee on resolutions, so they can get together tonight and work. I will appoint on that committee Mr. A. F. Johnson, Mr. R. E. Turpin, and Mr. A. E. Mauff.

Now, if there is nothing further to come before the meeting, we will stand adjourned until ten o'clock tomorrow morning.

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DECEMBER 18, 1912, 10 A. M.

Mr. Cline: Ladies and Gentlemen: As it is now past the hour of ten o'clock and we have a long program before us, the convention will be called to order. The first thing on the program this morning is the "codling-moth," discussion led by Professor G. P. Weldon.

Mr. A. C. Newton: I notice on the program the last thing is to be the question of the "Distribution of the Fruit Product." At that late hour, when this important subject is taken up, many of our out-of-town folks may not be here, and it is the most important subject on the program. I suggest that it be taken up immediately after dinner.

Mr. Cline: It was announced yesterday that it would be taken up the first thing after dinner, at one o'clock.

Mr. Newton: That is a good idea.

Mr. Cline: Professor Weldon will now give us some valuable information on the codling-moth.

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### CODLING MOTH

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BY PROFESSOR GEORGE P. WELDON AND PROFESSOR ESTES P. TAYLOR

Professor Weldon: Mr. President and Friends: I have talked codling-moth so much to Grand Junction audiences that it is getting to be a kind of chestnut. Most of you know my ideas on the codling-moth question pretty well. When I was thinking about this topic, there were three words that suggested themselves to me as embodying practically everything that it is necessary to know, in order that we may be successful in the control of the codling-moth under ordinary conditions; and those were "time," "spray," and "thoroughness." What *time* shall we spray? What *spray* shall we use? How *thoroughly* shall we apply it? In the first place, the proper time to make the application is of vital importance. Most of you are making the first spray for the codling moth at the proper time, and that time is when the calyces are open. I understood that last season there were some people in this valley who attempted to get along without that calyx spray. I should like to hear, before this discussion ends, as to how they came out, if there happen to be any of those people in the audience. I could make a guess right now, and I think I could guess right. These few were not convinced that the calyx spray is necessary, and were trying to get along without it, even though their ideas were contrary to everything that has been worked out by the experiment stations all over the country, by the government entomologists who have been working on that problem, and by all others who have sprayed for codling-moth for years. We know absolutely, if we know anything at all about this problem, that the calyx spray is necessary; it is the one spray that we are absolutely certain we cannot neglect in our orchards; if we do, we are going to suffer the consequences in the destruction of a very large percentage of our fruit through the calyx worm. So the time to apply the first spray is when the calyx lobes are open. These lobes remain open for different lengths of time in different varieties; some varieties will close their calyces quite soon after the petals have fallen, and others will remain open for two weeks. Of course, that depends somewhat on weather conditions. Ordinarily, we say there is a period of from a week to ten days when the calyx lobes are open, and during which time a spray of arsenate of lead, or some other arsenical spray, can be applied, and fill the calyces so that all the larvae which try to enter by way of the calyx will be killed. That is the time for the first spray; and, as I said before, that is the one spray we must apply if we are going to make a success with our codling-moth control. There are some cases where that spray is all that is necessary. You who are here this morning—some of you, at least—have known of seasons, or have known of certain orchards, where one application, at the time when the calyces were open, controlled the codling-moth almost perfectly. It is only when conditions happen to be very favorable that

such is the case. We have not had conditions favorable enough in this valley for three or four years or more, so that we could get along at all with that one calyx spray; but conditions in other parts of the country have been such that this spray was all that was necessary. The first year I worked on the western slope, in Delta County, we had an experiment in which we applied only the calyx spray with great success, and we were able to save practically 95 per cent of the fruit with the one spray. We tried that here in Mesa County two years ago, and were not successful at all; we found that we had to make many more applications.

Some entomologists, because of the fact that they have been able to control codling-moth with one spray, have made the claim that one spray is all that is ever necessary. We know that the one spray cannot be successful under our conditions such as we have existing among us at the present time. I picked up a bulletin, the other day, from the Bureau of Entomology. A comparison had been made between results from one, two, and three sprays applied for the control of the codling-moth. It was found in Virginia, and some other states in which the work was done, that successful control could be accomplished with merely a calyx spray under the conditions that happened to exist in certain seasons. The figures showed that in some cases more than 80 per cent of the fruit was clean on the unsprayed trees that were left in the orchard. Now, all of you know that if you were to leave any trees in your orchards without spraying at all, nothing like 80 per cent of the fruit on those trees would be free from worms. Probably, if you should leave two or three trees without spraying for the entire season, the entire crop of fruit, practically speaking, would be destroyed, because you neglected that spray. So we are working here under conditions that are not altogether favorable, at least at the present time, for one spray, or two sprays, or three sprays; we have to make several applications in order to succeed.

The question comes up: How are we going to time the later sprays? We are agreed, almost unanimously, that the time to make the first application is the time I first gave. But when are we going to make the second application? Some of you will say "two weeks after the first;" some of you will say "three," and some of you "four;" possibly; but how are we going to tell? What have we to judge from? How are we to know? Well, we can set the time at three weeks, and go by the calendar—maybe some of us do that; but there is a better way than that. Better than going by the calendar is to watch for the eggs; and every orchardist ought to become thoroughly familiar with the egg stage of the codling-moth. If we can become familiar with this stage, so that he can go out in the orchard and find the eggs on the leaves of the trees, or on the little apples, then he is in a position to judge for himself as to what time to make these later applications. If he cannot do this, he should get the advice of the county horticultural inspector, or someone else capable to judge in regard to such work. I do not believe there is any orchardist with normal sight who cannot find those eggs himself, providing he has been shown them in his orchard. The time of the second application will vary quite a little from season to season, and that is the reason we cannot set any definite date. Sometimes two weeks after the first spray is the very best time to apply the second; sometimes it will possibly be three weeks, or even four, before it will be necessary; and sometimes, as I said before, it will not be necessary to make it at all. We can judge best by the abundance or scarcity of the eggs in the orchard. If the eggs are being laid abundantly, and they are hatching well, and the larvæ are feeding, then we feel certain that the later sprays are necessary. On an average, then, the second spray should be applied three weeks after the first. I may be putting the time a little bit too long, and perhaps Professor Taylor may disagree with me slightly there, but I believe, on an average, that is about right. When

shall we make the third application, if such is necessary? The second application should be put on, of course, when there are numbers of eggs on the trees, and when they are hatching readily, so that we may be able to kill the first larvæ as they are eating into the apples. The third application should be made about two weeks after the second.

These three sprays are directed against the first brood. If later sprays are necessary, for the control of the second brood, when are we going to apply them? On an average, it takes the codling-moth about seven weeks, in round numbers, to go through all its stages; that is, from the time that the first eggs of the first brood are laid until the time of the first eggs of the second brood will be about fifty days. Now, you can go to the calendar and mark the time when you find the first eggs of the first brood; but the best thing to do again is to watch for the eggs, and not time the application by the calendar. Why? If your three sprays for the first brood have been made thoroughly, and conditions have been favorable, you may not have to make any more than three sprays, and the best way to decide whether or not later sprays are necessary for that second brood is to look for eggs in the orchard, and the time to look for eggs of the second brood is about fifty days after the time when the first eggs of the first brood were laid. The search should be continued for at least two weeks, as the maximum number of eggs would not be found until later. Sometimes it is necessary, and I think it is usually necessary in this valley, to make a spray at that time; so we will set the date for the fourth application about fifty days from the time of the first. It is well to follow up this spray with another in ten days or two weeks' time. These five applications, at approximately the times mentioned, should result in almost complete control of the codling-moth under even very severe conditions.

Other sprays besides the arsenate of lead have been used in this valley the last two or three seasons, and we have met with some reverses on that account. In some cases, possibly, you have had success with certain of these other sprays. I think I am safe in saying that we know of nothing better at the present time in the way of an arsenical than arsenate of lead. We were in hopes that the arsenite of zinc would prove to be better, but I am almost ready to give up arsenite of zinc, unless it can be made a little better product than we have received up to the present time. Arsenite of zinc is an excellent poison, and analyses of various samples of this material that we have made show that it contains little soluble arsenic and ought not to do any damage to the foliage. We had eight samples analyzed recently, taken from packages of the material that were used in certain orchards, and in not a single case did a sample run high in soluble arsenic. In every case the material from which samples were taken did burn the foliage. We don't know why it was, but as long as it is going to injure fruit or foliage we don't want to use it. We don't want to take the risk. Of course, we have to grant that there is occasional burning from arsenate of lead, and we find sometimes that this burning is severe, but I think the damage done by arsenite of zinc last season was much more severe than any damage that has ever been caused by the use of a good brand of arsenate of lead. It is not safe to advocate the use of arsenite of zinc as yet, although we are not going to give up experimenting with it, because it has certain advantages as a poison and is a cheaper product. Possibly, in the future the burning effect we got from it this season may be overcome, and, of so, there is no reason why it should not be used. For the present, then, we will continue to recommend arsenate of lead, and that is the spray which most of us use and which we have used with success for years.

How strong are we going to use it? Some of us are using six pounds to 200 gallons, some of us as much as eight pounds, and some of us possibly more than that. In one case, at least, last season six pounds of

arsenate of lead to 100 gallons of water, and three-fourths of a pound of Paris green mixed with it, were used in a certain orchard which came under my notice. I don't think anyone in this valley has been guilty of making any such mixture as that. Such was done for the leaf-roller, in hopes that the extra strength would scare them to death, if it did not kill them outright. We do not need to use it that strong at all. I think, in general, from four to six pounds to the 200 gallons of water is plenty. You can use less than that with good success. We know we can control the calyx worms absolutely with these strengths. Many of you would like to use it a little stronger for the later sprays, when you have to coat the apples with the poison, but even then from six to eight pounds to 200 gallons of water is plenty to do the work. Many of you have your favorite brands of lead arsenate, and if you have been using a certain one year after year, and have found that it does the work well, I would not change—better stick to that brand which has proven successful. It is well to let the experiment station do the experimenting with new brands and new insecticides, and for you to go ahead and use the things that they have proven to be successful. There are a great many brands of arsenate of lead on the market that are good; in fact, most of them are good. The striking thing about the analyses we have had made recently has been that, without a single exception, the different brands have had a high enough percentage of arsenic oxide. There has not been a single case where the arsenic content was as low as the minimum amount required by the National Insecticide Act. They have all been high enough in arsenic content, and we do not need to worry about their not being strong enough. Sometimes they contain a little too much soluble arsenic, and too high a percentage is liable to burn the foliage as well as the apples themselves, and considerable damage to the orchard will be the result. If there is a certain brand that shows through repeated analyses that it does run high in soluble arsenic, that is the brand that should be discarded; but most of them are all right in that respect.

I am taking up a little too much time; but the last word I chose to speak upon was thoroughness. Something was said about thoroughness yesterday in regard to the leaf-roller control, but it is just as necessary to be thorough in our methods for the control of the codling-moth as for the leaf-roller, San Jose scale, woolly aphis, or other pests. Upon thoroughness depends the degree of success with which we are going to meet. Sometimes our conception of thoroughness is faulty; sometimes we do not realize what real spraying means. Sometimes we think it costs too much time and energy to spray thoroughly; but the man who does meet with success; whereas the man who sprays carelessly usually loses a large percentage of his crop, and does not get the returns of the man who sprays thoroughly and carefully.

There is one point I wanted to bring up in connection with thorough spraying, that ought to be dwelt upon more than it is, and that is heavy pruning of the orchard. Recently a plan for spraying an orchard in a certain part of the state for leaf-roller was outlined. I knew the condition of the orchard perfectly, because of having been in it three or four times in the last two years, and during that time I do not think that any pruning has been done, and probably none for several years previous. The trees in that orchard are in such a condition that no man could spray them and meet with success, unless he just simply should go in there and use a barrel of spray, or more, to the tree. That is not an exaggeration; in fact, I would not attempt to control any pest in the orchard without first pruning it heavily. The trees are in such a brushy condition that a man could not spray them thoroughly enough effectively to control any serious pest. So our orchards should be pruned, and pruned heavily. Perhaps I need not dwell on this so much here, because we do prune on the western slope better than they do in most places.

Most of our orchards show the result of careful and heavy pruning, but there are a few that do not. This is a point we should bear in mind, in order that our trees may be in the best condition for spraying with the least amount of spray material. But this is not along my line; Professor Bennett can give you more about this than I can.

Then, how much liquid shall we apply to the tree? I can't say exactly what your trees on the western slope require; but, on an average, fifteen gallons to the tree for the first spraying for codling-moth, if such trees are from twelve to twenty-five years old, is none too much. I generally say ten gallons to the tree is enough, but I don't believe it is where trees are so large as they are in this section. Again, the amount will vary in direct proportion to the amount of pruning that has been done. This is a good deal more spray than most of us are applying; probably the average will not run over from seven to twelve gallons—just about one-half what it should be. The amount of liquid that should be applied to each tree for the control of codling-moth is of very great importance. Fifteen gallons seems to be a lot of spray when we talk about it, but you attempt to spray a large tree with fifteen gallons, and you will find you cannot do it, and do it thoroughly, with any less. You may hit the blossoms or the calyces on a tree lightly by the use of less, but you cannot drench them as they should be drenched with much less than fifteen gallons, and that is about the amount which should be used on the average. For the later sprays, it may not take so much as that; the average would run down to twelve gallons, or less.

The question of thoroughness brings up, of course, the kind of spraying-machines and apparatus, but I don't think it is necessary to go into that matter today, more than to say that there is nothing better than the power sprayers most of us are using in this valley. It is very hard to do good work with the old barrel pumps some of us are using, and the sooner we can get away from their use the better. We cannot do justice to the codling-moth work unless we have a power sprayer that will maintain a pressure of at least 150 pounds, and with that pressure we can spray our trees thoroughly; whereas, if we had a barrel pump with which we could maintain a pressure of only eighty or ninety pounds, we could not do the work well.

I think I will stop right here and let Professor Taylor have a chance, and the rest of you who care to talk.

Mr. Newton: You didn't say anything about the trees after the third spraying.

Professor Weldon: I thought I mentioned a fourth and fifth spraying for the second brood. I said, put on the fourth spray, theoretically, fifty days after the first spray, and a fifth about ten days to two weeks after that time.

Mr. Cline: Professor Estes P. Taylor will follow with the discussion.

Professor Taylor: Professor Weldon and I used to go to school together in the same little country school; and when he started to enumerate those three conditions, "time," "spray," and "thoroughness," I, knowing him pretty well, thought he was going to say something about "the time, and the place, and the girl." (Laughter.) But he is getting more serious as he gets older.

Mr. Newton: He's got the girl. (Laughter.)

Professor Taylor: He has covered, in substance, the codling-moth proposition very well, and I think I can agree in every respect with what Mr. Weldon has said today. He has worked out the problem here on the western slope, knew the conditions that prevailed here, and has been over the state, and has seen it in other sections of the state; and, of course, before a person can draw conclusions for the control of the codling-moth he must know it under all conditions. He spoke of the number of times to spray; and it is amusing sometimes to go into the

other counties, where they get along with fewer sprays, and hear the growers say they understand that down in the lower Grand Valley they have to spray five times, and they are satisfied that the growers there do not spray thoroughly. Those people are honest in that opinion, but it is simply a matter of knowing the conditions that prevail. We do have a harder fight against the codling-moth in this section, I think, than in any other section in the state. It is probably because it is the largest fruit district in the state. I think, too, we have a harder fight against the codling-moth than the growers in the eastern states. Of course, the fight they have to put up against other insect pests more than offsets this. But, after all, our insect-pest fight is comparatively simple.

I made no preparation for this talk, because I had no knowledge of being on the program for this discussion, and Mr. Weldon has covered it so thoroughly that there isn't very much for me to say. I might recite something as to the experiences with arsenite of zinc. I believe that I agree with Mr. Weldon's conclusions that zinc is still in the experimental stage, and arsenate of lead is still the best spray we have at the present time. In my experiments with the different kinds of insecticides (and I have run through the whole list of insecticides that have been proposed, including sulphite of arsenic, and arsenite of iron, and arsenite of zinc, Paris green and London purple), after all, I think arsenate of lead is the best spray. About three years ago the first arsenite of zinc was shipped into this valley for testing. Mr. Weldon got a portion of that shipment, and I got a portion, and that season it seemed to do very well; but we applied it in the orchard where I was working only as a late spray. Some of the same material I used at Fruita the next year, and in that application I put it on very heavily—the first spray, the calyx spray; and in that orchard I had quite a little burning. So my conclusions, after that year's experiment, were rather unfavorable toward the arsenite of zinc; and this last year, after talking with a number of growers here who have used the zinc, I find that there has not been very much burning, no serious burning, but enough to show that it is not so safe as arsenate of lead. That fault may be corrected; they may take out some of the properties that are injurious, or correct it so as to increase its safety; but at the present time arsenate of lead is the best. As to the amount to use, I might say that I have always contended that we would better not have the later sprays of arsenate of lead too weak. I think Mr. Weldon has about the right figure—eight pounds to the two hundred gallons; and I certainly would not use less than that for the later sprays, because in that case you are coating the surface of the apple with a liquid which must dry, and a certain amount is going to be left on a given surface, and the worms entering would have less chance to be poisoned. So the first spray I should be more inclined to cut down than the latter sprays; and the later sprays, when you are coating the surface of the apple, I would keep from eight to ten pounds at least to two hundred gallons.

Now, Professor Weldon has spoken of the apparatus to be used. It is not absolutely impossible to do good spraying with the barrel outfit, as I have been in sections where the power sprayers have not yet been introduced, and they do very good spraying, although it costs them a great deal more for it. This kind of spraying is practical in small orchards, and will continue to be practical, but here, or in any fruit section where the orchards are close together, we can certainly go in on community sprayers and get our spraying done with power machinery; and I believe that will be the most economical way of spraying. A great many of the people who depend upon community sprayers to do their work leave the spraying entirely to the man who comes to do the spraying. They are generally paying, perhaps, at the rate of one dollar per tank, and they want to get through with this man as soon as possible. I believe we make a mistake in trying to hurry this spraying through. If a man thinks he can do it with, say, five tanks of spray, I think it is a good

plan on that first application to keep him there until he has put on ten tanks of sprays. For the average sprayer in the valley where we hire the spraying done we don't use enough of the material, and the same thing applies to the spraying where we own our own machines. The apparatus—such as the extension poles, nozzles, and other details of the spraying outfit—I think is very important—very important. As to the nozzles, I think it is the opinion of most of the better sprayers now that the larger aperture is better for the first spray, or will do, at least; and we can cut the size of the opening in the nozzle down for the later sprays. I think it is fairly well understood that a mist spray will stick on the fruit better, whereas, in filling the calyces or the blossoms, the coarser nozzles will be better. I think the Bordeaux nozzles for the first sprays have accomplished good results, and the finer nozzles for the later sprays are good. For a power outfit, two of those on each line of hose is a good plan, fixed at an angle so as to direct the spray down into the calyx. The size of the nozzle opening will depend upon the pressure you are giving it, because the spray in the nozzle will be broken up finer with higher pressure. The man with a power outfit using a two-hundred-pound pressure can break the spray up into a fine mist, and can get along much faster. These details are important, and to most of you who have done the spraying these are facts you all know very well. Now, in regard to the spraying poles, I have always contended that a longer spray rod is better than a short one; but that, of course, will depend upon the size of the tree, and whether you are spraying from a tower or not. That brings up the subject of towers. I think that in the first spray we should use the towers, so that we can fill the calyces much better, having one man on the tower with a long extension pole, directing the spray at an angle from the pole, and placing it right where you want it in the blossom.

Mr. Weldon spoke of the experiments here in the valley this year, where some growers had cut down on the first spray. Now, that is a departure from the teaching of the college. I had contended all the time that the first spray was the most important spray. Mr. Weldon has told you that. I have not been in your orchards so much as I should have, liked this summer, so that I have not seen just what results have been obtained by the people who cut down on the first spray; but if anything along that line has been discovered, I should like to hear about it, because that calyx spray, I still believe, unless I get new information on the subject, is *the* spray. We must also get out of the idea that we can get along here in the Grand Valley with three sprays, because, as Mr. Weldon has said, it may be necessary to have three or four, or rather four or five sprays; and I think the time Mr. Weldon gave you is right. I think it will vary in different seasons. Last season the eggs came on earlier. Instead of coming on when the apples were three-fourths of an inch in diameter, I have seen eggs deposited (it was last year) on apples that were one-half the size, only about one-quarter of an inch—very small; and it was earlier than I have ever seen before, so that we must vary that rule. Year in and year out, it will be about three weeks after the first, or when the apples measure about three-fourths of an inch in diameter, for the second spray. Of course, the first spray, we all know, is before the calyx closes. The third spray is determined by the second brood of eggs, which will come along in July; and the fourth spray some two weeks after that—along up until the first of September. So that five sprays, or even six, may be necessary, extending until the first of September. I think we must all watch for the late appearance of worms. The number of those worms will depend on the efficiency of the earlier sprays, except where they may come in from neighboring orchards which have not controlled those earlier worms.

This will simply serve as the opening for the discussion on the codling-moth. In the paper yesterday, "Efficiency and Economy of the Orchard," I wanted to make clear that codling-moth control was one of



the vulnerable points in the increase of the efficiency of our orchard man—we have in this section, at least in the production of our apples.

Mr. Cline: Any further discussion?

Professor Bennett: I should like to ask a question of Mr. Weldon or Mr. Taylor. From the standpoint of affecting the cover crop under these heavily sprayed trees—as, for instance, clover—after the trees have been so heavily sprayed, is there any danger of allowing the hogs to run in the orchard, or cutting that for hay to be fed to stock?

Professor Weldon: I think there is danger, Professor Bennett. In fact, we have had some cases of poisoning of stock in this valley. I think, if Mr. Goff is in the audience, he will tell you about a valuable horse that he lost; and there have been several other cases of stock being killed from eating clover or alfalfa that was sprayed in the orchard. It is something which you must undoubtedly be careful about.

A Voice: What effect will this spraying have upon our land—putting this poison on the trees, and then dripping off on the land?

Professor Weldon: Well, I don't like to scare you, but we must control the codling-moth.

A Voice: It seems to me that, if you put on six sprays of eight or ten pounds of this poison to two hundred gallons of water, it would so affect our land that we should not be able to grow anything on it.

Professor Weldon: Of course, the arsenic accumulates in the soil.

Professor Bennett: How much have you in the first place?

Professor Weldon: There is arsenate in some soils in the first place, but it is bound to accumulate. That has been a question which has been discussed time and time again, and I don't feel that I can give you any enlightenment on it. Dr. Headden wrote a bulletin on it a few years ago, and he gave many cases where he was sure, from the amount of arsenic that he found in the trees, that they were killed by it. We cannot doubt the fact that the arsenic will accumulate, but we have got to spray; we cannot get around the spraying proposition, and while it is well to be careful and not to use more spray than is necessary, yet we have to spray heavily in order to control the codling-moth under our conditions. I don't know that we are going to kill all our orchards—I don't think we are—with the use of these sprays, but I think there is some danger from the continued use of any arsenical spray, or any oil spray, as I brought out yesterday in my talk.

Mr. Rice: What is the difference in the soil effect of the arsenate of zinc and lead?

Professor Weldon: I don't know that there would be any difference, Mr. Rice.

Professor Bennett: In time, wouldn't arsenite of lime accumulate in the soil?

Professor Weldon: Possibly so; I am not chemist enough to answer that. If there is a chemist here, he may be able to answer it.

A Voice: What is the question?

Professor Weldon: Professor Bennett wanted to know if in time arsenite of lime wouldn't accumulate in the soil. Wouldn't there be a chemical combination formed, and we should have, instead of arsenate of lead, arsenite of lime?

Professor Bennett: I am not half as well acquainted with the arsenate put on our soils as I am with the arsenate already there. You know what this yellow condition is all over the country, and there are lots of places where we get serious trouble.

A Voice: The question was asked whether this would make our soil so that our green plants would be unfit to use; would it ruin the land?

Professor Bennett: I think that is doubtful. It might get into it, but, so far as the arsenate gets into the soil, it becomes more or less insoluble. That is a question yet to be solved. The fact remains that it will take a long time to put as much arsenate into our soil as we have already, because we have arsenical soils all over Colorado.

Professor Taylor: Without doubting the possibility of injury to fruit trees from overspraying with arsenicals, as suggested by Dr. Headden, it occurs to me, after studying the conditions in the Grand Valley, that there is more danger of our skimping on our spraying from this fear than there would be danger of injury from the spray. I think the fear of doing injury has caused us more damage than the damage done by the excessive sprays, and if we keep cutting down on the amount of material that we use, and the amount of mixture we use on the tree, and all for fear of damaging the trees, I am afraid we are going to let the codling-moth get the best of us, as we have in past years.

A Voice: Can this solution be washed off?

Professor Bennett: It is not supposed to be soluble. Our danger, as Dr. Headden pointed out, was not so much that the arsenical goes into the soil, to be taken up by the roots, but in spraying the trunks and limbs of a tree thoroughly with a strong mixture and letting it run down the tree. In that case it is accumulated right around the root of the tree; just as, if you put a poultice of arsenite on the tree, you could kill the bark, if you wanted to. In that respect, you have the danger of it running down the trunk; so you need not spray the trunks and limbs any more than necessary. But the spray going down into the ground is not so dangerous, because it becomes insoluble in our soils very quickly.

A Voice: Then you would not spray the body of the tree at all?

Professor Bennett: No, no more than is necessary.

Professor Weldon: I might say that the Montana Experiment Station has published a bulletin on arsenical poisons, in which they corroborate practically everything that Dr. Headden says; but they found this to be true in their experimental work, that wherever a tree was injured close to the ground line—that is, if there was a crack in the bark, or a wound made by a disk harrow—a rot would take place very quickly from the arsenate of lead getting into the tree at that point. They determined that the injury from arsenic was secondary; that is, that there was a primary injury there that allowed the arsenic to come in contact with the inner bark of the tree, and the harm to the tree resulted afterwards.

A Voice: What do the experiments show in regard to it getting into the apple?

Professor Weldon: Yes, if the trees would take it up, it is reasonable to expect that you would find more or less in the apple, and I believe that you do; I believe that has been determined accurately.

Professor Taylor: That might be of scientific value, but not of practical value.

Mr. Newton: I think the arsenical-poison business is possibly a good deal more of theory than it is of practice. According to Dr. Headden's theory, I should have been scared to death long ago, but I am not afraid of being killed by poison.

Mr. Hill: I should like to ask whether the spraying that was done with the zinc was with the large-size cartons. I sprayed with the small-size cartons a block of Jonathans and a few Winesaps, with zinc, and I didn't notice a single case of burning. The question of burning was brought up here, and I thought I would relate my experience. I noticed a great number of stings on the York Imperials, which surprised me, because they claim that the action of the zinc is quicker. I should also like to know whether the precipitation of arsenate of lead, hot or cold, makes a difference. They claim, by precipitating it hot, it makes it stick better.

Professor Weldon: I don't know in regard to the size of the carton: I have no information along that line. Mr. Latimer may be able to answer your last question.

Mr. Hill: Yes; they claim, if it is precipitated hot, it sticks better, and the action is quicker.

Mr. Latimer: All precipitates that are brought down cold are much finer than precipitates that are brought down in a hot solution. It is possible to manufacture arsenate of lead so that one keg manufactured by precipitating in the hot may be stiff, while, if precipitated in the cold, with the same percentage of moisture in the paste, it may be thin. When you are painting a surface with paint, the finer the paint the better it spreads; and the same applies to arsenate of lead. I can't say anything about the killing qualities of it, whether it would be any better. We have been precipitating our lead for the last year in cold solution. All we put out is precipitated cold.

Professor Weldon: You do that so that you will get a finer-grained product?

Mr. Latimer: Yes.

Mr. Hill: How about the burning? Was the burning due to the small-size carton, or the large-size?

Professor Weldon: I have no information; I cannot answer that question. Has someone else had any experience with the different-size cartons, with the arsenite of zinc? I don't see myself why there should be any difference.

Mr. Hill: The large size would be twice the quantity to the two hundred gallons; the mixture would be twice as strong. Everyone in this valley uses the same size tank, same pump; some use the large size in the two hundred gallons, and some use the small size in the two hundred gallons.

Professor Weldon: You would have twice as strong a mixture in the one as you would in the other?

Mr. Hill: Yes, that is what I say.

Professor Taylor: The point is, how strong should we use the arsenite of zinc?

Professor Weldon: Possibly we have been using it too strong; I should think it should be used half the strength of the arsenate of lead. The arsenate content of the arsenite of zinc is about twice that of the arsenate of lead.

Mr. Latimer: No, it is not twice. It is about 40 per cent on the dry basis, where arsenate of lead is about 32.

Professor Weldon: They first recommended a pound and a half to one hundred gallons, but I think they increased that, and just exactly what has been used this year I don't know. Now, you spoke about burning Kieffer pears with arsenite of zinc. You can burn a Kieffer pear with arsenate of lead just about as quickly as anything. In fact, you are very apt to burn them badly, if you spray them late in the season. I have seen cases of that kind. They seem susceptible to injury by arsenical sprays; that is, after they get to be any size. I don't know that this holds true in the case of other varieties, but I am sure it does in the case of the Kieffer.

Mr. Weaver: Professor Weldon will remember that last year he tried an experiment with the zinc in my orchard, and in one block we used altogether zinc, and we used it from two to three pounds to the tank.

Professor Weldon: That is right.

Mr. Weaver: I think we went as high as three pounds to the tank, and in our inspection in the fall we didn't find any burning.

Professor Weldon: No, sir; absolutely no burning.

Mr. Weaver: That gave me so much confidence in the arsenite of zinc that I used nothing but zinc, and I sprayed seven times.

Professor Weldon: We want your experiences.

Mr. Weaver: I should like to have some information. A good many of my neighbors sprayed with the zinc too, because of the success we had in the experiment, and possibly I am to blame for some of the bad luck we had.

Professor Weldon: Possibly I am more to blame than you are.

Mr. Weaver: My experience this year was this: I never had a cleaner lot of apples than I had this fall. I sprayed seven times, and I used, I think, in the first three sprays, two pounds to the tank; then I used one or two sprays—I am not sure, the boys did the work—two and a half pounds to the tank; and I had no burning whatever, except on the Kieffer pear; I had some Kieffer pear burning.

Professor Weldon: When were those Kieffer pears sprayed last?

Mr. Weaver: We sprayed them when we sprayed our apples the last time, about the first of September. I should like to know why it burned my neighbors' fruit and didn't burn mine, and yet we used it heavier and more often.

Professor Weldon: Because I experimented in your orchard, and I didn't in your neighbors'.

Mr. Weaver: I believe it would be a good thing if you could get around and experiment in all of them. I have so much confidence in the zinc that I expect to use it next year just the same, because I have had good luck with it.

Professor Weldon: Of course, those are things that we cannot account for at all. In some cases the burning was severe, and in other cases, where we sprayed just as heavily, there was no burning. I think possibly the weather conditions at the time of spraying have something to do with that.

Mr. Harrison: I had some of my trees, mostly the Ben Davis, and I was so satisfied with the result of the work that I wanted to keep on using the zinc in the rest of my orchard; but, to my disappointment, I was informed that they were not going to use it. I didn't notice any burning for at least a week or ten days after, and then, going out to the road, we noticed a few places of burning, but not much. Possibly I used something a little different from the rest of my neighbors. The whole season through I put so much soap in each tank of spray, with the idea of spreading it better on the fruit. The soap seems to spread it on better and make it stick.

Mr. Weaver: In talking with some of my neighbors—some of those who had the burning from the zinc—I found, upon inquiry, that they had trouble with the agitators in their sprayers; and I think there is the cause of the trouble, of the burning of a great deal of the fruit with the zinc—because of imperfect agitation. I believe, if we look after the agitators carefully and see that the spray is in perfect condition, we shall not have much trouble with burning our fruit with zinc.

Mr. Jaynes: How clean was your fruit? You say it was the cleanest you ever had.

Mr. Weaver: I could not answer that, because we did not take the pains; we were in too big a hurry to take the pains to make the count on it to see how it ran. On several of the varieties it was so clean that we didn't make any standards at all; everything went into the fancy and extra-fancy. In fact, all the way through, in packing 1,400 boxes, I think I had forty boxes of standards and culls—enough to make a couple of barrels of cider.

A Voice: I happened to be in a couple of orchards sprayed with zinc, and one of them was the worst-burned orchard. Even the calyx end of

the apples was burned brown, and the foliage was burned brown. The agitator in the machine worked all right, and why it was I could not tell.

Mr. Rice: It seems that this is an experience meeting, and I want to give you my experience by way of showing the difference. I saw a block of Ben Davis apples which had been badly infected with codling-moth for several years, and I concluded to experiment with zinc on this block. We sprayed four times, and each time with zinc, and the result was we had the cleanest crop of apples we ever had on the trees—almost absolutely free from codling-moth; and I didn't notice a particle of burning of the foliage. Is that right, Mr. Carter?

Mr. Carter: Yes, sir.

Mr. Rice: We were very much pleased with the result. I don't know what the future will be, but this time it certainly was a success. Our apples were practically free from worms, whereas in the past they had dropped down before they matured. This time we had no drop to amount to anything, and our trees were too full; that was the only thing we had to complain of.

Professor Taylor: It strikes me that this is a very important discussion. In regard to the arsenite of zinc, it seems to me that we have not gotten the spray absolutely safe to be in the hands of everyone—not so safe as a good arsenate of lead seems to be. Now, the first arsenate of lead made was also an uncertain proposition, and it is possible the arsenite of zinc is simply passing through that stage. This discussion of ours, I think, is probably the first, and probably some of the experiences here of the growers in regard to the use of arsenite of zinc have not been given before in the state, and we are really doing a pioneer work in the use of these insecticides. If there is anything in it, we want to find it out, because, if we can save one-half of our insecticides, we want to do it; but we want to make sure while we are doing it.

Mr. Douglas: It happened to be my lot to spray Mr. Harrison's orchard this summer, and I watched with interest the experiment with arsenite of zinc; and in taking care of my own orchard, to the very best of my ability, with arsenate of lead, I am strongly of the opinion that there is something better for the careful grower in the use of arsenite of zinc than we have had with lead; and I believe that there will be a reduction in the price. If it is possible for me to get the arsenite of zinc next year, I shall use it. I did the best I could in taking care of my orchard, and spraying my orchard after the same method that we sprayed Mr. Harrison's orchard, he using the soap. There is an item I did not mention in his experiment that is worthy of notice, I believe, to the grower, and that is the fact that, when his fruit was covered, that which had been sprayed with zinc was clear of any stains—almost perfect—while the other fruit was stained with that stain that goes with the lead spray, and I noticed the burning on his. He and I went together and looked it over. I saw some of the calyx ends of his apples larger than my thumb nail; but, at the same time, I believe it can be overcome, and I am of the opinion that I can, by careful dealing with the arsenite of zinc, make it safer. I believe it is worthy of our careful attention.

Mr. Latimer: In regard to the arsenate of lead, we conclude it is something we should watch, because it is doing a great deal to change from arsenate of lead to zinc. I presume twenty or thirty growers have used the arsenite of zinc, and I found only two or three of those growers who would recommend it the following year. A great many would not consider using it in its present condition, and, as far as the results obtained from it are concerned, I believe they were below those obtained from the arsenate of lead. The results might possibly have been better if they had used the arsenite of zinc in larger quantities, and put in, say, three pounds to two hundred gallons; the result would probably have been better; but the consensus of opinion is certainly against the arsenite of zinc in this valley.



Harvesting Peaches in a Colorado Orchard.



Mr. Cline: Gentlemen, the time is passing rapidly, and we still have a long program before us. This afternoon we will take up a question that will undoubtedly take all the afternoon. It appears that the convention wishes to take up the subject of the distribution of the fruit product the first thing, at one o'clock, after lunch; yet we have a long program here, and unless the discussion is limited in some manner, I don't believe we shall get through. The discussion is all right, and it certainly is very important; but we shall have to limit discussion to get through.

Now, I should like to have one of your local men preside—someone who knows everybody. When a man gets up to speak or ask a question, I don't know him. I am going to ask Professor Taylor, who is better acquainted in this community, to come forward and take the chair and preside for the rest of the meeting. I think he can do it to better advantage than I can.

Professor Taylor: I am afraid I have come on the stage at a bad time. It is almost noon, and we have about six or seven subjects yet to be discussed. We may have to cut the discussion a little short on this, in order to get through, because we have, as the chairman said, two topics which must come up by all means, one by Professor Gillette, and the question of the distribution of our fruit. We will pass on, then, and take up the next topic, "Success in the year 1912," by Mr. William Harrison.

Mr. Harrison: Mr. Chairman, Ladies and Gentlemen: The gentlemen who were responsible for placing me on the program to speak on the topic, "Success in the Year 1912," must have been in a sarcastic frame of mind. I fail to see how a man can very well speak on a state of affairs that does not exist. I don't think any of us will assert that the past year has been very successful in the Grand Valley. If you will agree with me there, I should like to take up another topic in its place. I will speak from what I see of the needs of the Grand Valley on the western slope.

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## THE NEEDS OF THE WESTERN SLOPE FRUIT-GROWER

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BY WILLIAM HARRISON, CLIFTON, COLORADO

Mr. President, Ladies and Gentlemen, and Fellow-Fruit-Growers: I make no apology for my presence here today, although I do not claim any special knowledge which will remedy all the evils and remove all the disadvantages under which we, as a community, labor. Rather, it is the realization in my own case of my greatest need which impels me to submit my views for your consideration.

As I have worked year in and year out—in fact, since boyhood—in the horticultural industry as a means of sustenance, I think you will admit my claim that I know something about the importance of my subject.

Fellow-fruit-growers, I submit that our greatest need, our most urgent need, is systematic education. By that term I mean such education as will enable us to make the fullest use of the undoubted opportunities that a suitable soil, magnificent climate, and unfailing water supply give us to produce one of nature's finest products. It cannot be doubted that here in Colorado nature has provided all the essentials for the production of the most perfect fruit. We also know that here and there are men who seem to have solved the mystery, if mystery there be, of how to utilize these essentials, to their own benefit and to the benefit of the community.

But it is the need of the average man that I bring before your notice—the need of the man who, seeing the success of his neighbor, tries to emulate him, fails, tries again and again fails, for no reason that he can



discover; and finally retires, baffled and beaten, to try his fortunes elsewhere.

From my limited observation of the conditions prevailing in this western country, in spite of its magnificent climate and virgin soil, success as growers can be attained only by following certain sharply defined lines of culture—lines which are but vaguely outlined by our agricultural and horticultural authorities, and which, I submit, should be persistently demonstrated to enable them to be utilized to the fullest advantage by the average grower.

You all know that you can read the able publications sent out by the Board of Agriculture and our agricultural colleges; but, while they serve a useful purpose, their brevity necessitates that the information they convey must be couched in generalities only. You may attend lectures, hear the discussions at farmers' institutes, etc., and carry away a fair idea of the theories propounded by the speakers; but when the time arrives to test those theories, how many of you are able to apply them successfully? I am like the man from Missouri who has found that "show me" is preferable to "tell me;" and I hope the time is not far distant when demonstration farms and orchards, cultivated under the supervision of trained experts, in conjunction with skilled growers and farmers, will be established everywhere. This will enable the newcomers and struggling fruit-growers to see with their own eyes what magnificent possibilities await them if they pursue their chosen avocation with system and intelligence.

In view of the importance to the community of the success or failure of the producer, would it be too much to ask for an immediate extension of the practice whereby experts are appointed to visit and advise with such growers as need their aid? Such assistance must surely raise the average quality of the products of our valley, and, by so doing, enhance the value. That in itself would go far toward minimizing the most serious anxieties of our friends and neighbors; and would it not result in removing some of the difficulties our sales force has to contend with?

When you visit our great fruit-loading platforms, what will you find today? Thousands upon thousands of cases of fruit, labeled "extra-fancy," "fancy," and "standard." Close inspection will, however, reveal the important and ominous fact that the superior grade is in the minority, and, in addition, the platforms are cumbered with small consignments of varieties of secondary importance from a market point of view. The management of our associations will tell you how much these unnecessary varieties add to the difficulty and expense of marketing our fruit, without any compensating benefit to the growers. My observation leads me to the belief that we have at present less than a dozen really first-class marketable varieties of apples; and, if I am correct, why do we persist in trying to produce what we have no market for? These are matters that cannot be too persistently brought before the notice of the growers, and in particular the newcomer, who, generally speaking, is only too anxious to get started on the right lines. As it is, the advice he usually receives from older residents is of so varied a character as to require the skill of an expert to dissect the really beneficial from the positively misleading information, usually so freely given.

When we have remedied these difficulties, and enabled our producers to market a uniform product, at a minimum cost—a cost which will compare favorably with those prevailing in other fruit-growing centers—may we not then turn our attention profitably to the education of the consumers?

Son and I, as apple-growers, know the difference between the attractive, full-flavored, western-grown Jonathan and the, comparatively speaking, northern Ben Davis as produced in the East. But how many residents in our great cities and our apple-producing sections know the differ-

ence between these varieties, or are able to distinguish on sight, and appreciate the excellence of flavor lurking under the pale-colored skin of the White Winter Permain? How many consumers know the time of year when the most common varieties are at their best for either dessert or culinary purposes? I venture to say that a large proportion of the large dealers in apples do not appreciate the importance of such details.

If you and I were trading in any other product than fruit, should we leave it entirely to the purchaser to find out for himself, when the sale was completed, what were the special merits of the product we had for disposal, or when it could be most advantageously used by him? I guess not, if we were desirous of securing the utmost profit by our trading.

I have yet to see any systematic effort made to advertise the merits of our western-slope fruit. If at any time I feel the urgent need of a wash, I have only to turn to the pages of some of our popular journals to see portrayed, for my benefit and information, the illustration of a hobo of decided hue, who claims that years before he had used a certain kind of soap to advantage, and since then had used no other. Need I give further illustrations of the beneficial uses of advertisement from an educational point of view? They are so numerous, and the results so obvious, that no progressive firm or community can afford to disregard them.

Ladies and gentlemen, this question of education is vital to the well-being of our communities. The success of our producers means the success of our association, of our traders, of our bankers, of our railroads, and of our state. Is it too much to ask that the representatives of these varied interests consult together, and carefully consider means whereby these essentials can be effectively brought before the notice of the producer, thus enabling him to learn the most efficient methods of culture, utilize every source of revenue, eliminate waste, and by so doing add to his comfort and stability, and enrich the community in which we live?

Our legislators evidently recognize our needs and are trying to help, to a certain extent, by means of the Lever bill now before the legislature. But why need we wait? Should we not do something in the meantime to help ourselves?

Professor Taylor: Certainly we have all enjoyed the paper by Mr. Harrison. Mr. Harrison, since coming into Grand Valley, I think I can say, has been a constant inspiration to the other growers in his discussion, and he never has anything to say but what we can get some good from him.

We will pass the discussion, unless there is something very urgent under this paper, on account of the lateness of the hour. The next paper is on "Woman's Work on a Fruit Farm," by Mrs. F. S. Carman.

## WOMAN'S WORK ON A FRUIT FARM

BY MRS. F. S. CARMAN, GRAND JUNCTION, COLORADO

Mr. Chairman, Ladies and Gentlemen: As a rule, we women are not very conspicuous at these horticultural meetings, and when I learned that I was the only woman on the program, I promised myself that I would not discuss my subject before a lot of men, unless there were a fair number of ladies present.

My husband tried to encourage me by saying that Mrs. Wilcox would undoubtedly be present, and that would be as good as having a dozen ordinary women.

Mr. Mauff instructed me to confine my talk along horticultural lines; but if I should wander somewhat from my subject and talk about sweep-

ing, dusting, or cooking, etc., it will not be intentional, but from force of habit only. I do not happen to belong to that class of women who feel that to be ignorant and incapable of performing the ordinary household duties is a distinction and virtue, or to be able to do anything along horticultural lines is simply nothing short of depravity.

On the other hand, I could cite any number of cases in which the sole management and work on fruit farms has been done entirely by women.

After practically six years of life on a fruit farm, I am obliged to confess that the performance of the countless tasks seems indeed simple compared with the more difficult one of telling it. And this is saying a great deal, since one of the first expressions I heard after coming to Colorado was that a fruit farm was a woman-killer. Be that as it may, the work on a fruit farm, or any other kind of a farm, is such as to tax a woman's strength to such an extent as to undermine her health, if she is imprudent in estimating or applying her time and strength.

I can truthfully say, since having had experience in both, that our work on a fruit ranch is child's play compared with the work a woman is expected to do on a stock or dairy farm. I would sooner stand on my feet from morning until night packing peaches, pears, apples, or anything else, than to cook for a threshing crew on one of the large grain farms in the East.

The necessity in most cases of our helping in the fruit, especially at packing time, eliminates the extra burden of boarding hired help, for which I am truly thankful. Since no woman, unless she is differently constituted from what I am, can work in the packing-house and garden day after day, in addition to performing her usual household duties, and assume the responsibility of boarding hired help, without risking a nervous breakdown. Some women hire their housework done and work out of doors in the fruit and garden altogether. This never appealed to me, since I usually find enough outside work to do after my housework is done; and I much prefer housework, anyway.

The first year I lived on a fruit farm I was very ambitious to help in the outdoor work as much as possible. When picking time came, I was anxious to help pick apples and see how well I liked that part of the heavier work. So I donned my picking-sack, helped myself to a short ladder, and proceeded to a near-by tree. I did not fall from the top of the ladder, because I didn't get that far. It took me less than half an hour to decide that I didn't care anything about the picking business. A great many women do this part of the work on a ranch, though; but I want to tell you right here—and it's a big, rough, unvarnished truth—that too many men on our fruit ranches depend altogether too much on their women to help with this heavier work. I have still to be convinced that this pays.

It was with a feeling of keenest regret that I gave up trying to have a flower garden. Anyone who has succeeded in raising flowers in the kind of soil we have here has won success only through the most stubborn perseverance. My own efforts along this line met with poor success—more on account of proximity of ground to shade and fruit trees. A lady who does not live a great way from my home has made a success in flower-gardening in every sense of the word. But she keeps persistently at it. You might visit her home any time during the summer months and find her digging, pruning, or fussing at one thing or another among her flowers. Not long ago I mentioned the fact to her husband of how I couldn't quite understand how his wife managed and accomplished so much, and his answer was: "I'll tell you, Mrs. Carman, she can actually do more work than a dozen of your ordinary young women of today." And I readily agreed with him. Anyone who has tried to raise flowers in the East knows with what splendid results our smallest efforts were rewarded. I have in mind my own home state of South Dakota, where the soil is dark and rich, and responds

readily to cultivation, and with what exquisite delight my eyes welcomed the wonderful blaze of color in my flower garden all summer long.

My own experience in raising flowers has been confined only to the old-fashioned varieties, the most popular among which are the coreopsis, snap dragon, gladiolas, ten weeks' stock, phlox, verbena, salpiglossis, pansies, and dahlias; besides of course, roses and peonies. We never needed to bother about beds of violets, since they grow abundantly wild in the meadows.

To say that my efforts to have a row of raspberries between two rows of bearing apple trees proved futile is putting it rather mildly. Just so sure as I am feeling confident of a goodly number of berries about spraying time, along come the men with the old spray machine; and, of course, there's no other place for the wheels of the wide-tired spray wagon than right through my row of raspberries, leaving just about enough berries to tell the story.

Up until the last year we have succeeded in raising enough strawberries for the table. It so happened there was a small open spot of ground near the house, with fruit trees on one side only; and only those who have had the experience can understand the feeling of pride and satisfaction gained when able to pick the luscious strawberry raised and tended with your own hands.

It is absolutely useless to try to raise a garden of flowers, berries, or vegetables on a ranch where every available spot is taken up by shade trees or fruit trees in full bearing; and since such happens to be the condition on our own ranch, we shall be compelled to meet the high cost of living necessitated by these conditions in some other way.

But where we women on fruit farms really shine is in the packing-house. I have not been called upon myself to work as constantly in the fruit as a great many have. Instead, I keep myself and housework in readiness for any emergency that might turn up during the busiest time of the season. This last year, on account of an abundant crop and scarcity of help, my emergency help was almost continual; especially during peach- and pear-picking time, which lasted about six weeks. During this time I did not try to do any more housework than was absolutely necessary.

I firmly believe that there isn't any part of the work on a fruit ranch but what a woman can do, if necessary. But I do not believe that we are called upon to do the heavier work. There are too many idle men to justify us in doing the work that should fall upon their shoulders. Not that my opinion will make any difference either one way or the other; I still feel the necessity of urging upon my sister ranch women the importance of keeping in touch with other things besides the daily grind and, so often, drudgery of our lives. There are too many ranch women whose world consists only of their own immediate families, and who would look at you in dumb bewilderment should you try to discuss with them a new book, picture, or piece of music.

The subject of woman's work is such a broad one that I have not been able to do more than touch on it in the fifteen minutes I have taken. Fifteen years would be more like the length of time it would take to discuss this subject and do it justice.

"Man's work it may be from sun to sun,  
And rest when the night appears;  
But woman's work it is never done,  
While toiling through weary years."

Professor Taylor: We certainly have made no mistake in the selection of the lady to take part in the program. I have had the pleasure of attending some of the big fruit shows, both in Colorado and in the

East, where there was some fruit from the Carman ranch. Mr. Carman, of course, assumed a certain share of the responsibility or the credit for that fruit, and the packing of that fruit, but I suspect, if the truth were known, Mrs. Carman had a great deal to do with it.

The next paper on the program is, as you will notice, on the subject of "Getting Together," by Governor-elect E. M. Ammons; and I should like to ask Senator Crowley to make an announcement on this.

Senator Crowley: Mr. Chairman, Ladies and Gentlemen: At my request, Governor Ammons gave his promise to put his name on the program. Since doing so, he has had the misfortune of losing a member of his family and is unable to be here; and he specified, when he permitted his name to go on the program, that his place should be taken care of if he was unable to get here. So I take pleasure now in trying to make good for the governor on the subject of "Getting Together," and I want to call on Mr. Arthur Williams, if he is in the audience, and ask him to come forward and talk on "Getting Together," the topic chosen by Governor Ammons. Mr. Williams has lived in Colorado a long time, and is known to a good many people in Colorado; he is known to a great many people of this state who have given a lot of time to the making of Colorado, and they know what it means to get together. I now take pleasure in introducing to you Mr. Arthur Williams, secretary of the State Horticultural Society.

#### GETTING TOGETHER

BY ARTHUR WILLIAMS, SECRETARY STATE HORTICULTURAL SOCIETY,  
DENVER, COLORADO

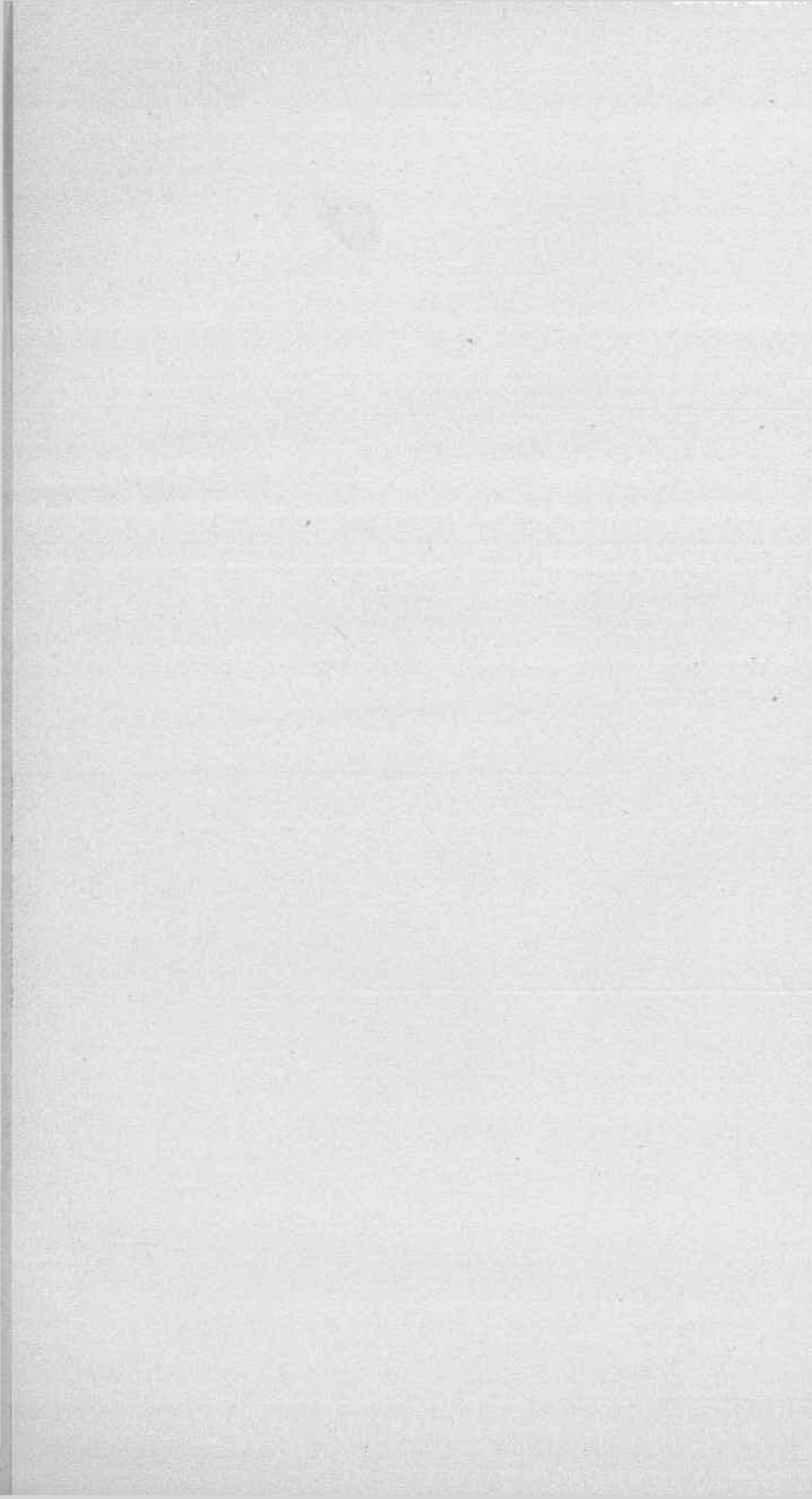
Mr. Chairman, Ladies and Gentlemen: I am sure that our hearts go out to Governor Ammons and his family in their bereavement, and we regret his unavoidable absence.

I particularly regret that Senator Crowley is not addressing you, for your sake. I have known both Governor Ammons and Senator Crowley for a long time. I have met them in public work, and know them both as ever ready to get together with others for the benefit of their neighbors and the state. The measure of our success in this world is what we do for others.

As Senator Crowley has told you, I have been in Colorado for some time—about thirty years—coming to Denver in the early eighties. I have watched the growth of Denver and the development of the state. In 1897 I was elected secretary of the Denver Chamber of Commerce, and for eleven years filled that office. Very naturally I acquainted myself with the history of that organization from its inception, and became acquainted with its founders. Many of these were pioneers who had come to Denver before the advent of the railroads. Those of you who have lived very long in this state know how the early settlers came here. They crossed the plains mostly with ox teams, and before leaving Leavenworth were told that they would not be permitted to leave that town singly or in pairs, but must wait until a sufficient number had gathered for the long trip; and it would be necessary to select a leader or captain, and be under his authority, as a protection against the Indians. At night, when they camped, the wagons were arranged in a circle, with the live stock inside this improvised corral; and discipline was maintained until the end of the journey. Thus, these pioneers came to Denver, inculcated with the "get together" spirit. As time went on, Denver grew; and then came a period when its growth seemed to be retarded, and the



Packing House Scenes During Fruit Harvest. Upper Picture—Stamping Grower's Lot Number on Peaches. Lower Picture—Box Makers at Work.



leading men of the community discussed what was best to do. Here was Denver, on the map, it is true, but not commercially so to any great extent; and these great pioneers—ex-Governor John Evans, William N. Byers, the Brown brothers, Roger W. Woodbury, and others—got together and organized the Denver Chamber of Commerce, to promote the material prosperity, not only of Denver, but of the State of Colorado. They were great, broad-minded men, empire-builders, and their life's work is inseparably woven into the history of Colorado. A railroad was built to Leadville, and that wonderful camp poured its riches into Denver; but north and south the transcontinental lines gave us the "go-by," and Governor Evans said: "This will never do. We must build a railroad to Cheyenne, to reach the Union Pacific, and we must build a line to the Gulf." The "get together" spirit prevailed, and this was done. And the state prospered, and Denver prospered; and Denver belongs to the state, and there are none of us who are not proud of it as one of the most beautiful cities in the United States.

It has been my pleasure to attend conventions and meetings of men engaged in various industries: cattlemen, fruit-growers, bee-keepers, farmers, and others. There is generally, at all of these, a program of addresses on various assigned topics.

At our fruit-growers' meetings we have addresses by learned and scientific gentlemen of our Agricultural College, and they are instructive; but the most interesting of all are the informal talks of the fruit-growers, who get up and tell their experiences. There is nothing academic about these; the speaker may not speak grammatically, but his talk grips his audience.

As I did not know I was to be called upon, my talk must be informal; but I can tell you of the experiences I know of as a result of the "get together" spirit. It is necessary to get together before any organization can be effected, and if the "get together" spirit wanes in any community, that town begins to die of dry rot.

The greatest industry of this state is agriculture. For years Colorado was noted for its mineral wealth; its output in gold, silver, and lead exceeded that of any other state; but today the wealth produced by the farms far exceeds in value the output of the mines.

In 1897, at a meeting of the directors of the Denver Chamber of Commerce, Mr. Earl B. Coe, editor of the *Denver Times*, said: "I have just returned from Washington. I met there a number of prominent men connected with the government, and took them to task for neglecting the West; told them they were spending millions to protect the banks of the Mississippi and said: 'Why not do something for Colorado?'" And Mr. Wilson, Secretary of Agriculture, replied: "Tell your people to raise sugar beets, and they will not need help from anyone." The Denver Chamber of Commerce took up the idea; organizers were sent to the various agricultural counties, beet seed was distributed, prizes were offered; the Agricultural College co-operated in every way by instructing the farmers and analyzing the beets. The Department of Agriculture furnished seed; and when this supply was exhausted and more was called for Mr. John F. Campion, then president of the Chamber of Commerce, said: "Buy more; buy all you need, and I will pay the bill." We did so, and I think Mr. Campion paid over \$500 for the extra seed we bought. The Agricultural College made its report, the prizes were awarded, and the statistics are embodied in, and a part of, the government reports. And do you know what was learned? That Colorado's soil could produce sugar beets of a higher percentage of sugar, a greater coefficient of purity, and a larger tonnage to the acre than any other country in the world. This was something to be proud of. The "get together" spirit took hold of Grand Junction, and an effort was made to start a sugar factory. Some capital was enlisted, here and elsewhere in the state, but not enough; and the promoter of the enterprise came to me, as secretary of the Denver Chamber

of Commerce, and told his troubles. He said he had reached the end of his string and could not get the capital necessary. I did not take this matter up with the directors, but went immediately to Mr. Campion, and he, and several of his friends, furnished the additional capital necessary—and it was no small amount; and the sugar industry was established, and Grand Junction got the first factory. Today there are seventeen factories in the state, and their output this year amounts to 124,800 tons, valued at ten millions of dollars.

For fear that some of my hearers may be a little pessimistic and say: "Oh, that is all very fine, but it takes more than one swallow to make a spring," I'll keep on with this experience meeting. The Bible tells us that one of the apostles was a doubter—I think his name was Thomas; but he changed his mind and became a saint. I do not want to weary you, but this is interesting. Along about that time—about 1897, I think—this great "get together" idea gripped one of the committees of the Denver Chamber of Commerce. This committee considered matters relating to the live-stock industry. This industry was not flourishing; the cattlemen were discouraged; and so the committee met to analyze conditions and discuss the great problem; and this suggestion was made. "Let's get together and have a real, old-fashioned live-stock convention." And the idea was unanimously adopted. A convention was called, and the live-stock men came from everywhere: Oklahoma, Nevada, Utah, Wyoming, Montana, Kansas, Texas, California, Nebraska, and Colorado. The great packing-houses in Chicago and Omaha, the railroads, and everyone interested in the industry, were represented, and they had a convention, and they were entertained. The barbecue held at the stock-yards was the greatest ever pulled off. And did they get together? Well, I should say they did! And organized the National Live Stock Association; and from it other associations were formed, all having as their watchword "Get Together." Governor Ammons was there, and he knew, when he selected his subject for this meeting, that it was the keynote to success. The live-stock men have been together ever since, and there are no doubting Thomases among them.

Later the Denver Chamber of Commerce called together the fruit-growers of the state; conventions were held, prizes offered, and, when won, were promptly paid; and the fruit-growers were aided in forming the State Horticultural Society, of which Senator Crowley, whom you all know, is president and I am secretary. And although our society is not numerically so strong as it will be, its members and officers maintain the organization, and it stands equipped with a "readiness to serve you," if you will only "get together."

This same Chamber of Commerce called meetings to discuss "good roads," and the National Good Roads Association was formed. Today the subject of good roads is a live one, and one of your public-spirited men, Senator De Long, is on his way to Denver to try to have the great national automobile highway, from the Atlantic to the Pacific, pass through Grand Junction and this valley. The value to the fruit-growers of good roads I need not dwell upon, nor what it will mean when we have this great national highway.

When I saw this valley years ago, it did not look as it does today. None of you are ashamed of your beautiful orchards; no one can be. Fruit culture is carried on in this state along scientific lines, under the advice and instruction of these learned men from our State Agricultural College. We can never pay the debt we owe to science. The fruit-grower today who neglects to prune, thin, spray, and cultivate, injures not only himself, but his neighbors and the industry; and his neighbors should get together and show him a light.

But life is not one continual round of pleasure; obstacles beset us; and today an emergency confronts the fruit-grower which must be met and judiciously handled and overcome. How is the fruit-grower to receive



what is due him from the sale of his fruit? If the prices paid by the consumer, after the profits of the retailer and commission men, and the railroad charges, are deducted, do not leave the fruit-grower a profit, it is time for the latter to sit up and take notice. Competition may make trade lively, but co-operation means success. This afternoon, I understand, this subject is to be discussed.

"In the multiplicity of counsel there is wisdom," is an old adage. You must get together. Now, people who get together intelligently become broad-minded; they discuss the vital points; they argue as to the best methods, and, after a majority has decided that a certain course is the proper one to pursue, they get together and say: "We intend to support the combined wisdom of this organization and help carry it out." The meeting this afternoon may be stormy; each of you may have disagreeable experiences to relate, and we all know what a relief it is to tell our troubles to a sympathetic listener; and this afternoon the audience will be sympathetic. But when a remedy is proposed, or different remedies, discuss them and decide upon a definite line of action; and, if you hit upon a plan, give it a trial; do not depend upon someone else to make the plan a success, but get together in co-operation. That man best succeeds who has faith in himself. It is but a short time since the whole country was in the midst of a political turmoil; but the election is over, the political atmosphere has been cleared, and every loyal American citizen accepts the result. All have an abiding faith in the noble character and integrity of President-elect Wilson. Of Governor-elect Ammons I need not speak; he is one of us; to doubt him would be to doubt ourselves.

Again I advise you to "get together." Gentlemen, I thank you!

Professor Taylor: I have had handed me a copy of yesterday's *Rocky Mountain News*, in which it tells about the getting together of the fruit-growers of the Northwest, at Spokane, Wash. The meeting there was composed of representatives from the principal fruit districts of Washington, Oregon, Idaho, and Montana, and they have appointed representatives from these four northwestern states to meet and organize a distributing selling agency for the fruit product of those states. That is one of the principal topics before this convention this afternoon, and we should certainly have the largest attendance of any session of this convention, as that is one of the most important matters to the fruit-growers at this time—not only the fruit-growers of this state, but of other states as well. As you will see by this announcement in the paper I hold in my hand, the fruit-growers in the northwestern states are up against the same proposition that we are, and they are trying to find a way to overcome this difficulty.

DECEMBER 18, 1912, 1:30 P. M.

Professor Taylor: The meeting will please come to order. I am glad to see such a large attendance this afternoon. As we have a number of subjects to take up, we will start with the next paper on the program, which is a paper by W. O. Fletcher, of Loveland, on "The Cost of Raising Fruits, and How Their Food Values Affect the Industry."

Mr. Fletcher: Mr. Chairman, and Gentlemen of the Grand River Valley: I want to say just one word. There will be some points in what I have to say that were covered materially by Professor Taylor yesterday. I hope he will not consider that it is a copy, because I have hardly had time to copy what he said yesterday; but my conclusions are along different lines, and I possibly, in the face of what is before you on the rest of the program, leave out some points in my topic in order that you may have more time for the discussion of that great subject—the subject which

is coming up in the later part of the afternoon; a subject that not only interests you, but interests every grower in Colorado, and every grower in the United States.

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### COST OF RAISING FRUITS, AND HOW THEIR FOOD VALUES AFFECT THE INDUSTRY

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BY W. O. FLETCHER, LOVELAND, COLORADO

I have read that it takes eighty-four quarts of strawberries to make a meal for a healthy man, as the nutriment value is so low. Fact or not, it has a counterpart in the following incident: In the wilds of Africa several persons were found in a precarious condition; some were dead, others just alive. Fruit was found among their effects; yet they starved—starved on fruit.

I have also read that a peach orchard in Alabama has been cut down because it did not pay. This orchard was the largest in the United States, containing 250,000 trees, and its product brought the best price of the season, because it was the first on the market. If this orchard could not make good with the most favorable conditions, what could one expect where the selling price is not much above the cost of the mechanical operation, boxes and handling?

What is the matter? The consumer paying too much, and the grower getting a fortune? Where can they meet, and both get a fair deal? There ought to be some place where neither would feel the other was grafting.

The consumer is governed by his purse, and the grower by the profit on his investment. If the nutritive values of foods are out of proportion to their cost, we must perforce seek other values.

I cannot discuss this food question scientifically, as I am nothing but a layman. The field is large, with opportunity for the professional man. I am trying to dig out a few points that I can understand, that is all, and shall feel repaid if I can transmit them to others.

It is a big task to put conclusions into the language of dollars and cents, not only because of the work involved, but because of the lack of data. All I expect, after weeks of effort and correspondence, is that I can do little more than open the way for others. Perhaps, like Newton, I have gotten but a pebble by the great sea of opportunity. It is great opportunity in the industrial world to know what we are doing, and whether it is a paying business or not.

I know that the consumer and the producer are very far apart—farther than they ought to be, by the width of the carrier and the middleman. Can this breach be bridged? I have not seen the remedy as yet by any theory that has been advanced, because much of the evil is nothing but graft. Take the legitimate office of the middlemen away, and the distribution would be seriously hampered; neither the grower nor the consumer would find his Utopia.

I am not discussing this feature any further than it affects the figures of my calculations. Take away the graft, and both would be benefited. One has only to read the recent reports of some commission men in the East to see that this is true.

What of fruit-raising as an industry—is it profitable? What of fruit as a food—is it reasonably economical?

I have sent out more than one hundred coupon cards to growers, to associations, to dealers, and to others, including agricultural colleges and experiment stations. Not 25 per cent of these have any kind of an answer, and not over 5 per cent have anything more than a guess, even in the

mechanical process—that of boxes and handling. None had a definite answer as to the lowest figure at which a package could be sold so as to pay for the investment; for few had kept any definite record, one season with another; just sold so many cars, and got the market price—good or bad, as the case might be.

This ignorance (we might as well call it that, as it is such) speaks ill for the business. No other industry is so monumentally mismanaged. None other is so filled with guesses. It is a wonder that any of us ever make both ends meet. When we get a low price, we say it does not pay. Do we really know? Are our calculations based on accurate figures; or are we influenced by some good, clever talk that makes such a vivid picture that we see nothing but success, and keep on planting and hoping that the future will be bright?

The retail grocery business, which has many failures to its credit, could give us many pointers.

Agricultural enterprises are affected by a different set of probabilities from those of the merchant or the manufacturer; yet agricultural enterprises are just as susceptible to analysis as any other enterprise. These secure their data from year to year; so should we. They know to a cent the cost of producing any article before it is put on sale.

The sugar manufacturers know the cost of a pound of sugar, and consequently know what they can pay for beets.

Why should not the farmer know what it costs him to produce his every product? He usually lets the sugar companies set the prices of beets for him.

Who makes the price of wheat is an old "saw"—as much of a problem as ever.

Who makes the price of fruit? Apparently, no one. It is mostly go as you please.

Yet, if I go to my grocer and ask for a few pounds of apples, I pay two or three times as much as the grower gets.

Perhaps this part of the discussion is not material—price, cost, or ignorance; yet it is the basis of excuse for this paper, and obliges me to put too many figures and estimates into it, and by so doing weakens my findings.

Notice the loss the West must suffer in freights to New York City. From New York State, and other near-by points, the cost on a barrel of apples is 25 cents, while from the West it will be \$1.60 a barrel.

It has not been profitable to store apples for the spring trade, as then semi-tropical fruits are in the market and decrease the demand for apples.

Supply and demand would regulate the fruit industry, if it were left to natural causes; but want of co-ordination, and unprincipled dealers, often glut the market at some points, the result being that the price is broken to clean up.

At one time it was reported that seventy cars of apples were sidetracked in a little town in Texas where three cars would have been a glut. This has happened quite often this year—more fruit shipped into a market than could be used, and often sold at a loss.

Red raspberries were selling at Colorado Springs last summer for \$2.25 per crate. An excess supply was shipped into that market, and the price dropped to \$1.40 per crate.

I am using the apple as a representative of fruits, but not to the prejudice of the other fruits. The following figures are an excuse for so doing:

The apple crop of the United States is estimated at from forty-five to fifty million barrels, or one hundred and fifty million boxes, which constituted 55 per cent of the crop of all the fruits raised in 1900; or, to put it in another way, one and two-thirds boxes for every inhabitant in

the country. The price paid to the grower, if paid by the consumer, would give every family of moderate means or common wage his quota.

Again, I saw that Ben Davis apples were quoted at \$2.75 per barrel in London, and that the foreign demand to date has been not to exceed two-thirds of that of last year.

It looks as if there would be a check in new plantings, as there was following the big crop of 1899. This check resulted in reducing the number of bearing trees by 50,471,000 by 1909, or a loss of 33.25 per cent. But the continued short crops occasioned by the overproduction of that year induced a large replanting, which had not come into bearing in 1909; viz., 65,792,000 non-bearing trees. It looks as though there might be a repetition of the period mentioned—a check to the increased planting and the neglect of orchards. This would not be an unmixed evil, if it should induce fruit men to study the causes and plan to meet the conditions; not following, as a bell wether, some man who has lost his nerve and is a “knocker,” but doing what is wise, studying the signs of the times, and planning to have a crop when there seems to be a tendency to reduce the production, from whatever cause.

Here is a copy of the coupon card that was sent out by me in gathering data for this paper:

“Please state the price of putting the following fruits on the market per package, upon the attached coupon:

“Apples per box.

“Cherries per crate of 24 quarts.

“Red raspberries per crate of 24 pints.

“Black caps per crate of 24 pints.

“Blackberries per crate of 24 pints.

“Plums per basket of 20 pounds,

“Peaches per crate.”

Because of the lack of returns, I am giving my own findings; not to claim any patent of perfection, but as an example.

I bought a bearing orchard of one acre, in 1904, containing seventy trees. Some have died since and have been replaced, but the new trees are not yet bearing. The income from this has been as follows:

1904 crop, 200 boxes, bringing.....	\$125.00
1905 crop, 200 boxes, bringing.....	125.00
1906 crop, 225 boxes, bringing.....	100.00
1907 crop, nothing .....	
1908 crop, nothing .....	
1909 crop (175 bushels, estimated).....	110.00
1910 crop, nothing .....	
1911 crop, 150 bushels, bringing.....	76.42
1912 crop, 75 bushels, bringing.....	38.00
	<hr/>
Total, 1,025 bushels.....	\$574.71
Add home use and cider of culls.....	50.00
	<hr/>
Total .....	\$624.71
Investment—	
Cost of land .....	\$500.00
Interest for nine years.....	\$360.00
Taxes for nine years.....	225.00
	<hr/>
	\$585.00
	<hr/>
Total .....	\$1,085.00
Or.....	.57.5 cents per box or bushel
Care and enclosure.....	.40.0 cents per box or bushel
	<hr/>
Total .....	.97.5 cents

Omitting the three years of loss, and adding to their care \$49.90, I have a total cost of \$444.95, or an average of 83.4 cents as the minimum cost of the apple market.

The actual receipts were only 60.9 cents—a loss of 36.6 cents on a nine-year basis.

Note that the figures taken are local—taken because no other data were available. However, they show the method. Corrections can be made to suit the conditions in other localities.

I will give some figures as to cherries planted on land within a favorable distance from market:

Cost of land, per acre.....	\$200.00	
Interest till bearing, five years.....	80.00	
Care, five years.....	50.00	
Taxes, five years.....	50.00	
150 trees at 15 cents.....	22.50	
Total .....		\$402.50

Yearly expense and returns:

Interest on the investment for one year.....	\$ 32.00	
Taxes, one year.....	10.00	
Care, one year.....	10.00	
300 crates made up.....	60.00	
Picking 300 crates, at 36 cents.....	108.00	
Marketing .....	10.00	
Replacing dead trees.....	2.50	
Total .....		\$232.50

If I average the cost on 300 crates, on the basis of two crates per tree—which is not large, as some trees furnish as high as seven, and many as high as four, for a large percentage of bearing orchards—we have 77.5 cents per crate.

Next we will take red raspberries and calculate the plants for an acre:

Cost .....	\$ 20.00	
Land cost (estimated), \$150 to \$200 per acre.....	200.00	
		\$220.00
Interest for three years to bearing time.....	\$48.00	
Care (covering and lifting) for three years.....	35.00	
Taxes for three years.....	45.00	
		128.00
Total .....		\$348.00

Much of the raspberry land costs more, which will add to this first cost; consequently, this is conservative.

Yearly receipts, 300 crates.

Yearly expenditures:

Interest .....	\$ 34.40	
Taxes .....	10.00	
Care .....	75.00	
300 crates, at 17 cents.....	51.00	
Delivering .....	10.00	
Picking .....	72.00	
Total .....		\$252.40
Or cost per crate.....		.84

All above this is profit, provided this can be kept up for a series of years. A bad year must be divided up among the rest. Loveland had three years of partial failure, and one year almost a total one.

As I have had to compile these figures from my own experience, there might be some variation from the figures of other growers. As in the case of cherries and apples, they form a basis. These figures are encouraging, as only a few times have the prices fallen below \$1.

If they are raised where no burying is needed, a saving of at least \$50 per acre can be made, which is true outside of the eastern slope.

I have no record of comparative yields in other sections. I consider 300 crates per acre a conservative estimate, as in certain instances the yield has been as high as 750 crates per acre. The average in 1912 was more than 400.

The West sells most of its red raspberries to canneries, at about 3 cents per pound, or 51 cents per crate of 17 pounds without the crates.

With black caps it is practically the same as with the reds, but they bear less per acre and bring a better price; hence the net income is about the same.

Blackberries are a little harder to care for and bring a better price. The initial cost per acre is about the same, although the yield is less. I will estimate about 200 crates per acre.

I have no data on plums, currants, or gooseberries, although they were on my list.

I had but one return to my inquiry as to peaches, and that did not deal with anything but the mechanical cost, which was 17 cents per crate.

I have no reliable record of strawberries outside of Loveland. I had a report of 75 cents per crate from one acre in Loveland. One field had 230 crates, that averaged \$2.50 each, costing in the neighborhood of \$2 to market. This is a fair return for the investment, considering that you get returns from the time of planting much more quickly than from most other fruit.

Reports from Steamboat Springs, Routt County, give: Cost of land, \$400 to \$500 per acre; number of crates per acre, 300. Cost of each crate of berries on the market, \$1.25.

Will the fruit as a food—for as such it must be considered—keep pace with the advance in other foods, as to value and cost?

As an example, the year 1899 produced more corn than 1909; yet the latter date brought 73.7 per cent more than the former. There was no decrease in acreage, nor change either in methods or seasonable conditions. But the population increased 21 per cent; hence the increase in cost. This looks well for the fruit-grower to get a better price and demand.

We have tried to show the lowest figure at which fruit can be produced without loss to the grower. Government bulletins record some very interesting results in their food experiments, which are very favorable for the fruits. Conclusions are more or less uncertain, because experiments are in their infancy, but point to a future of better fruit values.

The cost, however, may be affected by overproduction, financial stress, or unfavorable climatic conditions; yet the natural relation between costs of different kinds of foods will remain, and dominate the normal condition, as a basal factor or principle, like that which governs the mechanical, commercial, or financial world.

What is that factor? If five dollars' worth of apples as a food equal eight dollars' worth of meat, the ratio is 5 to 8 in favor of the apples; so any change will affect this ratio favorably to fruit or otherwise. This ratio is found in the constituents, not in the digestibility. A scarcity of fruit raises the price of fruit and the consumption decreases, if its equivalent in meat is cheaper.

I have taken the apple as my fruit, to work out my problem, because of its greater universality in product and consumption.

As before stated, fruit seems to have three offices: nutrition, assimilation, and as a condiment.

While I shall deal with the first, nutrition, I shall not disregard the others, although they will be in addition to my findings for fruit values.

Fruit helps digestion, and thereby improves the health, aside from the nutrition it contains. Consequently, if a man gets more protein (food) and calories (energy) out of two dollars' worth of meat than he gets out of two dollars' worth of apples, it does not follow that the meat is cheaper, because he has not recognized these other values.

But the average consumer will be governed by the length of his purse, which will not permit him anything but the cheapest nutrient values. He may not see the others until he has a doctor bill to pay, and finds that his digestion is impaired because he has eaten too much of the stronger foods, whereas he needed fruits to make a well-balanced, healthful diet.

Hence I am dealing with the best hard facts that I can gather, and let the other fellow slip in the trimmings.

The two principles of body-building and life are protein, fats, and carbohydrates (sustenance), and calories (energy). When we find the relative coefficient of these, we have their relative food values, and, having found these, we may get their commercial values.

I know that the analysis of any food will show certain elements that may almost entirely change when they are subjected to the wonderful chemistry of the body in its digestion and assimilation. But experiments have permitted the investigator to reason from effect to cause, so that, when he says that protein (and fat and hydrocarbons) are the sustaining elements, he is not at fault, no matter what the chemical properties prior to the process of digestion. Hence I use the results of the experiment stations and accept their conclusions.

A dog can live on lean meat, and convert it into muscle and energy; so can man; but for neither is this the best diet, as both need a mixed diet. The most healthful food is that which is best fitted to the needs of the user; and the cheapest food is that which furnishes the largest amount of nourishment at the least cost.

As an illustration: The acid of the apple, uniting with the fat of meat, helps digest the fat. The meat would give some nourishment alone, but the acid alone would be almost valueless, and can conserve no building force. Therefore, when we eat meat we often want pickles to aid digestion. These condiments would better be supplanted by fruit, which would add a certain amount of nutrient as well as assimilative qualities. This line of thought belongs more to hygiene, and is used here only in explanation.

The incident that is mentioned, of travelers dead and dying, with plenty of fruit with them, has its counterpart in the early days of seafaring, before the day of canned goods. Many a vessel came into port after a long voyage, with its crew in bad condition from scurvy, because of no food but meat and bread. That is something which is unlikely to happen now, when a ship is properly provisioned. It was not that the fruit of the travelers was less valuable, but that its value could not be conserved without the more solid foods. There is not in the fruits enough of nitrogenous compounds—carbohydrates (sugar, starch, etc.). The fruits furnish 4.4 per cent of the food value, and 3.7 per cent of all the carbohydrates (sugars and starch).

On the basis of these data the California Agriculture Station made some very satisfactory tests, showing very favorable results with fruits and nuts mixed. Two women and four children lived on them for several years. The cost per day for women and children was from 15.7 to 27.5

cents. In another test, with men, the cost was from 8.1 to 47 cents per day. These tests answer the objection that fruit adds no increased cost to the economy of living. The details of these experiments are too long to be quoted here; but are given in full in Farmers' Bulletin No. 293, published by the government and to be had on application.

Some interesting deductions may be made. The fruitarians maintained all the energy possessed by those on mixed diet, and with no loss of flesh. The amount of protein compounds and calories (energy) in the fruit was much less than in the mixed diet. The experimenter is not concluding that fruit diet is equal or superior to a mixed one, as the only object was to get the cost.

He says, further, that we have found that fruits and nuts must not be looked upon as simply accessories, but as a fairly economical source of nutritive food. And this in the face of the present prices the consumer has to pay.

Here are the tables of assimilation, compiled from the result of ninety-three experiments, meeting a very favorable showing for fruits:

	Protein	Fats	Carbohydrates
Vegetables .....	83%	90%	95%
Fruits .....	85	90	90
Mixed .....	93	95	98

I will now give you the comparative values of different kinds of native fruits:

	Protein	Energy
Apples .....	0.4%	290
Cherries .....	1.0	365
Blackberries .....	1.3	270
Red raspberries .....	1.0	255
Black raspberries .....	1.7	310
Peaches .....	0.7	190

You will see that cherries are the highest, and peaches the lowest.

I will now try to show to you what ten cents will buy:

	Protein	Carbo- hydrates	Energy	Fat
Apples .....	0.02	0.72	467	0.02
Red raspberries.	0.01	0.18	365	0.00
Strawberries ...	0.01	0.10	250	0.01
Porterhouse steak .....	0.07	0.00	444	0.07
Flour .....	0.46	3.00	6,600	0.04

Notice that protein is low in fruits and energy is high; that protein is high in meat and energy is low; and that both protein and energy are high in flour.

It takes 4.8 pounds of apples to make....1,000 calories of energy.

It takes 0.6 pound of flour to make....1,000 calories of energy.

It takes 0.9 pound of meat to make....1,000 calories of energy.

It takes 5.2 pounds of potatoes to make..1,000 calories of energy.

Flour is the cheapest; and hence the foreign worker, with cheap wage, must use that only. Apples and potatoes are next.

Flour contains eight times as much food value per 1,000 calories as apples; and costs one-fifth as much.

Meat contains five and one-third times as much food value, and costs fifteen times as much.



Potatoes contain ninety-three times as much, and cost one-sixth less.

Mine may not be accepted as conclusive figures. Those of others vary according to data or local coloring; still others will not be convinced, no matter what is said. Therefore, conclusions are not always conclusive.

One farmer succeeds where another fails. Some are unlucky. I know of an instance where a farmer near Eaton, Colorado, was hailed out eleven times in thirteen years. Another in the same section paid for his eighty acres with two crops of potatoes.

Comment is unnecessary; but back of it all there is a set of facts that are as sure of definite solution as that two and two are four. When we get that, we will snap our fingers at the fellow who merely guesses at things; for we shall know what we are doing.

First—With the multiform methods of growing apples, they do not make good returns on the money invested. I am not a "knocker," but can reach no other conclusion. Fifty-five per cent of all fruit trees in the United States are apple trees, and it looks to me as though not over 25 per cent were properly grown, and fruit marketed therefrom.

Second—Cherries—and I am not taking my conclusions from Larimer County—can be raised for less money, because of more trees to the acre and the need of less care. The life of the cherry tree is something like twenty years. The nutrient value of the cherry is equal to that of any other fruit; but it does not depend upon that for a commercial value, as it is sought for barreling, for soda fountain, and other uses. This demand thus far has not been supplied, and it looks as though it would take all the product, no matter how large.

Red raspberries must be marketed at limited distances, and they have paid very well, the price received being far above the cost. Even including the three years of partial failure, during the last ten years the average has been above the cost.

Strawberries can be produced for less than \$1.50 per crate, and have sold for an average of \$2.40; hence they are a good investment.

Currants, gooseberries, blackberries, and black caps are about the same as red raspberries.

Peaches seem to be the most discouraging, both as to price and food value.

Tropical fruits have in recent years come into close competition with the fruits I have enumerated, and at a time when the apple should be in best demand. This is in the spring, when apples bring the best prices; hence there is very little to encourage a hope for better conditions.

The 150,000,000 boxes of apples produced in 1912 would give every inhabitant in the United States one and two-thirds boxes. The present prices should enable each purchaser to receive his quota, no matter what may be his income.

The purses of many will not permit them to get their share, because the fruit of itself will not give quite the same food values as meats, vegetables, or cereals, for the same money. It is hunger which governs our stomachs, not sentiment.

If a box of apples can be bought for \$1, it is possible that the purchaser would not buy if it was \$1.50, because he figures that he cannot afford it.

The decreasing production of cereals and the legitimately increased cost will make for more fruits to fill the demand for cheap foods.

A professor at the Illinois Experiment Station says that high cost of living is nothing but the forerunner of famine. Like the wearing away of Niagara, it is a fact—but not in our time. Yet eastern countries have had to face just such a condition. Perhaps it is in the province of fruits to meet such a possible condition by finding some way to grow them at

less cost and make them the panacea for famine ilis, present or future, possible or imaginative.

I am, in this line of research, but a beginner, and hope the class will be large; and if in any way I have contributed to bettering conditions, I shall feel well repaid.

A judge once said in my presence that there were other and higher courts who would correct his findings, if in error. The highest court in my case is the slogan of the last campaign, "The People."

Professor Taylor: That certainly is a good paper. Shall we take up the discussion of this paper at this time, or shall we take up other numbers of the program and leave the discussion to come up later?

If it is the sense of the meeting to proceed with the program, we will next have something on the topic of "Legislation." On the program, Mr. L. T. Ernst has been placed for this subject, but we have here with us a representative-elect from Delta County, Mr. C. C. Hawkins, and I understand he has something on this subject, in place of Mr. Ernst, who is unable to be with us today.

Mr. Hawkins: Mr. Chairman, Ladies and Gentlemen: I didn't know until a late hour that I was to be called upon to present this subject, but I have a few notes on one feature of our industry that I think needs attention, and that is protection from commission men who handle our product.

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#### RECOMMENDATION FOR LAW AFFECTING COMMISSION MEN

BY C. C. HAWKINS

First—Have all books and records for commission houses inspected, the same as our state and national banks. I can see no good reason why commission houses, which handle a far greater percentage of our produce that represents money, should not undergo the same examination as our banks, as these care for only what we have left after the commission men get through with us; and our past experience shows that they leave us very little.

Second—It is a very important matter to have this bill provide that the report of sales show to whom the fruit or other farm produce is sold, giving the address of the purchaser, and compelling them to keep duplicate bills of all sales.

Third—We believe that all commission houses should be put under bond, indemnifying the grower or securing him for his returns. This is a very important law, as there are a great many men who start in the commission business who have absolutely no credit. As to the size of the bond that should be given, it might be left to the Secretary of State, but no bond should be less than \$10,000. Under the present conditions we have absolutely no security for our shipments of fruit to a commission merchant. We are absolutely at his mercy and depend entirely upon his honesty. We, of course, know that there are a great many honorable and straightforward commission men, but a great many of them care nothing for their credit or reputation, and are only in the business to skin the producer. The giving of a bond would cut out all irresponsible dealers, and would not hurt the honorable and substantial commission men.

Fourth—I would have all books of commission houses handling farm products on commission open to an inspection of the shipper at all times.

Fifth—The bill should provide for boycotting, or using the products of one farmer or ranchman to undersell the other fellow; and sales should be made to anyone wishing to purchase, whether he buys all of his prod-



Irrigation in the Fruit Districts—Steel Flume to Convey Water to the High Mesa Lands, Poudre, Colorado.



ucts direct from the commission man or not. I know it to be a fact that it is impossible for a retailer to buy apples or other products from the producer, as the commission men in Denver tell the dealer who may have bought apples and peaches, or other products, from the producer, if he wishes to buy oranges or other tropical fruits or produce, to go and buy them where he bought his other stuff, and refuse to sell him. I have been told by a number of retail dealers in Denver that they would be glad to buy from the producer, but under present conditions it is impossible for them to do so.

Sixth—I would impose a penalty of a fine and imprisonment for making false reports or returns.

Seventh—I would impose a fine for selling farm products, or other goods, received on consignment, to anyone connected with the firm. This is a very necessary provision, as I personally know of instances where apples were sold to one John Doe, and returns made to the shipper at a certain price, and sixty days later the same apples were bought from the same firm at a much higher price. I traced this transaction myself from the commission house to the cold storage, and then to the retail dealer. In some instances the returns to the shipper were \$1.50 f. o. b. Denver, and sixty days later this same firm sold the same apples to the retail dealer at \$3 per box.

Eighth—This is not all that should be embodied in this bill to protect us against the commission houses, but it is a start; and I should be glad to receive any suggestions or recommendations on the part of any producer. The time has come when the producer has got to do something for himself. We have trusted our business with other people too long. And experience has proved that they have not our interests at heart. No man can attend to your business as well as you can yourself. The present system of handling farm produce would soon drive the producer out of business, and is raising the cost of living beyond a reasonable price to the consumer. When you consider that during the year 1911 the farmers of the United States raised thirteen billions in farm products, and it cost seven billions to distribute it, it is clear that the middleman takes over one-half. We have read a great deal of late as to the cause of the high cost of living. Surely it is not because the farmer is getting rich; in fact, he is getting a lower price for his stuff today than he did five years ago. We are paying too much for brains. My experience has been that the farmer or ranchman works too many hours, too hard, and does not think enough. If he would spend at least a part of his time thinking out these problems, instead of letting the city fellow do it for him, he would be in far better condition financially than he is today. Of course, I realize the fact that we cannot cut out all commission; we have to pay somebody for handling our fruit; but I do object to paying three or four commissions. By a systematic and careful handling of farm products, we could reduce the price to the consumer, and at the same time get a larger share of it for ourselves. The high price of apples has curtailed the consumption to a very large extent. By careful investigation, I have found a number of instances where our best Jonathan apple has sold at retail for more than \$4 a box. Now, how many of these apples would the working-man buy, working at a wage of \$1.50 a day? At this meeting, if you do not form an organization for the better distribution of fruit, I hope that every fruit-grower will pledge himself that he will never let another box of apples or fruit sell on commission. If you can't get the money for it by actual sale, you had better let it rot in the orchard. I am quite a large grower of apples, and only once have I sold on commission, and I made a solemn promise that I will never do it again. My plan is to pick your apples and store them away in the picking-boxes, and pack them when you have a buyer. In this way I save the storage, and only pay freight on the good apples, as when they come out of storage they always have to be repacked, and there is quite

a loss; besides, you are paying storage on the loss in repack. I know from experience that apples will keep better in this climate in an ordinary cellar or storehouse than they will in cold storage elsewhere, and when the apples come out of the ordinary storage in this climate, they keep far better and longer than they do out of the cold storage elsewhere. Another thing in favor of storing your apples at home and shipping them later in the season is that you do not glut the market. In the past twelve years that I have been growing apples there has not been a year but what I could have sold my apples for cash at home for a good price.

Professor Taylor: The people of the western slope are especially fortunate this year in the fact that they have as representatives from Delta, Mesa, and Garfield Counties men who are intimately connected with the fruit industry. We have listened with a great deal of pleasure to this paper by Mr. Hawkins. Mr. Hawkins is a successful fruit-grower. I have seen his fruit away from home, and it looks good. It has won premiums in competition with Mesa County in certain instances. (Laughter and applause.) The meeting is favored in other respects in having present representatives from Mesa and Garfield Counties, both Mr. Newton and Representative Mann, of Rifle, and while we are on the topic of legislation, it seems appropriate that we call upon these two men for remarks at this time.

Mr. Newton: Mr. Chairman: At the session two years ago Brother Hawkins sat back of me, and Brother Mann at the side of me, and I relied upon them not to let me go wrong; and as they are both going back with me this year, I am going to do better than I did before, because I have learned something important, and I hope they have also. If there is anything I can do to assist the fruit legislation, I am going to do it, because I raise a few apples myself, and I raise a few peaches; and there is certainly some place or other where we can make some improvement in legislation, as well as in the economy of raising our product, in the economy of marketing the same, and in the economy of living. If there is anything I can do, as I said before, I am going to vote right, but I won't talk much, because I am not much of a speaker.

Professor Taylor: Mr. Mann, of Garfield County.

Mr. Mann: I am so tall that it will not be necessary for me to go up on the platform.

Voices: Platform, platform!

Mr. Mann: Mr. Chairman, Ladies and Gentlemen: I came down here for just one purpose, and that was to listen, and I propose to listen and learn. It has been suggested that my friend Hawkins was an expert fruit-raiser. I wish to say to you that I am an expert fruit-eater, and I know when I taste of good fruit—and I have had that in your section. You have gathered here for just one purpose, as I understand it. It is not to give long papers, nor insist upon your opinions, but to get down to rock-bottom facts—get together and bring about certain results, because of your needs in this section, and all other sections of the state. This paper which has been read by Mr. Hawkins is a very valuable one, and you will act upon the suggestion he has offered, I am sure. As one of the members of the coming legislature, I shall be only too glad to do all I possibly can. I don't always follow in the footsteps of some men without making a few tracks of my own, and good-size ones at that; and so I am very glad to be with you this afternoon, and I hope to see you again. (Applause.)

Mr. Hawkins: The fact is, I wouldn't want to follow his footsteps around Denver. (Laughter.)

Professor Taylor: We will pass on to the next paper, the next topic. We have with us this afternoon Professor C. P. Gillette, of Fort Collins. It has been suggested that we leave the subject to be discussed by Professor Gillette until later, because I understand the topic which Professor Gillette will discuss will be of interest to a great many who are not here—

the school children in particular; so we will pass on, then, to the subject, "Distribution of the Fruit Product." We will begin with a paper by Mr. R. E. Turpin, of Grand Junction.

## DISTRIBUTION OF THE FRUIT PRODUCT

BY R. E. TURPIN, GRAND JUNCTION, COLORADO

Mr. President, Ladies and Gentlemen: The marketing of our fruit was designated by the secretary of the State Board of Horticulture as the most important of all the subjects coming up for discussion at this meeting. I doubt if there will be a grower who will disagree with Mr. Mauff on that score. There is an urgency about this question never felt before by the growers; and all the industry it waves a menacing hand, demanding an answer. That answer is: More complete organization.

On every side the fruit-growers are faced by strong organizations; the railroads, commission men, brokers, and organizations of retailers. When we turn from the thorough organizations with which we are surrounded, and with which we must deal, to a survey of our own condition, and behold our scattered organizations, each one a rival of the other, we must realize how serious is our situation.

Not only is there no sort of understanding among the associations themselves, but, so far as I can learn, there is not a fruit-growers' association in Colorado whose grower members demand that all rules be strictly enforced, which insists that any member who violates rules and regulations get out, and stay out until he can abide by all rules and regulations.

These being the facts, the commission man uses one association or group of growers to beat down the prices as quoted by a neighboring association or group of growers. In one instance this season a manager of one of our associations, about to sell some Jonathan apples, was underbid twenty cents a box by a rival. I do not know that it did happen in this case, but it may very well have happened, as it no doubt did in other cases, that this grower may have had fruit in the hands of each of these competitors, so that, box against box, his fruit was consigned so as to bring him less money.

No one would have to go far to find men, and well-meaning men, who this season divided up their fruit between two rival associations. Not only does the manager of one association find his chief antagonist to be the manager of the association closest to him, but if a certain manager happens to receive a good offer for a large number of cars of a certain variety of fruit, he does not know whether to accept in full. There is a penalty for falling to fill orders once accepted. Under the present method, a manager does not know what he has to sell until the fruit is delivered on the platform. He cannot depend upon the number of empty boxes the association has sold; for growers, and well-meaning growers, will buy all their boxes from one association, and ship part, or even all, of their fruit, through some other association.

If a manager finds he has oversold an order, and calls up a member of his association who is known to grow the variety in question, and asks him to bring in what he has, that grower, if he is not satisfied with the price, may ask the manager what right he had to sell his fruit anyhow, without first talking to him.

What these conditions have cost the Grand Valley alone there is no way accurately to estimate. If the sum were known, it would represent many thousands of dollars. It can be approached in this way: The different associations have from year to year ended the season with differ-

ent averages of prices for the same kind of fruit. One association has had the best average, another next, and a third the least. In different years this order may have varied. There is no reason why, if we had worked together, the best average of a part of the growers of this valley should not have been the average of all the growers. We have surely lost the difference between the best and the least average of prices. May we not say also that, with one organization, the best average would have been better, thus adding to the amount of money squandered in rivalry?

This is but one aspect of the case. There is the item of what inferior packing has cost the growers of the valley, and always costing the growers who pack best, most. Each association has a pack of its own. They differ as to quality. The worst goes out and pulls down the reputation of the best. It is all Grand Valley fruit. The managers and the boards of directors of the different associations all recognize the importance of a good pack, but they are rivals soliciting business; therefore, I doubt if there has ever been a pack too poor to be shipped out of this valley by someone, with its blackening influence on the name of the Grand Valley. We all know instances of growers who, when their fruit has been rejected at one association platform, instead of repacking it, drive to the platform of another association, there usually to be welcomed as a new shipper. I know of one association to which complaints of an inferior pack in boxes bearing its labels have been made, which boxes had not passed under the association's inspection, or been shipped by it. Someone had degraded the name which so many of its fellows were working hard to build up; and perhaps he did so without any evil intention, thinking simply that he was minding his own business.

These things which have cost so much can be remedied to a great extent. We all feel the need of some remedy. We hear a good many proposals. Some of these begin a long way from home—such as selling direct to the retailer, or direct to the consumer. We cannot sell our product to the best advantage by any form of distribution, unless first we have taken up and solved among ourselves the problem of thorough organization. There is something we can do. Everybody nowadays wants to reform somebody else. Let us begin reform by reforming ourselves.

There are three associations in the Grand Valley. There are two ways of getting the three together. The better way would be for them to merge under one association; a new name, covering the whole of the Grand Valley, could be adopted, if advisable. I do not know how feasible this would be. It may be too long a step, to pass at once from wasteful rivalry to the consolidation of interests that are really identical. If such a consolidation be not workable this season, then we come to the central selling agency, which, so far as this valley is concerned, should not be considered as an end in itself, but as a step toward ultimate consolidation.

If the central selling agency should show that, by pooling certain of our common interests, we have reaped an advantage, then the arguments should be all the stronger for pooling all of our common interests. A central selling agency sells the fruit of a number of associations among which there usually exists some natural relation, and makes the same charge to each association for the service rendered.

Since the idea of a central selling agency was broached for the Grand Valley, it has been proposed that the affairs of such an agency be under the direction of a board of control, consisting of representatives from boards of directors of the three associations, and that the basis of representation be the relative size of these associations.

The agency would accomplish, if successfully organized, three great things for the valley as a whole:

First—A uniform grading card, regulating all the packs prepared, and issued by the central selling agency.

Second—A uniform inspection by a corps of inspectors in control of the central selling agency.



Third—Elimination of competition between the three groups of growers in the valley.

Since this paper was undertaken, there have been two meetings of the managers, and some members from the boards of directors, of the three associations of this valley. The meetings were informal—merely for the discussion of what could be for the betterment of our fruit industry. Those present simply represented their own individual opinions. The consensus of those opinions has, however, some meaning. It was the unanimous opinion of those present that a close co-operation between the associations would be of great advantage to all concerned.

Numerous benefits to be derived from a central selling agency were put forward by some of those present at these meetings. In addition to the primary benefits already mentioned, some of these were:

It will reduce the consigning of fruit to a minimum. To consign fruit usually costs something like 10 per cent on the gross, or generally three times as much as the straight brokerage of \$15 a car. But this is not the worst feature of that practice. If one of our associations has a cash customer in a certain territory, and a rival association consigns a car of the same kind of fruit to another dealer in the same territory, the second dealer, not being controlled by any fixed purchase price, cuts under the other dealer, demoralizing the market. In the case of one association in the valley I know of dealers who were taking cars right along for cash, and who were lost because a rival association began consigning apples either to the buyer in question, or to another dealer in the same district.

A central selling agency would provide the best sales manager obtainable for all the growers of the valley. His mind would be on selling the fruit to the best advantage, and not harassed by many other details, as a manager of an association is now.

The best brokers in the service of the three associations could be picked for the service of the selling agency. In addition, it is proposed that several salesmen be employed—to investigate new territory; to keep a check on rejections; to report on the question of distribution from the field; to look into statements that the retailers are taking an exorbitant part of the proceeds; to look into reports of poor distribution at certain points; in fact, to keep headquarters in close touch with what is going on in both old and new marketing territory. A few salesmen would also give an opportunity to "get a line" on the advisability of substituting salesmen for brokers. Expert salesmen require employment throughout the year, and, as our selling season lasts no longer than five months of the year, it would not be wise to embark too extensively on the salesman plan until we had an idea as to what it would accomplish.

With a uniform pack in the valley, and our selling interests consolidated under one head, it was suggested that a small fund for experimental advertising could be created. The money could be spent within a given territory, a close check on results kept, and, if it were found to pay, as has been found in the advertising of other kinds of fruit, the fund could be increased in proportion to the benefits received. Through advertising we get in direct touch with the consumer. With the consumer asking for Grand Valley fruit, we would begin to establish an independence from dealers between us and the consumer.

Much money is saved by the routing of cars by an expert. The central selling agency would give all the benefit of the best traffic manager to be had.

Each association now runs a big telegraph and telephone bill. There would be a considerable saving in cutting out the needless duplication that goes on now.

Another of the smaller advantages mentioned at the meeting was that in the shipment of early fruit, or scattering varieties, there would be fewer local shipments and more straight carloads.

Finally, at the close of the second meeting a motion was made and carried, endorsing the idea of a central selling agency for the Grand Valley, though there was probably not a man present who did not feel that, if it could be brought about, actual consolidation was the best thing.

The central selling agency is really a device for yoking together, under one selling head, contiguous fruit districts which grow the same varieties of fruit, as, for instance, the counties of the western slope of Colorado, or indeed of the whole state, or, as the Northwest proposes, at a meeting held in Spokane this very day, the output of several adjoining states.

Such an agency will, when the test comes, be no stronger than the cohesive power within its individual units—the local association. The first step, then, toward such an agency for the western slope, or for Colorado, is strong local organizations in the several districts concerned—organization which the members stick by.

It is not intended to propose that any man dictate to another as to whether or not he belongs to the association; but those who do belong to the association, and who abide by the rules and regulations they have adopted, or by the rules and regulations adopted by the board of directors they have elected, should require that all members abide by these rules and regulations. Those who show themselves deliberately unwilling to do so are not entitled to the privilege of membership. Until we growers recognize this as a principle fair to all, and enforce it, we shall not attain to the standard of the organizations with which we have to deal. Such thorough organization is dictated by no man or set of men. It arises out of an inexorable condition of modern development. The sooner we see it, the better. Until we do see it we are not really ready to form a large territorial organization.

Let, then, each of the western-slope counties growing fruit in quantities organize thoroughly at home in one local county organization, if possible; if not, in a group acting under one head as to pack, inspection, and selling. Then the counties will be ready to join into an effective selling organization. One good start could be made at once toward that end by the adoption of a uniform grading card for the entire western slope.

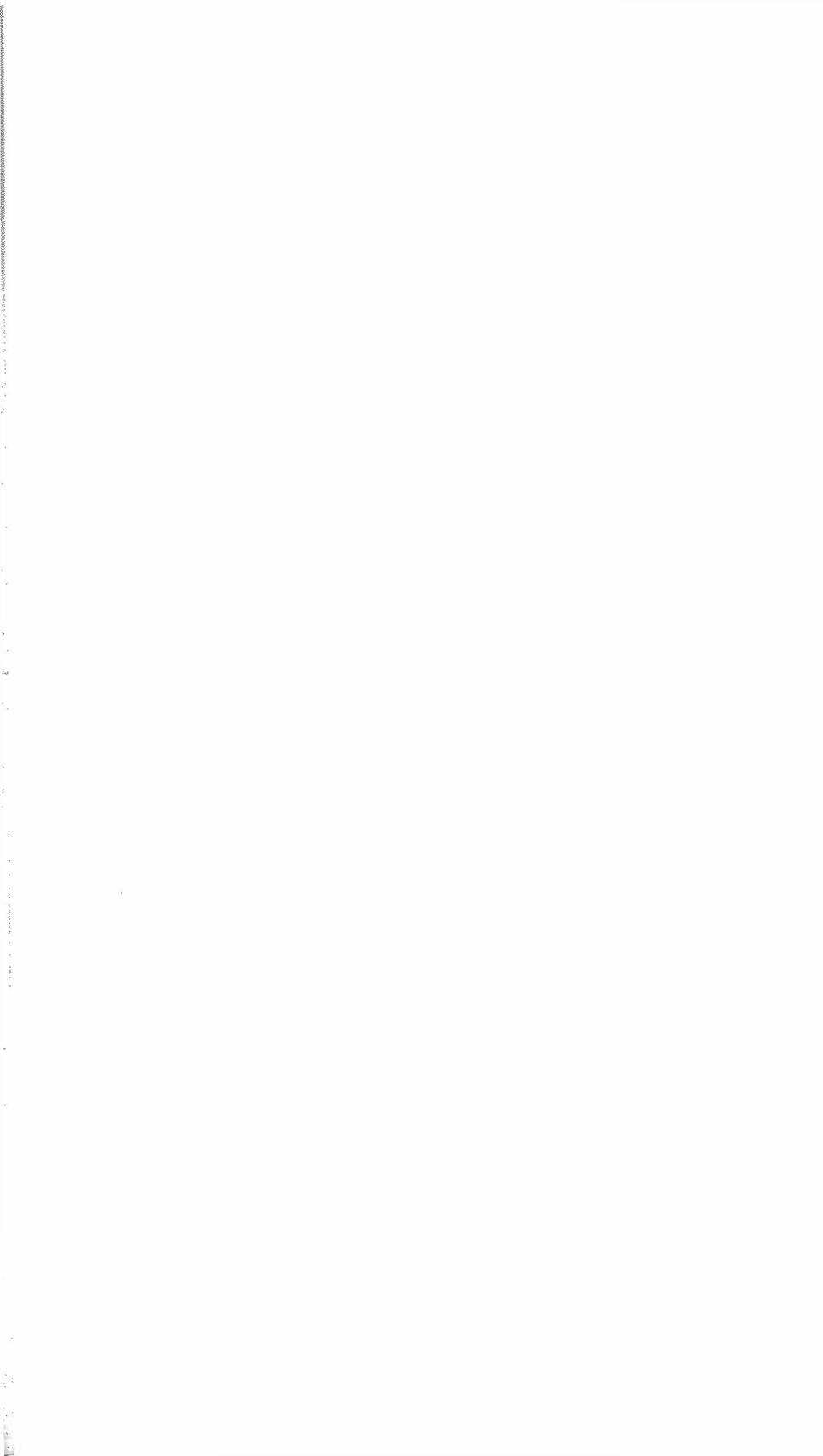
So with the eastern slope fruit counties; let them in like manner actively begin to get together. With the counties of the state well organized, the ground will be prepared for the formation of a central selling agency for Colorado.

Professor Taylor: The subject has been ably opened in this paper by Mr. Turpin, and remarks and discussions are now in order. Let us discuss this thoroughly from every standpoint.

Mr. Cline: Mr. Chairman, Ladies and Gentlemen in this Convention: As a grower of fruit from Delta County, I want to say that I am heartily in sympathy with this movement. As a member of the State Board of Horticulture, I was one of the first to advocate the getting together of all fruit interests for the marketing of our fruit. We suggested it at the meeting of our board held in Denver on November 25, and from the interest that has been shown since this subject has been put forward we know we are right. Our people in Delta County are just as anxious for it as you are, and we believe it can be done. Let us get together and work for the success of this proposition—a central marketing agency. I have written a few notes on what I have to say, and will give you my ideas on the subject.



The Apple Shop, Denver, Colorado—One of the Stores Established by the Fruit Growers of Delta County. Sales Made Direct to the Consumer.



It is generally conceded that our present method of handling the crops from the orchards of Colorado, and especially those of the western slope, might be improved upon. There is a feeling among the growers at large that they are not receiving a fair share of the price paid by the consumer.

Perhaps some of you have heard the story of the barrel of apples sold two or three years ago by a Missouri grower for 75 cents, into which he placed a card requesting the final purchaser to let him know how much he had paid for the apples. In due time the card was returned, with the statement that the consumer had paid \$5.25 for the barrel, and he added the remark that: "At this rate apple-growing should be mighty profitable."

We know from experience that in many, many cases within the confines of our own state the consumer is called upon to pay heavy toll to the various hands through which our fruit passes. It is known that apples which could be bought from growers in the best sections of the state for from half a dollar to a dollar a box, packed, have sold at times as high as \$3, \$3.50, and in rare cases \$4 per box.

This is a fact regarding all farm products. Often it may appear to us that the fruitman is unduly oppressed, whereas, if we look about us, we shall see that there are other branches of agricultural industry which show even a less proportionate profit for the grower, as against the consumers' prices. Your can of smoking tobacco, which cost you 10 cents, brought only a fraction of that sum to the producer of the tobacco. The pair of shoes for which you pay \$5, deducting the difference in proportion of manufacturing cost, yielded the man that grew the hides a nominal sum. Cotton, wool, lumber, and cereal products are all conspicuous examples of the high tribute levied by middlemen, notwithstanding the portion of the whole that belongs to manufacture, as compared with the cost of preparing fruit for market.

But, since the fruit-growers have taken one step in the right direction—namely, the formation of co-operative associations—it now seems feasible that another step might be taken. Before suggesting a plan of betterment, it will be necessary to look carefully at the present plan.

There are now fifty or more co-operative and corporate shipping associations and firms in western Colorado, which secure supplies, superintend packing and shipping, and sell the fruit for the growers. These concerns, by buying in large quantities, save for the growers many thousands of dollars annually. They set a standard for packing, so that there is a semblance of uniformity and every small grower is assured that, however small his shipment may be, it will be enabled to get the advantage of car-lot rates, and the growers are not individually compelled to seek a market.

Thus far it is good. But when there are fifty associations, there are fifty men who devote more or less of their time to the selling end, and not one of these fifty men is in the market where the selling is done. They are in western Colorado, and their markets are practically all far removed.

We often hear of f. o. b. selling, but we assert, without fear of contradiction, that not 1 per cent of the fruit of western Colorado is sold f. o. b. shipping station. In nine cases out of ten which are reported as f. o. b. sales, they are not cash f. o. b. shipping station, but f. o. b. destination, subject to inspection and rejection at that point. This latter I shall not detail now, but I know and maintain and take as granted that for the past five years there has been practically no f. o. b. selling in western Colorado—and *there cannot be*. If it is advantageous for twenty or more growers to combine for buying supplies and shipping their fruit, it seems that it would work in the same manner for the fifty associations to combine for the distribution and selling of their outputs.

Under the present system, each salesman received each day telegraphic reports of the conditions in several eastern markets. Did you ever try to estimate what this expense is? The manager of one association tells me that they spent annually about \$1,500 for telegrams. If \$1,000 is taken as an average, there is an expense of at least \$30,000 annually that must be borne by the growers.

And what is the result of all the organizations getting these daily reports? If some morning during the peach harvest the reports show that Omaha, for example, is short on peaches, and the prices are strong, each association salesman makes all haste to divert some of his cars to Omaha. If they average two cars each, Omaha, within the next two days, receives sixty cars of peaches. What is the result? Probably five cars would be all that market would stand up under. Mr. Omaha commission man must dispose of his peaches, and the prices are cut to pieces. Thus the growers are paying \$30,000 a year for reports that oftentimes are really working to their disadvantage. When forty cars of peaches are diverted to Omaha, some other point or points are probably left practically empty, which in a few days causes a general scramble for such place or places.

I believe the foregoing contains the answer to an argument which I was told appeared in a western-slope paper last week from the pen of a prominent fruitman. His argument seemed to be that such a scramble for markets would not, could not, affect the price, because every house has its line of trade. Evidently he overlooked the fact that not a single house is content with the trade it has, and that, if one can undersell his neighbors to their old-established customers, he is going to do it, in the hope that he will line up those customers as steady comers with him; and nothing held such a state of affairs like a glutted market.

If one head did the distributing, \$24,000 a year might be saved in telegraphic bills, and many times \$24,000 might be saved by averting the gluts, such as I have mentioned. I am firmly convinced that 10 per cent could be added to the returns received by the growers of Colorado if one man had charge of the distribution, and all else went on as under the present system.

But I believe it is radically wrong for the products of the orchards to be sent to eastern markets, to be turned over to commission merchants upon whom there is absolutely no check. Many of them are honest, but our present system puts a premium upon dishonesty, and we find by experience that a very large percentage of the commission men are not strong enough to withstand the temptation.

It is almost a daily occurrence to read of the exposure of the dishonesty of some commission firm. The system is absolutely wrong, and so long as we pursue it, we growers are going to lose. What other class of men on earth turn over the results of their labors to men upon whom there is no check—men whom they cannot know—and say: "Here is what represents the labors of most of my lifetime; take it, and give me what you will"?

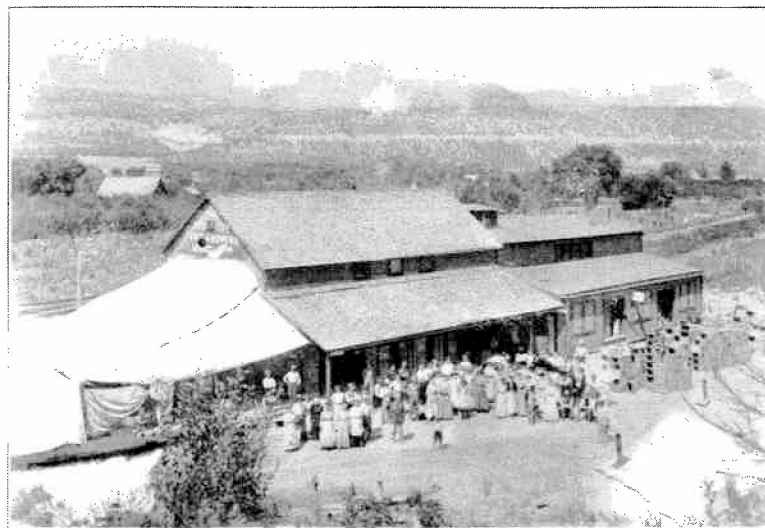
The ideal way would be for the producer to sell to the consumer; but since this cannot be, the next best thing is for the producer to have paid representatives to sell his products for him for the best prices obtainable.

I believe that all the fruit-shipping concerns of Colorado should have one head, to whom they might deliver the products for distribution; and under the control of this head should be agents in all the important distributing points, who will be paid to sell his fruit to best advantage. And when I say *sell*, I do not mean to *consign*, in any sense of the word, unless at certain times it seems best to sell through an auction; but whenever control of the fruit is relinquished, cash should be in hand.

As I said in the beginning, we have taken steps in the right direction. We have the inspiration of many examples of producers of like and different commodities to spur us on to a successful pursuit of this ideal mar-



Fruit Shipping Station, Coburn, Colorado.



Fruit Shipping Station, Roberts, Colorado.  
Fruit Association Houses in the Fruit Districts of Colorado.



keting system I am advocating. You may have heard how the Lima-bean growers of the southern California territory stood by their guns, until today they meet once a year, fix their price at nearly three times the figure they might expect if they operated under the competitive system, and *get it*.

You probably have read of the organization of the Michigan grape-growers; or you may know something of the banana business of today. The stories of co-operative concentration, intelligently followed, are stories of success.

As the most favorably and widely known example of this, I would cite the California Fruit Growers' Exchange. Organized less than twenty years ago, in the face of the bitterest opposition and severest discouragement, it now maintains salaried representatives in nearly seventy-five principal markets of this country, Canada, and Europe, selling the product of over 5,000 growers, who compose the 100 or more associations of the sixteen sub-exchanges. The sales of this concern are made on a delivered basis. That is, by keeping in close touch day and night with the present and prospective conditions in every inch of the territory covered by each one of these agents, the distributing heads are enabled to apportion a steady and suitable volume of fruit from the various associations in the various markets. The machinery of this wonderful organization has required years to build. But it is now perfected so that sales are made only to dealers of whose responsibility and integrity there is no question. The percentage of losses through poor customers is unbelievably small. If one market is growing stronger fruit is sent to it from some place which seems to give signs of weakening, and thus a fine balance is maintained, which makes a disastrous market almost unknown.

It has occurred to me that, with the proper organization in this territory, we might join hands with our California friends in using the machinery of their exchange sales force. The larger part of our business comes at a time when there is little business in citrus fruits, and all the energy of this sales agency could be given to the selling of our products. Probably this would be welcomed; for it would enable the exchange to pay still better salaries to its men, thus assuring the highest class of salesmanship available on salary. It would greatly lessen the pro-rata sales expense on each package of fruit from both California and Colorado. It would give both California and Colorado still greater prestige on the market. The dealers would welcome it for various reasons; one being that they could look to one source of supply for the major portion of all the stock they buy of these two great classes of fruit.

In conclusion, I might say that the formation of this selling agency is not for the purpose of forming a trust, or to advance the price of our product, but so to distribute the fruit that it might really be sold to the consumer at a reasonable price, which would naturally create a greater demand, which would mean greater consumption. This lower price to the consumer can be brought about by cutting out the greater part of the middleman's expense; and this can be done only by the co-operation of the growers through a central selling agency.

I believe this covers all of the points on the line of thought that I have given this subject, and I should like to hear from others in this convention as to their views. Ladies and gentlemen of this convention, I thank you for your kind attention. (Applause.)

Professor Taylor: Are there any further remarks? As to utilizing the machinery of the California Fruit Exchange and shipping our apples through that medium, since they are most closely interested in the shipment of citrus fruit, it seems to me that the Watson Hill District ships ordinarily about 5,000 cars of apples itself.

A Voice: Mr. A. E. Johnson has studied this pretty carefully; let us hear from him.

Professor Taylor: Mr. A. E. Johnson has been called for.

Mr. Johnson: Mr. Chairman, Ladies and Gentlemen: I was just about to say that I have been talking this on the street corners and every place else, and with everybody I met on the street, for the last two or three weeks; in fact, ever since last spring. It has been talked of so often that it has become rather monotonous, and lately we have made a few moves to see if we could start the thing again. Last spring I went up to Delta County to put in a few days with Mr. Cline, but it was late in the season, and so we postponed it. In the last two or three weeks, however, we have had a couple of meetings up at Palisade to go over the matter again and see if we could agree on a sort of line-up on this whole proposition. What we have been discussing was to get the simplest kind of a proposition to start with. We have talked of a plan something like this: Let the associations do their business just as they are doing it now, until a car is laid out on the track, and then turn it over to the selling agency, and let it do the selling; and when the returns come back, turn them over to the association that made the shipment, and let that association distribute the funds exactly as it is doing now. If they pro-rate, let them pro-rate; if they pay on the basis on which the goods are sold—all right, do that. Now, with reference to forming this central agency, we talked of making a controlling board; and let it be composed of so many members of each association, or else on a representative basis. Let this board of control hire a sales manager, a traffic manager, and any other help that it needs. Let this board of control also have the authority to make the grades and the pack; also to handle the inspectors—the inspectors to be hired by this board, so that they are under no obligations to any association, and so that no association would have any undue influence with them. Now, of course, there could be added to that a great many other things—add an auditor, a field superintendent; but you are adding more expense to it all the time. I thought by just starting out on a simple outline, and getting together, it would be better. Of course, we have talked so far only with reference to this county; if we take in the whole state, it would be quite a hard proposition to work out at the beginning. If we start in on this county and get this county organized, then the others could come in later. Now, I believe we have been making very good headway. The members who have been attending these meetings all seem to be favorable, and we were in hopes that it would be threshed out at this meeting with regard to the best method of the selling agency—how much of the responsibility we want to put on the selling agency. I hope to hear from every source and have this thoroughly threshed out. I believe that is all I have to say at this time. I thank you. (Applause.)

Professor Taylor: Are there any further remarks? We want a full discussion of this. It is what we have all been talking about; it is the keynote of the whole meeting—the proposition of the improvements for the distribution of the selling of our fruit; and here, with a representative gathering, not only of Grand Valley growers, but of other growers from all parts of the state, it seems as though we ought to have a full discussion of it.

A Voice: Mr. Fletcher.

Professor Taylor: Mr. W. C. Fletcher, of Loveland, is called upon for his opinion on it.

Mr. Fletcher: Mr. Chairman, I hardly think it advisable for me to say anything upon this question, but my own opinion is that we have got to have some kind of an organization that will prevent the interfering of one salesman with another. You will remember that I mentioned the fact of so many cars, all upon the same track, in a little town down in Texas, because there was no central thought, no central management, and therefore those cars were put there in competition. Now, if the state itself had been thoroughly organized, that condition never would have materialized, and you never would have had that difficulty. That incident may not have influenced or may not have had any effect upon you, but it had its effect upon the general market of the state; and it seems to me that



the proposition you have outlined, both in the papers and by Mr. Johnson and others, is the proposition that you have got to thresh out, and I believe, when it is threshed out, you will have come to some point where everybody's apples should be sold, and other fruit should be sold through systematic co-operation, and congestion will be avoided. (Applause.)

A Voice: Howard Fletcher.

Professor Taylor; Mr. Howard Fletcher is called for.

Mr. Howard Fletcher: Mr. Chairman, Ladies and Gentlemen: I am heartily in sympathy and in favor of any proposition that will be for the betterment or advancement of the fruit-growers. I don't know that there is anyone who realizes more than I do the necessity of eliminating a certain amount of competition that is in existence today. Before going into this matter, I should like to add a supplement to Mr. Hawkins' paper, and, instead of making it a crime alone for the commission man to accept commissions, and also to remit less than he received for the fruit, I should like to see it made a crime for anybody to make any consignments. I don't think it is necessary; I think it is wrong. (Applause.) It may be possible, under that condition, that there would be some fruit, or some stuff that is called fruit, that could not be put on the market; but there is no reason under the sun for anybody consigning salable fruit. This proposition of a central marketing agency is a matter under discussion in every fruit-growing district of the United States and Canada. In the Northwest, where they have been holding their annual apple show, as I believe they call it, they have gone into this matter very extensively; they have set aside a whole day, and they have some of the greatest marketing talent of the world discussing it. It is of vital importance, not only to the Grand Valley, but to every other district where fruit is raised. There are possibly a great many changes to be made along this line, but the greatest change, and the change which makes it almost necessary to pursue something of this kind, is the elimination of the competition among the growers. Just as Mr. Turpin said, there are fruit-growers in the Grand Valley who compete among themselves with their own shipments. They take part of the fruit to one association, and another part to the other, and, before they know it, the dealers and the markets are competing with this identical fruit which belongs to the same man. Those conditions are wrong. I don't know that anyone has worked out all the details of a proposition of this kind; but there has been one marketing agency, similar to what you have been talking about, in operation in the State of Utah, and I understand they have made a failure of it. About eleven associations have been combined over there in this one marketing agency, and, while I have not that information direct, yet from the records that I have seen, and also from the operations that I have noticed during the past year, I don't see how they could do otherwise than fail. But that is no reason for anyone condemning the proposition. Why was it that fruit-growers organized associations in the first place? It was for the purpose of bettering their conditions. Now, why not eliminate those associations and form your marketing agency, or some scheme whereby these different associations and their operations can be amalgamated? I have not had an opportunity to study out this problem nearly as much as I should like, but I think there is something to it. I think that, especially in the Grand Valley, where we are so closely allied together, this matter could be worked out to advantage. As to Mr. Cline's suggestion with regard to the using of the machinery of the California Fruit Growers' Exchange, I want to say that the majority of the growers in Delta County, from which I believe he comes, have been using that machinery already for the past several years. Mr. Garvin, who, I understand, markets or sells the fruit of a number of associations, markets practically all of it through the agency of the California Fruit Exchange. I don't think it is practical. Those people are citrus people; it is a different line entirely. They are paid by their principals, or their employers, to handle citrus fruit,

and if you put out your line of fruit with them, I think it is likely that a good many will "lie down." In fact, I have seen it demonstrated. I think it was Mr. Cline also who made the statement with regard to the number of cars that are rushed to Omaha or some other markets. That statement is absolutely correct. Two years ago, when I was in Omaha, there were as high as 250 to 350 carloads of apples a day on the Omaha market—not on the market, but on the sidetracks. Of course, a great many of these were diverted. This year in the City of New York there were as high as 115 carloads a day that came to a certain pier; and, in addition to that, there were from fifty to seventy-five cars that could not be brought over on the lighters. Now, that is a condition that not a market in the world, even New York City, can stand up under; it is bound to break. We have been talking this over, as Mr. Johnson said, with some representatives of the associations in the Grand Valley. Mr. Moore, former manager of the association, and myself have for five years tried to do our best to influence the people in Delta and Montrose Counties in something of this nature. We were unable to get any satisfaction from our friends, but it seems now that they are coming to it, and I believe that the time will come when these associations will have their fruit sold under one head. I thank you. (Applause.)

Mr. Turpin: Mr. Fletcher, you made the statement that you did not think consignment is necessary. I should like to know if you could give us some figures as to the amount of fruit you have consigned this year. I have heard the statement made that you had consigned a good deal of fruit.

Mr. Fletcher: On the apple deal, I presume we have consigned between ten and fifteen carloads. One car we placed at auction. The majority of those cars were of unsalable fruit; the majority of those were marked-down standards. If you know what that is, you have got me beat. (Laughter.) In one market in the United States this year we were unable to sell as many cars as I wanted to sell, and of a quality that I wanted the market to have. It is a market where we worked up an extensive trade on our fruits. This year the conditions were such, through shippers taking advantage of the consignment proposition, that it was the only way we could interest our customer at all, by consigning him some fruit. We did consign between five and six cars of fruit that could be sold, but the balance of the cars we consigned were unsalable. Does that answer your question?

Professor Taylor: What were some of the weak points of the Utah organization responsible, in your opinion, for their failure?

Mr. Fletcher: Well, I have asked for information, to get it first-hand, along that line, and I have not received it. My own idea might be absolutely unfair. I would rather not make the statement.

A Voice: How many cars of apples have been shipped out from Grand Junction by the Fruit Growers' Association?

Mr. Fletcher: About 1,200 cars.

A Voice: And you consigned about twelve or fifteen?

Mr. Fletcher: About twenty-five, I think I said.

Professor Taylor: We have had some ideas that are excellent suggestions, and we don't want to pass up this subject yet for a while. We ought to discuss it thoroughly.

A Voice: Let us hear from Mr. Janes.

Professor Taylor: Mr. Janes is called for.

Mr. Janes: I have nothing to say at this time; I have nothing to say in favor of it yet. At the present time I see no reason why the people of Grand Junction should consolidate under one marketing agency, and until I can be shown where it is going to be a success from the view-point of the Grand Junction Fruit Growers' Association, I am not

in favor of going into it. The discussion at this time seems to be on the other side of the question.

Professor Taylor: That is just why we would like to hear from some people on the other side.

Mr. Janes: I don't believe that this is the proper place for me to tell what I think about it. (Applause.)

Voices: Janes! Janes!

Professor Taylor: Mr. Janes is again called for.

Mr. Janes: I don't know why I should be called to the platform to say anything at this time. I can't see why we of the Grand Junction Fruit Growers' Association, if you will excuse a personality, should consolidate with the other organizations in this valley at this time. As you know, I am one of the nine directors of the Grand Junction Fruit Growers' Association, and I am working at all times for the interests of our association, and for the interests of our growers. But, of course, I am open to conviction. If this is the proper thing, why, I want to know it. If we can better our condition by going together, I want to know that. But I can't see yet why there is any reason to do it, from our viewpoint. The Grand Junction Fruit Growers' Association controls practically all the fruit that is not sold directly to buyers, west of Bridges, in this valley. There is a lot in Palisade that is handled from three different associations, and I want you to show me why it is to our advantage to join with the other two smaller associations and form a central marketing agency, and put this proposition farther out of our own hands, and get farther away, and increase the expense of marketing the fruit. What I want to know is where I am going to get off myself. I am not so much interested in the other fellow just at the present time. For several years past we have assembled at some place in this city, and have held meetings, and every time it has been for the increase of the production and the marketing of the fruit, and for the increase in prices; and I want to know now where we are going to get off ourselves, before we go any farther and help to lift up some other organizations that, we think, are able to take care of themselves. I thank you.

A Voice: Mr. Orr.

Professor Taylor: I know that Mr. Orr has raised some fruit in the last year, and we ought to hear from him.

Mr. Orr: I will stand here just a minute and will give you my viewpoint. I am not a speaker, but I want to say this, that this matter has been hanging on for a number of years, and the only objection I can see to its being adopted right here and now is, that I don't think this valley has starved quite long enough to come into it; the people are not hungry enough yet. When they have starved long enough, they will be for it (Applause.)

A Voice: I should like to ask Mr. Orr if he didn't form some organization of this kind some eight or ten years ago at Fruita—didn't form a western-slope organization.

Mr. Orr: I think the matter was started, but I don't think it was carried to a determination.

Mr. Cline: Last spring Mr. Johnson, as he has already told you, came up to Paonia on this very question. We tried to start something last year, and we did start something that set everybody thinking. We came up there, we went to all the associations, and everybody we talked to was in favor of it—a western slope central exchange of some kind, and we went to two or three of the associations—there are only seven associations in our town—and they turned us down. I had a meeting called in Paonia. I got Mr. Johnson; and Mr. Port, of the Western Slope Association, was coming up to that meeting. The house was a good deal larger than this theater, but it couldn't hold the people that turned out from all over Delta County; and they were very enthusiastic. We appointed a commit-

tee there, and there it died. I said then: "They have got to have another knock. You have got one coming to you in one more round." This year they got it. Now I think everyone in Delta County will go into it, for they did get a good bump this season. I believe I can organize the Delta County Association in thirty days to come into this selling agency with Mesa County under one head. Let us maintain an association; we need it; we have to have it—up to the point, as Mr. Johnson said, where the car was loaded; and then forget it after that. Organize, and you will stop this running into one another's market. Delta County and Montrose County are cutting their own throats, and the best salesman on earth could not handle it unless he had it all. Someone spoke about Mr. Garvin. He does sell a small percentage of the fruit of the North Fork through the California Exchange; but what can the California Exchange do through a few hundred cars, any more than one of these associations can, because you are all running into his market and cutting one another's throat? I hate to see this thing fall down, and I don't want to see it fall down. California is evidence of what can be done. They have brought one hundred associations in there, and they have brought up the price of land, too. A few years ago land went down 200 per cent; it crawled back up, and their land is worth something down there now in the fruit district. Our land will also advance, when results will justify it. There was a committee on resolutions appointed last night, and they have prepared some resolutions along this line, which I want to see adopted by this convention.

Professor Taylor: The objection to the increase in expense has been spoken of. What items of expense might this bring up?

Mr. Cline: I think it will be a saving. I don't see where the expense will come in. There are about fifty shipping companies on the western slope today that get these telegrams from all over the United States every morning, and they expend from \$500 to \$1,500 a year for this service. The one house or selling agency would be all that it would be necessary to telegraph; and this one house could be telephoned from the central exchange. Every one of these houses keeps a salesman, a manager, several employes, and a high-salaried bookkeeper. That could be dispensed with. I can't see where the expense comes in; it looks to me more like a saving. I am not a shipper; I am a grower; I never had anything to do with actual shipping; but I have watched it for a long time, and it seems to me that the central agency would save money and take a whole lot of work off the hands of the different associations.

Mr. Janes: I should like to ask Mr. Cline one question, with his permission: How many fruit-growers' associations and fruit companies are there doing business in Delta County at this time?

Mr. Cline: Twelve or fifteen; I can't tell you exactly. Not associations, all of them; some of them are corporations.

Mr. Janes: I asked, fruit companies or associations.

Mr. Cline: Yes, we have about fifteen fruit corporations and associations.

Mr. Johnson: I should like to talk a little about the expense of this proposition. Some of you seem to have an idea that this is going to be a great addition, an additional expense. I have not been figuring that way at all; I have been figuring that as a saving. To start with, this board of control—I don't see why they should get any more pay. We give five dollars for every meeting of the directors in our association, and we have one regular meeting a month, and twelve months in a year is sixty dollars. I don't see that it would cost any more for a meeting of the selling agency. After the organization is formed, and after they have decided on the principles and methods, they do not need to get together very often, and I think five dollars for each meeting would be plenty. Now, in regard to the matter of salesmen: Of course, we want the best salesman we can get; he should be an expert, and we should expect to pay him a good salary. Then, if the selling was done through a central agency, we

should not need a \$5,000-a-year manager; all we should need would be a superintendent or foreman, or whatever you would want to call him. A \$150-a-month man would be all right for that job, and we could save on salaries of managers. A very important position according to this selling agency plan would be that of traffic manager. Each of us has a traffic manager, and they are high-priced men. We can have one good one in a selling agency, and cut the others out altogether in the association. Well, there is a considerable cutting-down of expense. With each manager trying to sell, he has to have a stenographer, and they are about \$100 a month. Nearly all of these men have some correspondence. Take our association this season; we had three stenographers; whereas, under the other plan, we shall need but one. So we are cutting out two stenographers at \$100 a month, or \$2,400 a year on this item alone. That is another place we cut out, and it is not altogether in the cut-out. By eliminating the competition and distributing our stuff, we ought to get more money. But supposing even that this agency made it cost a little more—suppose it cost us two cents a box more, and we realized three cents a box more, we are ahead of the game, aren't we? That is the way it looks to me. I don't see how anyone can figure out it will cost us more to have the one selling agency to do all the selling, than to have twelve or fifteen selling agents on the western slope. I think that is a mistaken idea, that the selling agency is going to cost us more. I know the expense can be made less.

Mr. Janes: Let me correct Mr. Johnson right there. All the talk up to the present time has been the consolidation of the associations doing business in Mesa County. That was what I had reference to, and not taking in the whole of the western slope.

Mr. Johnson: Of course, we have been talking Mesa County, because it was too big a job to undertake to organize the whole western slope, or the whole state, at the outset. We tried that last spring, and it was too big a job. But even taking our County, you are cutting out some. Now, the labels, and the brands we are using, we will carry on just the same. Each organization has its own label, that is copyrighted; that is advertising, and that is all right. You don't lose that. We are not asking you to adopt a general label. Each association will use the same label it is using now, and you don't lose your identity. If each association wants to put up a neater package than it is doing now, or a new label, or to improve its label, it has the privilege of doing that. That has nothing to do with the selling agency. The selling agency is just to sell the stuff, and to handle the funds when they come back.

A Voice: Is it your idea that the package would be uniform?

Mr. Johnson: Yes, sir; the board of control would have the authority to make the crates in the package. In other words, we should have uniform crates. We have to have that, if one man is to do the selling. Now, we have looked into it pretty carefully. It would be a saving, instead of increasing the expense of the grower. Mr. Cline was speaking about the telegrams costing the association \$1,500. I think ours last year cost us more than twice that amount. But there are at least two of those services that can be cut out, and the telephone service can be cut out; we don't need much of that if we do the selling through the selling agency. That is certainly a saving of some expense there. Now, with regard to the three associations in this county. You have some people here who have an idea in their heads that one association is a little stronger, and they wanted to "do" the other association. The smaller associations were not able to cope with the larger association; and what effect did that have upon the grower? Every time one of those associations went to the wall, land went down \$25 an acre. It has been doing that ever since the associations have been dying. If you want to kill the associations, it will kill the price of your land. These associations should be kept alive and encouraged to get together, to do business together. Now, it may be my neighbor whose apples are in one of the other associations, and why should I want to do something in my association to the detriment of the other

association, when some of its members are my neighbors? If we can do our own association some good and help the other association, I think it is up to us to do it. (Applause.)

A Voice: There is a question or two that has come up in my mind. If a central agency, through which all of our fruit in the different associations might go, is a good thing, thus eliminating the expense to some extent, as Mr. Johnson has pointed out to us, why, then, would it not be better for us all to go together in one large association, and let our fruit all go through the one association at each shipping station in the county? Why could we not eliminate a still larger amount of expense in the different set of men that we have in these different associations, by putting it all into one? I understand that for years the manager of one of our associations has been working to that end, to put in some more of these empty buildings that have been mentioned. Instead of having this real estate that is tied up, and necessarily must be, in these different associations, why do we need the identity of these different associations? Now, our fruit all goes through the one selling agency under this plan, or goes through the same process, no matter what association you take; it all goes through the same channel to its destiny—to the place where it is sold. There is no material difference where I market it. Then, why not eliminate these other associations, and do away with the taxes and other details of expense that are necessary in the running of these different associations?

Mr. Berger: I want to enlarge upon one side of the subject that Mr. Orr hinted at. It is easy to see, because there is absolutely no argument on paper or by the voice against the enlargement of the selling agency that has been proposed here. There is just one interrogation point in my mind as to why it would not work, and that is the one advanced by Mr. Orr; and that is, I don't believe the people of the western slope are hungry enough yet for it. Now, my connection with the association for the last four years—I said that I had not grown any fruit or marketed any—has been confined to one meeting a year, and that is the annual meeting of the Grand Junction Fruit Growers' Association. My experience and observation from attendance at those meetings is that we are not nearly hungry enough yet. The objections and the forces that impel toward disintegration, which appear there every year, I don't believe are operative yet. They grow out of the ignorance and the jealousy in the hearts of the people; and they will continue to dominate their actions until they do get hungry enough. I don't know how long that will continue, but I do know that the reason we have three associations here is simply because people act upon misinformation and not upon information, and because they base their actions upon their feelings as to what ought to be, rather than what is. If they are not getting enough for their fruit, somebody is to blame for it; not themselves. We never suspect that we are to blame for anything that happens. If we get down to the scientific basis of the cost of marketing, so that all would know what they ought to have, the condition of the market, what the other fellow is getting and what he has got, then, if we all know those things and drowned the suspicion and jealousy existing within us, there would be absolutely no trouble. There will be the same trouble in carrying out this plan that there is in keeping the people together in one association in the Grand Valley. I have been connected with the one association since I came here, and I will say, as I did last spring, that there is no one who can lay his finger upon a piece of information that would justify having three associations here, excepting jealousy. In other words, the conditions of the human heart are such that they will form a dozen associations until, by the slow process of education, the people act upon information rather than suspicion. Until they do this, we shall never be able to build up a structure that will endure. It is not the theory of how we shall get together; it is the condition of the human animal in his animalism; and how shall we eliminate that? I can form an organization on paper that, with ideal beings, will work

anywhere; but until we can educate our people to build up with efficiency and integrity that is sure of itself, co-operation is absolutely impossible. I believe it is the goal toward which we are working; but it must be built by a slow process, and it must be built upon the hunger of the human heart. It seems to me that this is the only side of the question that is keeping us apart, and it ought to receive much consideration in the deliberation of this question. (Applause.)

Mr. Hawkins: I have listened with a great deal of pleasure to the remarks pro and con here, and the whole thing simmers itself down to this: Will you growers name the price, or will the other fellow name it? (Applause.)

Professor Bennett: There is a man down east whom it would be well for you to send for to take part in this discussion. He is the man who has perfected just such an organization as we are seeking to form here. His name is John D. Rockefeller. (Applause.) Now, that is not a joke. If the Standard Oil Company can control competition and eliminate it, I don't see why the fruit-growers cannot do it. If the International Harvester Company can get together for its own benefit and eliminate competition, why not the fruit-growers? It is a matter of jealousy, as has just been stated. Now, we have here on the western slope something like twenty or thirty, fruit-selling agencies, and they are more or less in the class of commission houses; they compete with each other about the same as the commission houses. I believe we have got to get together, not by the starvation of our hearts, but by the starvation of our stomachs; get together and fight these things that are keeping the producer and consumer apart. It seems to me that with two things—one, legislation against the dishonest commission man, and the other, organization and getting together—we can all get together in one body. We have heard a lot of talk this afternoon, and I believe, if we appoint a committee to handle this business, to take care of legislation and to get these different organizations together, we shall accomplish the things which we all know must be done sooner or later, or go to the wall. I thank you. (Applause.)

Mr. Rice: I was just thinking that, if hunger was to be the major part of this delay, the time is about here. I have not found any particular fruit-growers but what are pretty hungry, and if we are in doubt about the sentiment, not only of our county, but of the whole western slope—I don't know so much about the sentiment on the eastern slope—I think the time has just about arrived when we are ready for action. Reference has been made to the necessity for education, and made in such a way as to indicate that education has just begun. I want to point out to you the fact that it is now sixteen years since a company of us fruit-growers met in Delta and Montrose and discussed this very same question we are discussing today. To be sure, we had not the light of experience then that we have today, but the same essential questions were being discussed at those meetings that are being discussed here today; to-wit, the employment of human effort in the work of marketing our fruit. The work of education has been going on all these years. It has been an extensive education, but I remember a little motto from the time I was a schoolboy, that experience teaching is a dear school, but fools will learn in no other; and I wonder if we haven't passed through that experience. I believe, Mr. Chairman and gentlemen of this audience, that the time is ripe, it is here now, for us to take action; and if we need any more argument in order to establish this, we have the fact that our neighbors in the Northwest are just now taking this very action; and we have not measured our action very largely in the last few years by their action out there. Three years ago, at the apple show in Denver, we came in competition with those people in the Northwest, and we realized we were up against a live wire. They have been teaching us some things from that time until the present, and this last action of theirs has

been the last lesson they have taught us, and that is the lesson of the absolute necessity of the union of effort—the united effort on the part of the fruit-growers. The time is here, and if anybody doubts whether our people have so far learned a lesson, and that they are ready for action, just put it to a vote at this moment, and I venture to say that there will not be half a dozen dissenting votes. The time is ripe; it is bound to come in the end; and although we may not be able to take action today, as a people we are ready to act and to take any forward step in this great forward movement. There is no reason under the sun why for the last fifteen years we should not have been united. We are of the same region, and possessed of the same natural advantages, and it is our duty, and there is no reason why we should destroy ourselves and commit commercial suicide by standing apart and regarding ourselves as rivals, rather than as copartners in this great work. (Applause.)

Professor Taylor: Yesterday a Resolutions Committee was appointed, and it occurs to me that this Resolutions Committee may have something in its report bearing upon the topic under discussion. I therefore ask if it is not the time for this report from the Resolutions Committee

A Voice: Report.

Professor Taylor: The report is called for. Mr. Johnson is the chairman, and if he is able to make the report at this time, I think it is time for it.

Mr. Johnson: Mr. Chairman, and Ladies and Gentlemen: Perhaps we had better act on one resolution at a time, so I will read the first one.

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#### REPORT OF RESOLUTIONS COMMITTEE

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WHEREAS, At the last session of the General Assembly an appropriation of \$20,000 was made to the State Board of Horticulture and Agriculture for the payments of premiums for exhibits and expenses in the Department of Agriculture and Horticulture at the Colorado State Fair at Pueblo for the years 1911 and 1912; and

WHEREAS, The revenues of this state being insufficient to pay this appropriation, the premiums awarded during these two years remain unpaid; therefore be it

*Resolved*, That we recommend to the incoming Assembly that a bill be introduced and passed to liquidate this obligation.

Mr. Johnson (continuing): I move the adoption of this resolution.

Mr. Mauff: I second the motion.

Professor Taylor: Motion has been made and seconded that this resolution be adopted. Are there any remarks?

A Voice: Question.

Professor Taylor: All in favor of the resolution as read signify by saying "Aye;" those opposed, "No."

Professor Taylor: There being no dissent, the resolution is unanimously adopted.

Mr. Johnson: I will now read the next resolution

WHEREAS, The fruit-growers of Colorado, through lack of organization, are not receiving a proper return for their fruit products; therefore be it

*Resolved*, That it is the sense of this body, consisting of the State Board of Horticulture, the Horticultural Society, and the fruit-growers of the state, in convention assembled, that an organization of the associations and corporations engaged in the handling of fruit form a central



organization for the judicious distribution and control of the sale of fruit products of this state, to the end that better profits to the grower be realized; and we further recommend that a committee, consisting of E. P. Taylor, of Garfield County; Ira B. Cline, of Delta County, and R. E. Turpin, of Mesa County, be appointed by this body, to appoint subcommittees in each of the fruit-growing counties, and to present through these subcommittees a tentative plan to the fruit-growers of this state to overcome this condition.

We further recommend that a committee on legislation be appointed, to attend to all legislation affecting horticultural and agricultural interests; and we further recommend that the following committee be appointed: C. C. Hawkins, of Delta County; Senator Tobin; George Weaver, of La Plata County; A. C. Newton, Mesa County; O. C. Skinner, of Montrose County, and Horace Mann, of Garfield County.

Mr. Johnson (continuing): I move the adoption of the resolution.

Mr. Mauff: Second the motion.

Professor Taylor: It has been moved and seconded that this resolution be adopted. Are there any remarks?

Mr. Becker: I should like to ask one question of the legal fraternity: whether such an organization would be a combination in restraint of trade.

Professor Taylor: Can any of the legal talent give us any light on this subject? Are there any further remarks on this resolution as read by Mr. Johnson?

Mr. Green: I should like to say just a word: Organization and centralization is the tendency of the day. We have but to look about among us in any branch of industry, and we see this organization. It is the elimination of competition—an industrial evolution that must come about; and if efficiency is to be maintained, I don't see any reason why we fruit-growers should lag behind the rest. We must get together and eliminate this unnecessary expense, if we are to succeed. I hope we may all vote for this resolution.

Professor Taylor: Any further remarks? If not, all in favor of the resolution, as read last by the chairman of the Resolutions Committee, say "Aye;" those opposed, "No."

Professor Taylor: The resolution is adopted.

Professor Taylor: We are not only fortunate in having as representatives in our legislature men who are intimately acquainted with our needs, but we have at the Agricultural Station at Fort Collins a man thoroughly familiar with the needs of the fruit-growers of the state. Professor Gillette, the director of the station, is here, and we will call upon him at this time to give us the closing number on the program, an illustrated lecture on "Mendel's Laws in Relation to Plant Development."

Professor C. P. Gillette thereupon gave a very interesting talk on this subject, which cannot, on account of its illustrative nature, be put in print in a manner that could bring out its very interesting and educational points.

Professor Taylor: Senator Crowley, as chairman of this convention, will now take the chair.

Senator Crowley: Ladies and Gentlemen: This meeting was held here in Grand Junction at your invitation of a year ago at our last convention at Canon City. We came at your invitation, and have been at your service. We appreciate the men from the college. If we have done you any good, we are glad of it. We have enjoyed coming to see you; we are glad to meet the intelligent faces and the good class of people we have met here. We see that you people appear to be "on the job" and

have opinions of your own, and I am glad to see you are able to express them.

We have now finished our program; and I will say, in conclusion, that the intent of the Horticultural Society was to come to this valley this fall and ask each one of you for a box of apples, and for that box of apples we would give you a membership in the society; but it didn't seem to be the opportune time to ask you to do that, and so we forego asking it. We should, however, like to have every grower in the State of Colorado a member of the State Horticultural Society. We have the state society to back the State Board of Horticulture; and we want all the fruit-growers to be united, and to boost for Colorado.

Now, I thank you for your attention, and for your good attendance; and we hope this convention has been a pleasure and source of education, to you, and that you will profit by the experience gained through the discussions we have had. I thank you. (Applause.)

The convention will stand adjourned.

# Reports of County Horticultural Inspectors

## BOULDER COUNTY

T. B. HOLMAN, INSPECTOR FOR BOULDER COUNTY

At present Boulder County contains about 750 acres of fruit-bearing orchards and about seventy-five acres of non-fruit-bearing orchards. During the year 1912 there were ten acres planted.

Owing to the very unfavorable weather conditions in the fall of 1911, a very small crop of fruit was harvested in the year 1912.

The estimated number of cars of fruit produced in this county during the year was four, three of which were apples. The average price per box for fancy apples was \$1.50, and for choice \$1. Ben Davis, Wealthy, Yellow Transparent, Geniton, Wine Sap, and Rome Beauty were the varieties which produced the best crops. We produced one car of small fruits: strawberries, which sold for \$3 per crate; raspberries, for \$2.25, and blackberries, for \$2.40.

The codling-moth was quite prevalent, as was also the elm-tree leaf-roller.

Spraying was not thoroughly done, and no interest was manifested in smudging, owing to the poor crop.

We have one canning factory, for vegetables only, which is located at Longmont.

We have two fruit associations in Boulder County, viz.: the Boulder Fruit-Growers' Association, located at Boulder, and the Longmont Fruit-Growers' Association, located at Longmont.

The outlook for this year is very good, in spite of the fact that many orchards are in poor condition on account of the poor crop in 1912. However, if we have a favorable spring season, we are looking for good crops in all lines.

## DELTA COUNTY

L. T. ERNST, INSPECTOR FOR DELTA COUNTY

In Delta County there are 14,000 acres of orchards in bearing and about 18,000 acres not in bearing. During the year 1912 there were 2,000 acres planted.

We produced 1,850 cars of fruit, of which 1,500 were apples. The average price the fancy apples brought was \$1 per box, and choice 75 cents. The best crops were produced by Jonathan, Rome Beauty, Ben Davis, Gano, Greening, Black Ben, and Winter Banana. We also produced 350 cars of peaches, 50 cars of cherries, and five cars of small fruits. The average price of cherries was \$1.75 per crate; pears, \$1.10 per box, and plums, 60 cents per crate. Strawberries brought \$2, raspberries \$2.50, and blackberries \$2.50 per crate.

In several parts of the county we found the leaf-roller, but though it was not very prevalent, the growers are planning to fight it this spring.

Another pest appeared in the Paonia district, which I believe will cause the growers more trouble than any other pest this county has had to deal with. This is the rosy apple aphid. As they work on the fruit principally, and roll the leaves so that it is almost impossible to reach them with spray of any kind, it is difficult to overcome them. In one orchard this pest destroyed so many apples that it is safe to say that fifty cars of fruit were damaged.

The growers on a whole did unusually good work in spraying, and the fruit showed the results of this extra care. A good many growers used arsenite of zinc for the first time, with excellent results.

Delta County has two canning factories and two evaporating plants: the Austin Canning Factory, located at Austin; the Paonia Fruit Canning Company, located at Paonia; the Hotchkiss Evaporator, located at Hotchkiss, and the Paonia Evaporator Company, located at Paonia. We produced fifty cars of canned and evaporated fruit, and thirty cars of cider and vinegar.

We have twelve fruit associations in Delta County, viz.: Colorado Fruit-Growers' Association, Delta County Fruit-Growers' Association, Surface Creek Fruit-Growers' Association, Smith Glidden Fruit Company, Hotchkiss Fruit and Produce Company, Materns and Pierce Fruit Company, Earl Gibson Fruit Company, Nelson Brothers Fruit Company, North Fork Fruit-Growers' Association, Paonia Fruit Exchange Company, Union Fruit Company, Growers' Fruit Company, and the Gibson Lumber Company, which handles fruit in Delta, Paonia, and Hotchkiss.

Although the fruit crop was injured to some extent by the extreme cold in January, there are still enough buds uninjured to make a fair crop. At the present time the orchards are in fine condition.

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## DENVER COUNTY

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G. A. KLAIBER, INSPECTOR FOR DENVER COUNTY

There are about 100 acres of fruit-bearing orchards in this county. During the year 1912 Ben Davis, Snow, and Rambo produced the best crop. The fancy apples sold for \$1.75 per box, and the choice for \$1.25. Plums sold for \$1 per crate, strawberries for \$2, raspberries for \$2, and blackberries for \$2.50. The fruit produced in this county is sold at retail on the local market.

Owing to frequent rains during the spring and summer months, spraying was not done as it would have been if the season had been a normal one. However, spraying was done when the weather would permit. Experiments were made, in co-operation with the State Entomologist at Fort Collins, in various sections of the city and county, and also in the parks. Experiments were made with lime sulphur mixture, and also with the oil called scalecide, for the destruction of the cottony maple scale and the oyster shell scale. The oyster shell scale is confined to a very few locations in the county. However, the cottony maple scale is found in nearly all sections. The locust borer has perhaps done more damage than any other pest and is found all over the county. The use of carbon bisulphide and kerosene emulsion has done a great deal of good to those trees that are yet alive. The shade trees of Denver should have more water and cultivation for best results.

There are several canning factories in this county, among them the Kuner Pickle Company, Perkins & Epeneter Company, Baker Preserving Company, Orchard Products Company, and Jones & Jones Company. We also have a number of fruit associations: the Denver Fruit and Vegetable Growers' Association, and the Denver Vegetable Association.

The orchards and nurseries in this city and county are in splendid condition, and the outlook for crops in 1913 is very encouraging.

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### FREMONT COUNTY

A. S. TAYLOR, INSPECTOR FOR FREMONT COUNTY

Fremont County has 3,700 acres of bearing orchards and 5,000 acres of non-bearing orchards. During the year 1912 there were 250 acres of young orchards planted.

This county produced 325 cars of fruit last season, of which 300 were apples. The fancy apples sold for 90 cents, and the choice for 55 cents per box. The best producing varieties were the Ben Davis, Wine Sap, and Geniton. Peaches brought 85 cents per box, cherries \$2.50 per crate, pears \$1.75 per box, and plums 90 cents per crate. We produced twenty-five cars of small fruits. The strawberries sold for \$1.75 per crate, the raspberries for \$1.55, and the blackberries for \$2.25.

The apple-tree leaf-roller did a great deal of damage in this section this season, although spraying was thoroughly done. No smudging or heating was done, owing to the favorable spring.

We have one canning factory in this county, the Round Crest Canning Company, located at Canon City, which produced thirty cars of canned fruit this season. Twenty-one cars of vinegar and cider were also manufactured. We have four fruit associations in this county, viz.: the Fremont County Fruit Growers' Association, the Royal Gorge Fruit Growers' Association, the Round Crest Fruit Company, and the Gibson Fruit and Produce Company; all of which are located at Canon City.

Present conditions of our orchards are fine, and we look for a bumper crop this year.

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### LA PLATA COUNTY

P. S. TAYLOR, INSPECTOR FOR LA PLATA COUNTY

La Plata County has 1,800 acres of fruit-bearing orchards and 1,500 acres of non-fruit-bearing orchards. During the year 1912 there were 500 acres of young orchards planted.

We produced about forty-five cars of apples, the average price of the fancy being \$1.50 per box and of choice, \$1. The Gano, White Winter Permain, Wealthy, Wagner, Delicious, Ben Davis, and Rambo produced the best crops. The average price of cherries, per crate, was \$3.25; pears, per box, \$1.40; plums, per crate, \$1.25; strawberries, per crate, \$3.25; raspberries, per crate, \$3.50, and blackberries, per crate, \$4.

We have had trouble with such pests as green aphid, codling-moth, woolly aphid, brown mite, red spider, and black aphid.

On account of unfavorable conditions and a scarcity of cash, fruit-growing has been neglected considerably during the last two seasons. The orchards are in splendid condition now, however, and the prospects for a good fruit crop this year are excellent.

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### MESA COUNTY

GEORGE M. LIST, INSPECTOR FOR MESA COUNTY

Mesa County has at the present time 7,611 acres of orchards in bearing and 16,892 acres of orchards not in bearing.

Mesa County produced during the year 1912 about 4,000 cars of fruit, of which 2,400 were apples and 340 pears, the balance being mixed fruits. The varieties of apples producing the best crop were the Ben Davis, Gano, Wine Sap, Rome Beauty, Jonathan, and Black Twig. The extra-fancy apples sold for about \$1 per box, and the fancy for from 65 cents to 85 cents per box. We produced 1,250 cars of peaches, which brought unsatisfactory prices. Pears were sold for \$1 and \$1.25 per box, and plums for 50 and 75 cents per crate. Strawberries brought from \$2 to \$2.25 per crate.

As is usually the case here, the codling-moth has been our worst insect pest; but, probably due to the short season and the more thorough spraying by the orchardists, it did not do so much damage as in previous years. The orchardists are beginning to realize more and more that this is a very destructive pest, and are putting on more spray and doing more thorough work, as well as getting more and better machinery for its application. The green peach aphid and green apple aphid were quite prevalent in some sections, and their eggs are abundant at this time.

Smudging was not practiced to any great extent last spring. A very small per cent prepared for the work, but they were not called upon to light their pots.

We have three canning factories in this county: the Curry Canning Company, located at Grand Junction; the Fruita Canning and Preserving Company, located at Fruita, and the Loma Canning and Preserving Company, located at Loma. These produced five cars of canned fruit. We also manufactured about forty-eight cars of vinegar and cider. We have three fruit-growing associations in this county: the Grand Junction Fruit-Growers' Association, with branches at Palisade, Clifton, and Fruita; the Western Slope Fruit-Growers' Association, located at Palisade, and the Palisade Fruit-Growers' Association, located at Palisade.

The layer pack has been used exclusively this season and has proved very satisfactory. This improvement seems to have stimulated the growers to put up a more honest pack. A better and more uniform pack than this has never been put out.

We have had some very cold weather this winter, and there is some doubt as to how the peaches, cherries, and apricots will come out; but at the present time it seems that a very large per cent of the buds of these are killed. Some of the bearing apple trees have their trunks split from the excessive freezing, but not to such an extent as to do permanent damage. Otherwise they are in fine condition for a good crop, considering the heavy crop they bore last season.

Many orchardists are beginning to grow shade and cover crops, especially in the apple orchards, thereby not only cutting their running expenses, but adding much to the fertility and humus to the soil. All of our arid soil is lacking in humus, and the orchards that are having it supplied by these cover crops are showing results that will soon convince all the growers that this is the method to practice.

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## MONTEZUMA COUNTY

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J. M. KINSLEY, INSPECTOR FOR MONTEZUMA COUNTY

There are 300 acres of orchards in bearing and 800 acres not in bearing, at the present time, in Montezuma County.

This county produced sixty cars of fruit during 1912, fifty of which were apples. The average price for apples was \$1 for fancy and 65 cents for choice. The Rome Beauty, Jonathan, N. W. Greening, and W. W. Permain produced the best crops. We produced five cars of peaches, which sold for 50 cents per box; also three cars of cherries, which brought \$2.25

per crate. We had no pears, strawberries, raspberries, or blackberries. Plums were sold at the rate of 2 cents per pound.

Smudging was not done last season. Spraying was done to some extent on account of the prevalence of the codling-moth. There was considerable green apple aphid, and the crop of one orchard, located in the McElmo Canon, away from the other orchard sections, was destroyed by leaf-roller.

At the present time the orchards are in very good condition, in spite of the low temperature of January. Conditions in general are good.

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## MONTROSE COUNTY

HON. T. W. MONELL, MONTROSE, COLORADO

We have 3,643 acres of orchards in bearing and 2,200 acres not in bearing in Montrose County. During the year 1912 there were 1,000 acres planted.

The estimated number of cars of fruit produced was 800, and of these 794 were apples. The average price of apples was \$1.05 per box for fancy and 65 cents for choice. Ben Davis, Jonathan, and Gano produced the best crops. We produced six cars of peaches, which sold for 40 cents per box. We had only a few cherries, which sold for 5 cents per pound; pears, 3 cents per pound, and plums, 2 cents per pound. Strawberries brought \$2.25 per crate; raspberries, \$4, and blackberries, \$3.50.

We were bothered with green aphid and codling-moth, and spraying was thoroughly done wherever these were prevalent. Smudging was done in some localities, but not to any great extent.

We manufactured five cars of cider and vinegar last year.

There are five fruit associations in this county: the Montrose Fruit and Produce Company, Robert Halley, R. L. Townsend, Long Brothers, and the Gibson Fruit and Produce Company; all of which are located at Montrose.

The fruit trees are in fine condition, and a good crop is looked for. The peaches may be affected to some extent by the freeze of January, but we are hoping that they will turn out all right.

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## OTERO COUNTY

E. N. BERRY, INSPECTOR FOR OTERO COUNTY

In Otero County we have about 2,000 acres of orchards in bearing and 875 acres not in bearing. During the year 1912, 612 acres of orchards were planted.

Owing to the very unfavorable weather conditions in the winter of 1911-1912, very little fruit was produced in Otero County the past season. The fancy apples sold for \$1.25 per box, and the choice for \$1. The Ben Davis produced the best crop. We produced about 1,000 baskets of peaches, which sold for \$1 per basket. We had very few plums, and no small fruits to speak of.

There was very little spraying done in the county this season, as there was very little fruit, owing to the unfavorable weather conditions in the fall of 1911.

There are three canning factories in this county—one located at Fowler, one at Manzanola, and one at Rocky Ford. We also have one fruit

association—the Manzanola Fruit-Growers' Association, located at Manzanola.

With the exception of peaches, which were killed by the freeze of January, the orchards are in excellent condition, and the prospects for a good fruit crop for 1913 are fine.

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## PUEBLO COUNTY

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J. N. SALTER, INSPECTOR FOR PUEBLO COUNTY

In Pueblo County there are 2,400 acres of orchards in bearing and 3,450 acres not in bearing. During the year 1912 there were 350 acres planted in new orchards.

The estimated number of cars of fruit produced in this county for the year 1912 was about forty, twenty-three of these being apples. The fancy apples sold for \$1.25 per box, and the choice for 90 cents. The varieties producing best were the Wealthy, Ben Davis, and Wine Sap. We produced about 500 crates of cherries, which sold for \$3 per crate. Pears brought \$1.65 per box, and plums \$1.60 per crate. Strawberries sold for \$2.75 per crate, raspberries for \$3, and blackberries for \$2.75.

The leaf-roller did more damage to fruit than all other insects. We also were bothered with the codling-moth to some extent, and likewise with the woolly aphis and cherry slug. Spraying was used extensively in almost all orchards, but not with very gratifying results in the orchards where the leaf-roller was prevalent, as this requires a power spray pump and the orchardists used only the hand spray pumps. We expect to have power pumps next season, which will enable us to get the pest under control. Owing to an ideal spring, very little smudging was necessary.

We have two canning factories in this county: the Eloma Manufacturing Company, and the C. H. Green Canning Company, both located at Pueblo. Owing to the fact that Pueblo consumes a large quantity of our small fruits at good prices, the canning factories are unable to compete with our local market, except in seasons when we have a bumper crop.

The prospects for a good crop for 1913 are splendid, except in the case of the peaches, which, I fear, have been severely damaged by the recent freeze. The prospects for a good acreage being planted this year are also very good, as one land company expects to plant about 500 acres.



FOURTH ANNUAL REPORT

OF THE

State Entomologist  
OF COLORADO

For the Year 1912



C. P. GILLETTE, State Entomologist  
FORT COLLINS, COLORADO

BOULDER. COLORADO.

OFFICERS

CLARENCE P. GILLETTE, State Entomologist.

GEORGE P. WELDON, Deputy State Entomologist.

WESLEY FOSTER, Deputy Bee Inspector.

W. L. BURNETT, Deputy, Rodent Investigations.

# Fourth Annual Report of the State Entomologist

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C. P. GILLETTE, STATE ENTOMOLOGIST; GEORGE P. WELDON, DEPUTY

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## ORCHARD, NURSERY, AND NURSERY-STOCK INSPECTION DURING 1912

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County horticultural inspectors have been at work in each of the following-named counties the past season: Boulder, Crowley, Delta, Denver, El Paso, Fremont, Garfield, Huerfano, La Plata, Larimer, Mesa, Montezuma, Montrose, Otero and Pueblo.

In most cases men have been hired for only a short time during the season. Their principal work has been that of inspecting the nursery stock shipped into their respective counties in the spring. The work is not considered of enough importance by the county commissioners in several of the counties to justify the expenditure of much money for its maintenance. While there are counties where the expenditure of a considerable sum of money would not be practicable, it is equally true that too little money is appropriated in others, and instead of making it an object for a man trained in horticulture, or at least that phase of it which pertains to inspection work, to put forth his best efforts for success, a very small sum is set aside, which is not sufficient to encourage earnest endeavor. In some counties, where men should be hired and paid a salary by the year, the amount appropriated and the work done are so little as to make it scarcely worth while. The tables which follow in this report give a good idea of the amount of work that was done by the various inspectors the past year.

A very large number of trees infested with crown gall were condemned and destroyed, and a great many were also found to have San Jose scale and Putnam scale. Inspectors were notified to report to this office any case that they might find of shipments of fruit trees coming into the state without proper fumigation certificates. In some cases such shipments were fumigated in the county where received, and a bill for the work rendered to the nurseryman who failed to comply with our state horticultural law in making his shipment. It is hoped that another season will see practically no trees or shrubs delivered to nurserymen or private parties in the state without fumigation certificates indicating that such work has been done before shipping. In counties having no inspectors there has been no way to find out about the condition of shipments;

BOULDER. ILLINOIS

consequently those counties are usually made dumping-grounds by unreliable nurserymen for their undesirable stock.

The Colorado nurseryman is fumigating more and more as the years go by. We have a number of jobbers in nursery stock who grow practically no trees, and who require that everything shipped to them be fumigated previously; consequently, they are doing very little of this work themselves.

Certificates have been issued the past fall to the following nurseries:

Boulder County Nursery, Boulder.  
 J. G. Braun Nursery, Denver.  
 Broadview Nursery, Arvada.  
 Herbert Chase Nursery, Delta.  
 William Clark Nursery, Colorado Springs.  
 Colorado Nursery Company, Loveland.  
 Denver Nursery Company, Denver.  
 J. W. Dillon Nursery, Greeley.  
 Gutheil Park Nursery, Aurora.  
 Hall and Sons Nursery, Colorado Springs.  
 Ivywild Nursery, Colorado Springs.  
 International Nursery Company, Denver.  
 Patrick Lee & Sons, Colorado Springs.  
 Mapleton Nursery, Denver.  
 W. E. Milton Nursery, Durango.  
 Muhlenbrock Fruit Ranch, Arvada.  
 Northern Nursery Company, Denver.  
 Northern Colorado Nursery Company, Loveland.  
 W. C. Osborn, Fruita.  
 Park Floral Company, Denver.  
 Agnes Randberger Nursery, Lafayette.  
 Rockmont Nursery, Boulder.  
 G. A. Rodell, Pueblo.  
 Roselawn Cemetery Nursery, Pueblo.  
 Russell Bros, Nursery, Palisade.  
 Sutherland Nursery, Boulder.  
 T. H. Trimmer & Sons, Denver.  
 J. L. Turner, Eckert.  
 J. C. Vanderbeck, Paonia.  
 Wallace Creek Nursery, DeBeque.  
 Ward Nursery, Lafayette.  
 Lyle C. Waterbury, Denver.  
 Western Plains Forest Nursery, Arvada.  
 W. W. Wilmore, Denver.

There are possibly a half-dozen small nurseries that have not yet been visited this season.

The approximate number of fruit trees growing in nurseries of the state at the present time is 528,175, representing an area of about 120 acres.

The following are the more important insect pests found while the nursery-inspection work was being carried on:

Putnam scale, Howard scale, cottonwood and willow scale, San Jose scale, oyster-shell scale, and several species of Lecanium scales; barberry

aphis, dogwood aphis, woolly aphis of the elm, woolly aphis of the apple, green apple aphis, black cherry aphis, snowball aphis, plum aphis, and box-elder aphis; apple-tree leaf-roller, cherry slug, peach-borer, flea beetles, birch-borer, locust-borer, cottonwood leaf-miners, brown mite, red spider, pear vagabond mite; and many other species of lesser importance.

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.

TABLE 1—BOULDER COUNTY.

NURSERY	Apple	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Colorado Nursery Co.....	3,150	....	200	200	750	850	1,570	200	1,000	150	4,300	33
Gilbert Coslich .....	....	....	....	....	....	....	....	....	....	900	....	....
Davis County Nursery.....	250	....	....	....	....	....	....	....	....	....	250	6
Chas. Dietrich .....	....	....	....	....	....	....	....	....	....	5,950	....	....
Ellwanger and Barry.....	....	....	....	....	....	25	....	....	....	150	....	....
Galbraith Nursery .....	30	....	....	....	6	....	....	25	....	....	36	....
German Nursery .....	25	....	....	5	....	....	....	....	....	10	30	....
International Nursery Co.....	130	....	....	8	....	....	25	100	1,000	....	138	....
Jackson and Perkins.....	....	....	....	....	....	....	75	200	....	240	....	4
H. P. Kelsey.....	....	....	....	10	....	400	....	....	....	730	10	....
Maloney Bros. & Wells.....	10	1	1	800	500	....	....	....	....	350	1,312	4
Thos. Meehan & Sons.....	....	....	....	....	....	125	....	....	....	625	....	....
Milton Nursery .....	270	....	....	....	....	14	....	25	....	....	270	....
Mt. Arbor Nursery.....	1,680	....	100	375	1,580	1,000	795	150	....	480	3,735	10
Northern Colorado Nursery Co.....	943	6	20	314	1,030	769	300	....	600	....	2,313	72
Ohio Nursery Co.....	8	....	....	....	12	604	....	....	20	400	20	....
Peterson Nursery Co.....	....	....	....	....	....	3	....	....	....	40	....	....
J. H. Skinner.....	70	....	....	....	....	....	....	....	....	....	70	....
F. H. Stannard.....	100	....	....	30	100	....	145	....	....	....	290	2
Stark Brothers .....	40	....	....	....	....	....	....	....	....	....	40	2
Sheehan Nursery .....	130	10	5	....	300	40	....	20	....	20	445	....
Storrs and Harrison.....	300	....	110	40	....	30	1,100	400	1,200	1,675	450	25
Whiting Nursery Co.....	....	....	....	....	50	220	100	100	....	100	50	....
L. E. Williams.....	....	....	....	....	....	500	....	....	....	100	....	....
Total.....	7,136	17	436	1,782	4,388	4,580	4,110	1,220	3,820	11,920	13,759	158

BOULDER, COLORADO

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 2—HUERFANO AND CROWLEY COUNTIES.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Alabama Nursery Co.....	4,400	....	....	....	....	....	....	....	....	....	4,400	154
Mt. Arbor Nursery.....	793	....	42	232	17,496	586	350	138	....	29	18,563	129
Southern Nursery Co.....	500	....	....	....	565	....	....	....	....	....	705	12
Total .....	5,693	....	42	232	18,061	586	350	138	....	29	22,468	295

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 3—DELTA COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Herbert Chase Nursery.....	117,883	5,327	13,133	1,894	3,850	500	2,000	750	1,000	500	142,087	3,850
Colorado Nursery Co.....	355	10	6	10	5	....	....	....	....	....	286	5
Davis County Nursery.....	42,994	4,776	4,391	893	2,375	300	1,475	306	6,916	274	55,339	54
Gardener Nursery .....	10	....	....	2	5	....	....	4	12	32	17	1
German Nursery .....	191	188	2	4	49	....	....	....	....	....	344	106
Griesa Nursery .....	3,398	71	51	118	116	....	37	618	1,405	137	3,754	122
Guthell Park Nursery.....	....	....	....	....	....	31	....	....	....	29	....	....
Hall and Sons.....	180	6	7	....	10	....	7	14	....	....	203	6
Ince Nursery .....	60	2	4	1	3	....	....	....	....	....	70	....
International Nursery Co.....	427	1	1	1	....	....	100	4	33	....	430	6
Moutray and Shonaman.....	1,350	....	....	....	....	....	....	....	....	....	1,350	....
Mt. Arbor Nursery (Shenandoah)...	....	175	....	....	6	13	....	6	....	12	181	7
New Haven Nursery.....	171	3	....	2	10	....	....	....	....	....	186	2
Ottawa Star Nursery.....	....	....	....	....	....	....	250	....	....	....	....	....
V. A. Phillips.....	395	....	50	....	....	....	....	....	....	....	255	3
N. Pomeroy .....	....	....	....	....	....	11	....	....	....	....	....	....

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 3—DELTA COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Grape	Shade	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Russell Bros. ....	300	...	...	...	...	...	...	...	...	...	300	4
Sheerin Nurseries ....	60	...	...	...	...	...	...	...	...	...	60	3
Stark Bros. ....	1,699	13	15	14	15	...	12	60	125	50	1,756	15
L. R. Taylor & Sons.....	...	...	...	...	...	...	...	...	...	*152,000	...	...
Turner Bros. ....	2,500	...	...	...	...	...	...	...	...	...	2,500	17
Utah Nursery Co.....	9,045	764	133	53	377	25	74	74	800	50	10,372	130
Wallace Creek Nursery.....	3,513	174	356	126	362	96	232	248	4,371	36	4,531	43
Washington Nursery .....	425	...	...	17	33	30	12	24	80	4	475	1
F. Watson .....	...	...	...	...	...	...	...	...	...	1,750	...	...
Weincoupe .....	843	3	...	2	19	...	22	15	80	...	867	16
Winfield Nursery Co.....	51	4	12	4	3	...	2	...	...	...	74	1
Yakima Valley Nursery.....	10	...	...	...	...	...	...	...	...	...	10	...
Total .....	185,580	11,517	18,071	3,141	7,238	1,006	4,223	2,123	14,822	154,874	225,547	4,731

\*English Walnut Seedlings.

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 4—DENVER COUNTY

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Aurora Nursery .....	...	...	...	...	...	...	...	...	...	25	59	...
Benson Nursery .....	12	...	...	...	47	...	...	...	...	...	...	5
Arthur Biddington .....	...	...	...	...	...	...	...	...	...	15	...	...
Boulder County Nursery .....	...	...	...	...	...	...	...	...	...	195	...	...
Bryant Nursery .....	...	...	...	...	50	...	...	...	...	150	50	...
Colorado Nursery Co. ....	2,200	...	...	3,000	3,000	...	...	...	...	556	8,200	...
Danville Nursery .....	5	...	...	...	10	...	...	...	...	...	15	...
Davis County Nursery.....	43	...	...	...	288	...	...	...	...	...	331	...
Dingee and Conard .....	...	...	...	...	...	...	...	...	...	6	...	...
Henry Dreer .....	...	...	...	...	...	...	...	...	...	12	...	...
Galbraith Nursery .....	170	...	...	...	12	...	...	50	...	...	182	11
Gardner Nursery .....	5	...	...	...	15	...	...	...	...	10	20	7
Miscellaneous .....	7	...	...	7	81	12	...	...	2,000	59	95	...
Mt. Arbor Nursery .....	144	...	...	120	239	...	850	...	200	1,032	503	30
Northern Colorado Nursery Co.....	...	...	...	...	...	200	...	...	...	...	...	...
Ohio Nursery and Supply Co.....	...	...	...	...	...	...	...	...	...	200	...	...



TABLE 4—DENVER COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous,	Total Fruit Trees	Fruit Trees Condemned
Ottawa Star Nurseries .....	1,490	...	...	...	2,960	...	...	...	...	...	4,450	281
Geo. Reneberg .....	...	...	...	...	...	...	...	...	...	100	...	...
Rockmont Nursery .....	4	...	...	...	3	...	...	...	...	1,304	7	...
W. & T. Smith Co. ....	...	...	...	...	...	...	...	...	...	200	...	...
Stark Bros .....	18	...	...	...	...	...	12	...	...	...	18	...
Storrs & Harrison.....	...	...	...	...	...	...	...	...	...	200	...	...
Sutherland Nursery .....	...	...	...	...	...	...	...	...	...	700	...	...
Vaughan's Greenhouse .....	...	...	...	...	...	...	...	...	...	25	...	...
Watson Nursery Co. ....	6,600	...	...	...	...	...	...	...	...	...	6,600	318
Welsh Nursery .....	210	50	100	120	225	...	300	650	1,300	825	705	17
G. F. Wilcoxan .....	...	...	...	...	...	25	...	...	...	...	...	...
Willaden Nursery .....	...	...	...	...	...	...	...	...	...	245	...	...
Winfield Nursery Co. ....	...	...	...	...	6	...	...	...	50	...	6	...
<b>Total .....</b>	<b>10,908</b>	<b>50</b>	<b>100</b>	<b>3,247</b>	<b>6,936</b>	<b>237</b>	<b>1,162</b>	<b>700</b>	<b>3,550</b>	<b>5,859</b>	<b>21,241</b>	<b>669</b>

Besides the above, Mr. Klaiber, Inspector for Denver County, records 2 car loads of shade and ornamental trees, 8 bales miscellaneous, 41 boxes miscellaneous, 40 cases of Azaleas, and many bulbs. Azaleas and bulbs imported from Belgium, Holland, and France.

TABLE 5—EL PASO COUNTY

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
European importations .....	...	...	...	...	...	3,031	...	...	...	7,438	141	...
Gardner Nursery .....	20	...	2	25	94	56	16	41	36	830	...	...
<b>Total .....</b>	<b>20</b>	<b>...</b>	<b>2</b>	<b>25</b>	<b>94</b>	<b>3,087</b>	<b>16</b>	<b>41</b>	<b>36</b>	<b>8,268</b>	<b>141</b>	<b>...</b>

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 6—FREMONT COUNTY

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Alabama Nursery Co. ....	....	....	....	....	325	....	....	....	....	50	325	4
Arlington Nursery .....	100	15	25	55	177	....	....	....	....	....	372	10
Boulder County Nursery.....	73	3	15	6	291	....	515	425	100	40	388	1
Brown Bros. Nursery.....	203	25	7	36	257	....	75	10	36	30	528	8
California Nursery Co. ....	20	....	70	....	....	....	35	....	400	....	90	2
Chase Bros. Nursery Co .....	245	....	....	....	2,957	....	....	....	....	....	3,202	34
Colorado Nursery Co. ....	70	....	....	3	....	....	225	75	....	....	73	1
Davis County Nursery.....	200	....	....	....	....	....	....	....	....	....	200	2
Elkhorn Nursery .....	1,065	25	10	120	510	....	235	1,025	750	40	1,730	7
Fairburg Nursery .....	3	....	....	....	100	....	120	....	25	....	103	1
Galbraith Nursery .....	192	4	....	....	1,260	....	225	20	....	22	1,456	7
German Nursery .....	311	12	2	5	476	....	60	100	2,610	14	806	7
Ince Nursery .....	2,683	265	85	210	2,208	....	1,205	2,800	2,005	55	5,451	16
International Nursery Co. ....	270	....	....	16	151	....	....	400	2,000	2	437	32
William Kenley .....	7,815	....	....	....	....	10	....	....	....	....	7,815	1,282
Lees Summit Star Nursery.....	110	....	....	....	20	....	20	5,000	5,000	....	130	25
Miscellaneous .....	626	14	35	28	2,620	70	6,625	700	17,000	145	3,323	45
North Bend Nursery .....	400	30	100	....	....	....	....	....	....	....	530	13
Northern Nursery .....	445	....	....	....	155	5	....	200	500	....	600	2
Ottawa Star Nursery.....	200	....	....	....	....	....	....	....	....	....	200	95
Parker Bros. Nursery.....	5,425	40	....	20	525	....	....	....	....	....	6,010	52
Plumfield Nursery .....	7,442	....	....	6	6,651	....	....	35	180	....	14,099	51
C. F. Pressey Nursery.....	355	....	....	....	....	....	....	....	....	....	355	1
Sheerin's Wholesale Nursery .....	455	....	12	1	2,315	150	....	100	900	15	2,783	65
Shenandoah Nursery .....	90	....	....	....	20	....	....	....	....	....	110	5
Stark Bros. Nursery .....	9,910	512	63	72	2,468	122	730	3,440	3,495	260	13,025	103
Taylor and Son .....	11,110	....	....	....	10,300	....	....	....	....	25,000	21,410	280
Wallace Creek Nursery.....	35	....	12	....	....	....	....	....	....	....	47	....
Wichita Nursery .....	192	....	....	....	....	....	....	....	....	....	192	....
Willis Nursery .....	5,382	45	....	5	6,450	15	875	625	100	40	11,882	61
Winfield Nursery .....	1,170	....	....	10	361	....	....	....	25	1	1,541	10
Woodbine Nursery .....	....	....	....	....	....	....	....	2,300	....	....	....	....
Wragg Nursery .....	2,492	46	53	....	4,545	....	1,910	1,030	2,310	35	7,136	63
York Nursery .....	625	....	....	....	1,785	....	....	....	....	....	2,410	9
Total .....	50,714	1,036	489	593	46,927	372	12,855	18,285	37,436	25,749	108,759	2,294

BOULDER.

TABLE 7—LA PLATA COUNTY

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Condemned
Miscellaneous .....	35,745	2,015	105	760	1,410	350	1,150	2,015	1,400	2,850	40,035	207

TABLE 8—LARIMER COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Condemned
Arlington Nursery .....	155	....	50	....	800	250	100	50	....	50	1,005	23
Boulder County Nursery.....	256	....	....	28	156	105	8	91	12	16	410	....
Chase Bros. Nursery.....	....	....	....	....	800	....	....	....	....	....	800	....
Chase Nursery Co.....	500	....	500	....	....	....	....	....	....	....	1,000	....
Colorado Nursery Co.....	50	....	....	....	....	....	....	....	....	....	50	....
Crescent Nursery .....	500	....	....	250	....	1,000	....	....	....	....	750	2
Dillon Nursery .....	....	....	....	....	....	2	....	....	....	....	....	....
Donald Nursery .....	1,000	100	....	....	....	....	....	2,250	....	....	1,100	8
Eagle Nurseries .....	2	2	1	3	4	....	....	....	....	....	12	....
Easterly Nursery Co.....	....	200	....	....	2,650	....	....	....	....	....	2,850	1
Fields and Son.....	....	....	....	....	800	225	500	....	....	1,075	800	1
Forest Nursery .....	....	....	....	....	....	3	....	....	....	....	....	....
Fremont Nurseries .....	....	....	....	....	....	....	....	....	....	2,000	....	....
Galbraith Nursery Co.....	98	5	....	....	41	....	....	....	....	....	144	12
Gardener Nursery Co.....	30	....	....	6	10	10	....	2	20	....	46	....
German Nursery Co.....	170	6	....	50	75	2	....	100	....	2	301	3
Green's Nursery .....	230	....	4	20	804	....	1	578	2	64	1,058	4
Griesa Nursery Co.....	686	12	6	292	223	....	....	609	2,000	144	1,219	53
Harbaugh Nursery .....	....	....	....	....	....	....	....	....	10	40	....	....
Holsinger Bros. ....	15	....	....	15	17	....	....	....	....	2	47	1
International Nursery Co.....	34	....	....	11	66	....	....	....	....	4	111	....
Jackson and Perkins.....	....	....	....	....	....	....	....	....	....	66	....	....
Kelly Bros. ....	....	....	....	....	8,900	....	....	....	....	....	8,900	3
Maloney Bros. & Wells.....	....	....	....	....	100	....	....	2	....	....	100	....
F. W. Mineray.....	227	....	....	....	....	....	....	....	....	....	227	11
Miscellaneous .....	272	....	4	26	3,032	....	....	24	24	393	3,334	....
Morey and Sons.....	45	125	9	290	8,565	570	....	....	....	....	8,944	4
Mt. Arbor Nurseries.....	....	....	....	392	800	3,345	....	....	2,000	75	1,192	63
New Haven Nurseries.....	....	....	....	....	100	....	....	....	....	....	100	....
Rockmount Nursery .....	....	....	....	....	....	4	....	....	....	....	....	....

TABLE 8—LARIMER COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Shenandoah Nursery Co.....	1,000	....	....	850	5,300	65	32	4,000	....	95,076	7,150	85
Sherins Nursery .....	160	....	....	....	210	....	....	....	....	....	370	1
Stark Bros. Nursery .....	192	4	7	....	70	....	19	80	24	....	273	10
Stannard Nursery Co.....	30	....	....	10	1,400	....	....	....	250	21,000	1,440	....
Vincennes Nursery .....	....	....	....	....	3,600	....	....	....	....	....	3,600	1
Watrous Nursery .....	318	....	....	158	608	6	50	300	....	19	1,084	33
Welsh Nursery .....	....	272	....	515	2,260	785	1,450	2,700	2,500	882	3,047	12
Woodland Nursery .....	....	....	....	41	113	....	365	....	1,750	....	154	....
York Nursery .....	....	....	....	....	1,333	....	....	....	....	....	1,333	1
Total .....	5,940	726	581	2,867	42,837	6,372	2,525	10,786	8,592	120,908	52,951	332

TABLE 9—MESA COUNTY

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
O. A. D. Baldwin.....	....	....	....	....	....	....	40	....	3,000	....	....	....
Barteldes Seed Co. ....	....	....	....	....	....	....	....	....	....	11	....	....
Berrydale Nursery Co. ....	....	....	....	....	....	....	....	....	550	....	....	....
California Rose Co. ....	....	....	....	....	....	12	....	....	....	1,036	....	....
Cedar Hill Nurseries.....	3	3	....	6	....	18	....	....	....	....	12	....
Herbert Chase Nursery.....	10,668	3,138	2,589	239	235	....	1,157	370	1,250	....	16,869	389
J. L. Childs.....	....	....	....	....	....	....	....	....	50	....	....	....
Cooper and Rogers.....	1,500	500	10	8	50	....	....	....	....	....	2,068	7
Colorado Nursery Co.....	4,060	480	75	40	50	....	570	....	....	20	4,705	48
M. Crawford .....	....	....	....	....	....	....	....	....	2,500	....	....	....
Crescent Nursery Co. ....	110	70	....	....	2	....	....	....	....	12,000	182	2
George Crews .....	....	....	....	....	....	....	....	....	6,000	....	....	....
Davis County Nursery.....	45,379	13,336	5,252	586	2,325	302	5,202	2,802	7,475	452	66,878	333
Downer Bros. Nursery.....	9,500	....	....	....	100	....	....	....	....	....	9,600	50
Ellwanger and Barry.....	....	....	....	....	....	50	....	....	....	....	....	....
Fancher Creek Nursery .....	....	....	....	....	....	....	150	....	43	12	....	....

TABLE 9—MESA COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous,	Total Fruit Trees	Fruit Trees Condemned
Galbraith Nursery	345	5	470	3	100	....	50	....	110	2	928	96
Gardener Nursery Co.	47	2	2	16	25	72	6	17	922	5	92	....
Geisha Nursery	10	....	....	3	2	....	....	....	....	....	15	....
German Nursery	985	420	110	3	223	43	100	56	162	1,011	1,745	4
Glen Bros. Nursery	....	....	....	....	....	10	....	....	6,100	....	....	....
Glenwood Nursery	....	....	....	....	....	3	....	....	....	....	....	....
Green's Nursery	4	6	1	....	22	....	26	365	40	....	33	....
Griega Nursery	72	426	27	70	115	....	98	45	3,160	35	710	3
Guernsey Nursery	....	....	....	....	....	....	....	5	....	....	....	....
C. S. Harrison	....	....	....	....	....	20	....	....	....	5	....	....
Peter Henderson	....	....	....	....	....	....	....	5	....	....	....	....
D. Hill Nursery Co.	....	....	....	....	....	....	....	....	....	50	....	....
Holsinger Bros.	....	....	....	....	....	....	92	....	....	....	....	....
T. S. Hubbard Co.	....	....	....	....	....	....	800	800	....	....	....	....
International Nursery Co.	1	....	10	4	10	3	110	24	70	15	25	....
G. S. Josselyn	....	....	....	....	....	....	2,000	....	....	....	....	....
R. M. Kellogg	....	....	....	....	....	....	....	....	6,650	....	....	....
David Knight & Co.	....	....	....	....	....	....	....	....	650	....	....	....
La France Fruit Farm	....	....	....	....	....	....	....	....	10,000	....	....	....
Thos. Meehan & Son	....	....	....	....	....	110	....	....	....	168	....	....
Mills Seed Co.	....	....	....	....	....	....	....	....	150	....	....	....
Mills Seed House	2	2	....	....	....	....	2	....	126	....	4	....
Miscellaneous	....	....	....	....	....	10	740	60	832	....	....	....
Monmouth Nursery	....	....	....	....	....	....	....	....	50	....	....	....
Morey Nursery	5	....	....	....	....	....	....	....	....	....	5	1
Morris Co. Nursery	1,000	485	....	....	170	....	....	....	....	....	1,655	....
New Haven Nursery	....	30	170	....	....	....	....	....	....	....	200	24
Park Floral Co.	....	....	....	....	....	....	....	....	....	25	....	....
J. B. Pilkington	....	....	....	....	....	11	....	....	115	21	....	....
N. Pomeroy	....	....	....	....	....	....	....	....	....	30	....	....
Portland Wholesale Nursery Co.	1,000	....	....	....	....	....	....	....	....	....	1,000	6
Rockmont Nursery	....	....	....	....	....	53	....	....	....	24	....	....
Roeder Nursery	60	20	....	....	7	....	....	....	....	....	87	....
Sherman Nursery	....	....	....	....	....	....	....	105	....	....	....	....
W. & T. Smith Co.	....	3,803	....	....	....	....	....	....	....	....	3,803	77
Stark Bros.	2,247	635	310	26	260	6	1,339	215	141	19	3,478	26
Storrs & Harrison	....	....	....	....	....	....	70	....	50	10	....	....
Tennessee Nursery Co.	....	....	4	....	1	....	....	....	500	....	5	....
Twin Falls Nursery	573	9	10	8	9	10	....	....	....	....	609	1
Utah Nursery Co.	3,400	7,191	1,262	100	318	11	2,550	611	1,474	376	12,271	218
Wallace Creek Nursery	10,630	7,998	12,432	396	862	84	457	219	8,759	38	32,318	161

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 9—MESA COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
O. C. Waller.....	....	....	....	....	....	....	....	....	1,500	....	....	....
Washington Nursery Co.....	100	....	....	12	12	....	....	....	....	....	124	1
Willis Nurseries .....	100	100	....	20	50	....	100	125	....	10	270	2
Whittens Nursery Co.....	....	....	....	....	....	....	....	....	275	....	....	....
Winfield Nursery Co.....	754	355	1,230	3	259	....	12	....	....	....	2,601	92
E. H. Wynkoop .....	1,946	1,723	126	3	121	2	1,264	230	10,910	20	3,919	27
Younger and Son.....	....	....	....	....	....	125	....	....	....	....	....	....
Total .....	94,501	40,737	24,090	1,551	5,328	955	16,935	6,054	73,584	15,395	166,207	1,568

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 10—MONTEZUMA COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubby, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Alabama Nursery Co.....	935	35	220	50	75	....	200	50	150	....	1,315	....
Davis Co. Nurseries.....	17,242	500	500	250	500	....	1,000	600	450	....	18,992	30
J. D. Hall.....	750	250	100	....	....	....	....	....	....	....	1,100	....
International Nursery Co.....	86	....	85	....	50	....	100	....	100	....	221	....
New Haven Nursery.....	85	22	120	20	....	....	....	....	....	....	247	....
Stark Brothers .....	522	13	4	24	....	....	....	50	1,050	....	563	....
F. H. Stannard.....	3,260	650	2,060	55	....	....	20	200	1,500	....	6,025	2,635
H. C. Taylor.....	10,600	800	....	....	....	....	....	....	....	....	11,400	....
Utah Nursery Co.....	500	5	100	50	20	....	....	....	....	....	675	....
A. Willis Nursery.....	....	500	200	75	100	....	....	....	....	....	875	....
Wallace Creek Nursery.....	20,920	1,035	2,270	670	1,030	....	1,500	950	5,000	....	25,925	69
Total .....	54,900	3,810	5,659	1,194	1,775	....	2,820	1,850	8,250	....	67,338	2,734

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912—Continued.

TABLE 11—MONTROSE COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currents, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Herbert Chase Nursery.....	5,026	46	182	80	481	516	2,030	200	3,345	....	5,815	63
Davis County Nursery.....	50	10	25	....	10	....	....	....	....	....	95	1
German Nursery .....	560	199	150	45	96	....	325	....	....	76	1,050	70
Green's Nursery .....	....	11	....	....	....	....	....	10	....	....	11	....
Griese Nursery .....	1,922	186	182	107	22	....	494	30	530	8	2,369	11
Phoenix Nursery .....	5	....	12	5	....	....	100	....	25	....	22	....
Stark Bros. Nursery.....	476	55	84	31	43	2	275	210	55	8	689	47
Utah Nursery Co.....	7,964	331	343	137	545	....	1,059	355	774	....	9,320	161
Wallace Creek Nursery.....	5,489	255	878	538	746	102	925	....	....	....	7,906	114
Washington Nursery .....	228	28	92	56	39	....	32	112	48	576	443	16
Willis Nursery .....	198	8	10	50	....	....	20	24	25	....	266	8
Winfield Nursery .....	100	....	....	....	....	....	....	....	....	....	100	9
Total .....	22,018	1,129	1,908	1,049	1,982	620	5,260	941	3,802	668	28,086	500

NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 12—OTERO COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currents, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Boulder Nursery Co.....	....	....	....	5	15	....	....	....	....	50	20	....
Crescent Nursery .....	40	....	25	42	3,374	....	554	....	....	150	3,481	....
Capitol Nursery .....	5	....	5	....	4	400	....	....	....	....	14	....
Elkhorn Nursery .....	363	....	28	402	2,812	30	1,606	....	....	2,747	3,605	....
Gardener Nursery .....	10	....	....	....	5	....	....	150	....	100	15	....
German Nursery .....	113	....	....	4	26	3,000	50	50	....	....	143	....
International Nursery Co.....	225	....	3	80	858	291	45	50	....	228	1,166	....
Ince Nursery Co.....	1,134	43	36	183	1,755	....	279	3,576	....	131	3,151	....
Miscellaneous .....	695	....	40	195	6,625	1,047	210	35,324	....	75,176	7,555	....
Mt. Hope Nursery.....	132	....	40	....	1,792	175	324	1,660	....	130	1,964	....
Mt. Arbor Nursery.....	....	....	....	50	120	....	62	50	....	90	170	....
Morey and Son.....	....	....	....	....	18,440	2	....	5,000	....	....	18,440	....
Oregon Nursery .....	129	....	....	....	....	....	12	....	....	....	129	....
Stark Brothers .....	192	....	26	20	....	....	....	100	....	150	238	....
Star Nursery .....	656	....	133	176	1,873	....	1,011	825	....	985	2,838	44
St. Louis Seed Co.....	....	....	10	....	5	....	....	....	....	....	15	....

TABLE 12—OTERO COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Youngers Nursery .....	77	5	....	110	1,515	100	800	25	....	....	1,707	....
Vincennes Nursery .....	....	....	....	....	7,020	....	....	....	....	....	7,020	....
Willis Nursery .....	10	....	4	12	2,415	55	....	....	....	50	2,441	....
Wragg Nursery .....	....	....	10	....	1,450	202	....	300	....	....	1,460	....
<b>Total .....</b>	<b>3,781</b>	<b>48</b>	<b>360</b>	<b>1,279</b>	<b>50,104</b>	<b>5,302</b>	<b>4,953</b>	<b>47,110</b>	<b>....</b>	<b>79,987</b>	<b>55,572</b>	<b>44</b>

TABLE 13—PUEBLO COUNTY.

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Benson Nursery .....	100	....	....	....	75	....	....	....	....	....	175	....
Benton Nursery .....	70	....	12	....	....	....	....	....	....	....	82	....
Herbert Chase Nursery.....	40	....	....	20	20	10	....	....	....	....	80	....
Colorado Nursery Co.....	546	....	....	....	530	....	....	....	....	....	1,076	192
Elkhorn Nursery .....	60	....	....	12	82	....	....	....	500	4	154	1
Galbraith Nursery .....	50	....	....	....	25	....	25	....	....	....	75	....
Gardener Nursery .....	20	....	....	4	10	20	....	6	60	....	34	....
German Nursery .....	132	....	2	....	48	204	12	6	22	3	182	....
Green's Nursery .....	....	....	....	....	50	....	....	....	....	....	50	....
Ince Nursery .....	5,743	....	....	....	260	....	70	100	50	....	6,003	152
International Nursery Co.....	24	1	8	5	31	8	40	....	18	....	69	....
L. L. May & Co.....	....	....	....	....	30	....	....	....	....	....	30	....
Meehan & Son.....	....	....	....	....	....	360	....	....	....	2,360	....	....
Mills Seed Co.....	2	2	....	....	....	....	....	....	....	....	4	2
Mt. Arbor Nursery.....	803	....	....	30	2,336	....	250	24	12	3	3,169	31
Northern Nursery .....	679	12	3	329	1,332	203	772	243	....	65	2,355	71



NURSERY STOCK RECEIVED AND TREES CONDEMNED IN THE VARIOUS COUNTIES OF COLORADO DURING 1912.—Continued.

TABLE 13—PUEBLO COUNTY—Continued

NURSERY	Apple, Quince	Pear	Peach	Plum, Prune, Apricot	Cherry	Shade	Grape	Currants, Gooseberry	Other Berries	Ornamental Shrubbery, Miscellaneous	Total Fruit Trees	Fruit Trees Condemned
Oregon Nursery .....	300	.....	.....	.....	750	.....	.....	.....	1,000	.....	1,050	.....
Ottawa Star Nursery .....	1,727	17	69	331	1,419	109	3,596	928	2,016	63	3,563	174
R. Parsons Nursery .....	.....	.....	.....	.....	.....	300	.....	.....	.....	.....	.....	.....
Phoenix Nursery .....	.....	.....	.....	.....	650	.....	.....	.....	.....	.....	650	.....
Stark Brothers .....	7,891	42	.....	69	12,970	.....	1,569	252	400	.....	20,972	136
Southern Nursery Co. ....	100	.....	100	.....	1,935	.....	.....	.....	.....	.....	2,135	10
J. C. Vanderbeck .....	75	.....	.....	.....	25	.....	.....	.....	.....	.....	100	.....
Willis & Co. ....	2,950	90	.....	250	360	100	1,200	150	300	6	3,650	33
Winfield Nursery Co. ....	.....	.....	.....	.....	75	.....	.....	.....	.....	.....	75	.....
Woodbine Nursery .....	.....	.....	.....	.....	30,000	.....	.....	200	500	.....	30,000	109
<b>Total .....</b>	<b>21,312</b>	<b>164</b>	<b>194</b>	<b>1,050</b>	<b>53,013</b>	<b>1,305</b>	<b>7,534</b>	<b>1,909</b>	<b>4,878</b>	<b>2,504</b>	<b>75,733</b>	<b>911</b>

ARSENIC DETERMINATIONS FOR C. P. GILLETTE,  
STATE ENTOMOLOGIST

(The samples were all dried at 100° C. before analyzing.)

	As	Equiv.	
		to $As_2O_3$	Soluble to $As_2O_3$
No. 1. Zinc arsenite .....	28.61%	43.85%	0.16%
No. 2. Lead arsenate .....	16.03%	24.57%	0.43%
No. 3. Lead arsenate .....	21.21%	32.53%	0.04%
No. 4. Lead arsenate .....	18.51%	28.39%	0.22%
No. 5. Lead arsenate .....	18.07%	27.71%	0.31%
No. 6. Zinc arsenite .....	28.64%	43.91%	0.45%
No. 7. Zinc arsenite .....	28.24%	43.30%	0.49%
No. 8. Zinc arsenite .....	28.30%	43.38%	0.38%
No. 9. Zinc arsenite .....	27.84%	42.68%	0.19%
No. 10. Zinc arsenite .....	27.91%	42.80%	0.40%
No. 11. Zinc arsenite .....	28.36%	43.48%	0.09%
No. 12. Lead arsenate .....	18.91%	28.98%	0.51%
No. 13. Lead arsenate .....	21.44%	32.87%	0.45%

Denver, Colorado, November 7, 1912.

VON SCHULZ &amp; LOW.

## SAMPLES OF LEAD ARSENATE SENT TO VON SCHULZ AND LOW

No. 1. Zinc arsenite from the California Spray and Chemical Company; sent to Canon City for experimental purposes.

No. 2. Sherwin Williams lead arsenate; donated for experimental purposes at Canon City.

No. 3. Latimer's lead arsenate; taken from stock at Canon City and used in leaf-roller work.

No. 4. Ansbacher lead arsenate; taken from lead in storage at Pueblo by J. N. Salter.

No. 5. Sample package of lead arsenate from the Dow Chemical Company; sent by the Gibson Fruit and Produce Company, Montrose.

No. 6. Zinc arsenite from Fluckey's place at Clifton; sent by Mr. H. B. Scammell.

No. 7. Zinc arsenite sample from Goddard's orchard at Clifton; sent by H. B. Scammell.

No. 8. Zinc arsenite sample from Bourrough's orchard at Clifton; sent by H. B. Scammell.

No. 9. Zinc arsenite sample from Cassell's orchard at Grand Junction; sent by H. B. Scammell.

No. 10. Zinc arsenite sample from Merryfield orchard at Fruita; sent by H. B. Scammell.

No. 11. Zinc arsenite sample from Lester Johnson's orchard at Fruita; sent by H. B. Scammell.

No. 12. Lead arsenate used in Lester Johnson's orchard at Fruita; Grasselli brand.

No. 13. Lead arsenate (dry powdered); sent here for trial by the Corona Chemical Company, of Milwaukee.

## THE FRUIT-TREE LEAF-ROLLER\* IN COLORADO

BY C. P. GILLETTE AND GEORGE P. WELDON

In Bulletin 19 (1891) of the Colorado Experiment Station the senior author of this paper gave the result of his studies of this insect during a serious outbreak lasting for three or four years in northern Colorado, in a section that may be designated as the Fort Collins-Greeley district. This seems to have been the first record of the appearance of this insect as a serious pest west of the Mississippi River. In 1905 it rapidly decreased in numbers in the section named, apparently from the attacks of several parasitic enemies and a fungous disease. Since that time the insect has not reinfested the district in appreciable numbers. Immediately following the abundance of this leaf-roller about Greeley and Fort Collins, it became abundant farther south, first in the vicinity of Boulder, and then in and about Denver, and a year or two later about Colorado Springs and Pueblo. The outbreak was not so serious, however, in these more southern localities as it was in the vicinity of Fort Collins and Greeley, and the outbreak in each of these places was of shorter duration.

Accompanying the outbreak just mentioned, the box-elder leaf-roller† appeared in about equal numbers, and completely defoliated many of the box-elder trees in the sections where it was most numerous; but this species has not accompanied the outbreak of the fruit tree leaf-roller in the Canon City section during the past two or three years.

In the present paper we are bringing together our data upon the life-habits and remedies of the fruit-tree leaf-roller to the present time. In doing this, we are glad to be able to announce efficient remedies for the control of this serious orchard pest, as the result of our experiments in the laboratory and in the field. None of the means of control will prove very successful, however, if careless or slipshod methods are used in carrying them out.

A recent bulletin, No. 311, of the Cornell Experiment Station, written by Professor Glenn W. Herrick, gives an excellent bibliography of the more important literature treating of this insect, as well as an excellent account of its life-history and habits in the eastern states. This bulletin can probably be secured for the asking, as long as the supply lasts.

### LIFE-HABITS

*The Egg.*—The female moth deposits her eggs in compact oval clusters of about twenty-five to more than one hundred, anywhere upon the bark of the fruit trees that serve as its food supply. The eggs are distributed anywhere from the bases of the trunks of the trees to the tips of the twigs, or at least to the limit of the previous year's growth. These clusters commonly vary little from one-eighth of an inch in width to three or three and one-half sixteenths of an inch in their greater diameter, and the clusters are more or less oval in outline. (Plate I, fig. 5.) As soon

\* *Archips argyrospila* Walker.

† *Archips negundana* Dyar.

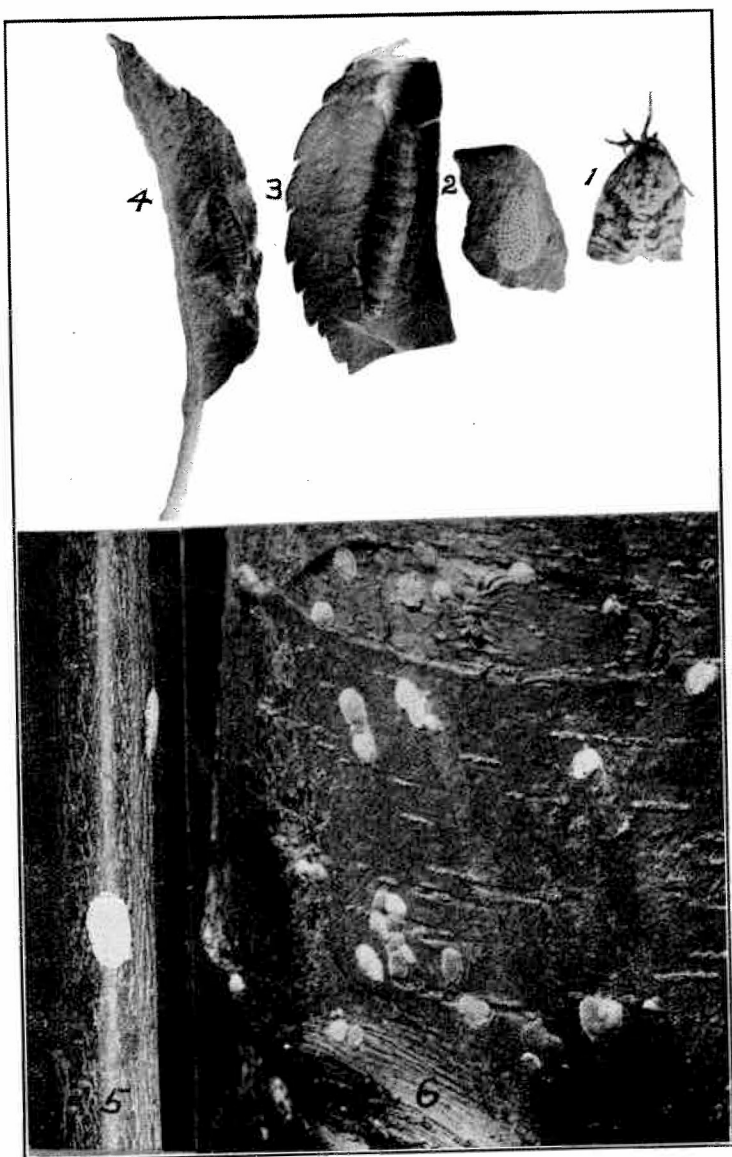
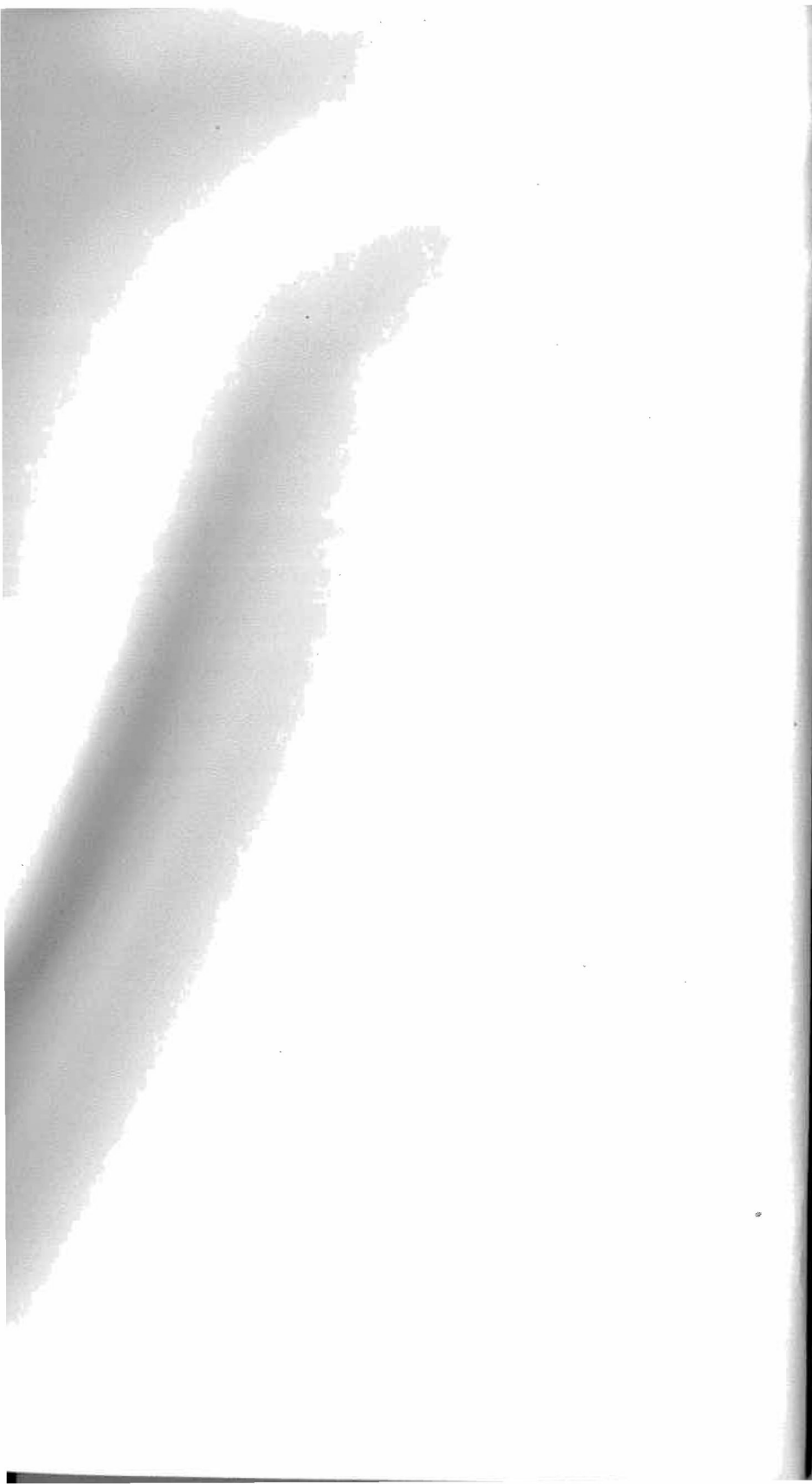


PLATE I.

Figure 1, adult leaf-roller moth; figure 2, hatched egg mass on bark; figure 3, adult larva; figure 4, pupa; figure 5, light-colored egg masses on bark; figure 6, thirty-five hatched egg masses in a space of twelve square inches.



as the egg mass has been deposited, the female moth smears the eggs over with an impervious material which is thrown out from the extremity of the abdomen, and which protects the eggs from the inclemencies of the weather and the attacks of predaceous insects for nearly ten months, or until the buds begin to open the following year. So there is but one brood of the worms each summer. (See Plate I, figs. 5 and 6.)

When freshly deposited, the egg patches are greenish-yellow in color, but soon become much darker on exposure to the sunlight, until they imitate very closely the color of the bark upon which they rest. Before spring many of the patches become bleached to a light-gray color, while others remain quite dark. The moths bred from the light and dark egg patches do not show any difference in their markings or coloration. The eggs are stuck so tightly to the bark when they are deposited that they often remain for several years. The old egg patches are readily recognized by the numerous small punctures from which the larvæ or worms escaped, as shown in figures 2 and 6, Plate I.

*The Larvæ or Worms.*—The larvæ do not all hatch at once, those in the warmer situations being the first to emerge, and those coming from a single egg patch usually vary several days in their date of emergence.

The date of hatching is by no means constant, but is determined by the earliness or lateness of the season, exactly as is the time for the opening of the buds. The earliest of the larvæ emerge with the first bursting of the buds of the apple trees, and when the blossom buds of the apple begin to show their pink color the larvæ of the leaf-roller have mostly hatched. The active hatching season is usually distributed over about one week to ten days, the time varying with the temperature. If the days and nights are cool, the period lasts longer than if hatching takes place at a time when the days and nights are warm.

At first the larvæ are very small, hardly one-sixteenth of an inch in length, and dull greenish-yellow in color, with black heads. As they feed and grow, they become deeper green in color, and the black head and first segment of the body above become quite conspicuous.

The larvæ usually require from one and a half to three hours to escape from the egg after the first appearance of the jaws through the shell. On hatching, the little larva goes at once in search of food, and may eat into an unopened bud or find its way into one of the folds of the tender unfolding leaves, which it soon ties together with delicate silken threads of its own manufacture. According to our breeding-cage record, thirty days of feeding are sufficient to mature the larva, which then ceases to feed, and in a few days more changes to the third, or chrysalis (pupal), stage, usually among the curled leaves which it has tied together with the silk threads above mentioned. The first egg-hatching noticed at Canon City this year was on April 29, and the first pupæ on June 8. Other observers have reported larvæ becoming full-fed in eighteen or twenty days.

About ten days (eight to eleven according to our records) after becoming a chrysalis, or pupa, the chrysalis (Plate I, fig 4) wriggles itself nearly out of the leaf cluster enclosing it, where it clings to the silken threads by a cluster of small hooklets at the tail end of the body. In this position, the chrysalis soon splits along the back, and the winged, adult insect, or moth, appears. (See Plate I, fig. 1.) On first appearing, the wings are crumpled and small in appearance, but in a few moments expand to their full size. After resting for a few moments, or possibly an hour, the wings have become sufficiently dried and firm so that the insect is able to take wing and fly.

*The Moth (Plate II).*—The moths measure from ten to thirteen millimeters, or from three-eighths to four-eighths of an inch, in length with the wings closed; the expanse of the full-spread wings usually varies between eighteen and twenty-five millimeters, or from eleven-sixteenths to one

inch; the prevailing color is a rusty brown, varying in typical specimens from rather light to quite dark, and there is always present a large pale-yellow to almost white diagonal patch on the front or caustal margin of the wing a little beyond the middle; a smaller light area occurs on the front margin of the wing about half-way between the large light area and the base of the wing; the two light areas are separated by a dark rusty-brown diagonal band or stripe; this stripe and an area just beyond the large light patch are usually the darkest portions of the wing; the dark-colored area is more or less broken or mottled with pale-yellow scales; the abdomen and lower surface of the hind wing are light yellow, but the upper surface of the hind wing is usually more or less dusky or smoky in color, especially toward the distal portions; the male averages smaller than the female and has the light and dark coloration more sharply contrasted; in the darkest females the smaller light-colored area on the wing is sometimes obliterated; in the lighter examples the distal portion of the wing is often distinctly yellowish in color, with a greater or less number of rusty-brown scales intermingled, this light portion frequently connecting with the larger light area on the anterior margin of the wing; in extremely light examples, which occur with some frequency, the entire surface of the fore wing is light yellow in color, with slight rusty outlines, as shown in Plate II, figure 1. There are occasional specimens with very contrasting colors, in which the ground color of the wing is light yellow and the dark markings somewhat in the form of a letter Y across the wing near the central portion, as shown in Plate II, figure 6. In all cases where these moths with the extreme light or dark colors have been reared we have obtained them from individual egg masses, from which the greater number of the moths had the typical color markings shown in Plate II, figures 2, 5, and 7. In all the examples we have reared the very light-colored examples have been females, while it is not uncommon for the darker-colored individuals to be females also.

#### FOOD PLANTS

The apple seems to be the favorite food of this species of leaf-roller. Plum, cherry and pear trees are subject to attack, but to a less extent than the apple. Peach trees seem to be practically immune.

In addition to the fruit trees to which it does its principal damage, it very frequently attacks currants, gooseberries, raspberries, roses, poplars, elms, locusts; in fact, when food becomes scarce it seems to attack almost any kind of green foliage. It has been seen feeding on alfalfa in orchards where the leaves had been practically all destroyed from the apple trees, and the worms had fallen to the alfalfa which was growing between the trees. In one case some onion plant, were seen that had been fed on slightly. A species of cercocarpus which grows in the foothills of Colorado, is also attacked by them.

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#### *History of the Leaf-Roller in the Canon City Section*

BY A. S. TAYLOR, HORTICULTURAL INSPECTOR FOR FREMONT COUNTY

The green fruit worm known as the leaf-roller, because of its peculiar habit of rolling up the leaves of the tree upon which it is feeding, was first noticed at Canon City in the spring of 1908, but the damage was so slight that little attention was paid to it. In 1909 it appeared in considerable numbers over a small area near the river on the north side. Just after the blossoms had fallen and the apples were beginning to set, the worm was noticed by an orchardist in the affected area, eating into small apples and doing considerable damage. Our fruit inspector made a careful examination of the entire district at this time, and did not find very much indication of the worm anywhere except in the affected area

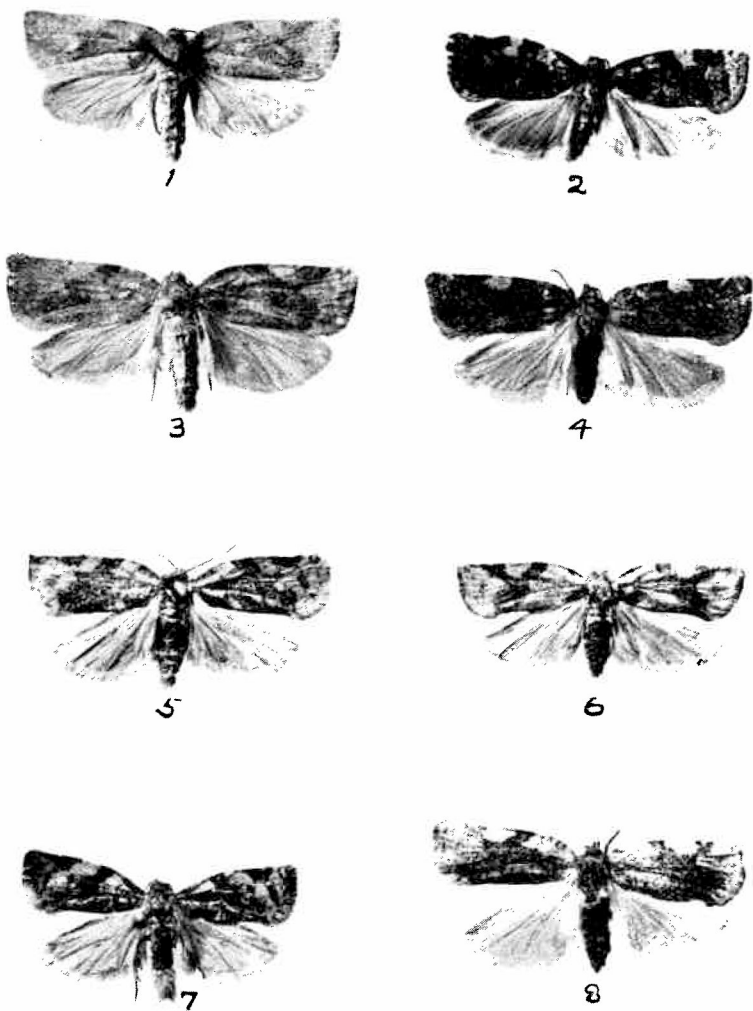


PLATE II.

Figure 1, light-colored female moth; figure 2, dark-colored male from same egg mass; figure 3, light-colored female; figure 4, dark-colored female from same egg mass as figure 3; figures 2, 4, 5 and 7 showing most characteristic markings





spoken of above. A little later, when the worms began to roll themselves up in the leaves so that they could be easily detected, they were found to be pretty generally disturbed over the mesa on the south side of the river, known as Lincoln Park. They were not in sufficient numbers anywhere, however, to do serious damage. Some of the summer and fall varieties, like the Yellow Transparent and Wealthy, were found to be quite badly injured. In the fall our trees were so heavily loaded that the few apples that were marked by the worms were thrown away and never missed, and very little thought was given to the leaf-roller as a destructive pest.

An examination by our fruit inspector, made in the early spring of 1910, showed many orchards on the south side to have a good many egg patches scattered over the trees, and some eggs could be found in most of the orchards in that section.

At blossoming time the worms began to hatch, and in all the orchards where the eggs were found in any numbers at all the worms were quite plentiful, but nowhere that spring did they affect the foliage seriously.

This season a few worms appeared on the north side, but not in large numbers at any point. At picking time the fruit in the orchards where the worm was known to be the worst was quite badly marked. In some cases as high as 25 per cent had to be thrown out.

During the winter of 1910 and 1911 an examination of the orchards on the south side showed that the pest was increasing very rapidly. In some of the worst-infected orchards the trees bore large numbers of egg patches.

In the spring of 1911 it was seen that the entire south side would be badly damaged. In some orchards the worms destroyed fully 50 per cent of the fruit at blossom time by eating into the base of the blossoms, causing the whole cluster to dry up and fall off; the orchards at this time looking as though they had been hurt by frost. At picking time the damage to the apples was found in some orchards to run fully 75 per cent, and would average 40 per cent for the whole south side, an area covering about 2,500 acres of orchard land. On the north side of the river, in an area covering about 3,000 acres of orchard, and divided only by the river from the south side, the damage was not over 10 per cent.

During the winter of 1911 and 1912 it could be plainly seen from the number of eggs that had been laid that, unless something could be found to check the ravages of the pest, the 1912 crop would be destroyed. On the north side the eggs were pretty generally distributed, but still in no great number anywhere.

Last spring (1912) the worms began to hatch almost before the leaves started, and as fast as the blossoms and leaf buds came out they were attacked by the worms, and so thoroughly eaten off in many orchards as to make the trees look as though they had been badly burned.

At the time of writing it is known that the crop on the south side is damaged fully 85 per cent, at least 75 per cent having been destroyed while in the blossom, and a large per cent of the balance are badly marked.

On the north side the trees show nearly a full crop at this time, but it can be seen that the fruit in many orchards will be found badly eaten when picking time comes.

In the spring of 1910, and again in 1911, many orchards were sprayed with lime and sulfur. Although the work, to my personal knowledge, was thoroughly done, and the solution made as strong as it could be with safety, we are positive that it did not destroy any of the eggs of the leaf-roller.

When the pest first appeared, we found the worm to be such a ravenous eater that we supposed, of course, we should be able to control it with arsenicals. In 1911 we made several extra sprayings, and in 1912 used lead arsenate as high as 7 pounds to 100 gallons of water; but we

did not succeed in saving the fruit. The heavily sprayed orchards, however, seemed to have their foliage protected to some extent by this spray, as indicated by the more healthy appearance of the trees. We are now convinced, through the experiments conducted by the State Agricultural College the past spring, that the miscible oil will kill the eggs, and that at last we have a solution to the very serious problem that has been confronting us since 1908.

Canon City, Colorado,  
August 2, 1912.

During June and July of 1912 the moths were more abundant at Canon City than any previous season. On the south side of the river, where the most injury has always been since the leaf-roller first appeared in that section, the eggs were probably no more abundantly laid than in the previous season. On the north side there is a noticeable increase; on one tree 245 egg masses were counted to a height of about five feet from the ground. Next season the fight will have to be waged on both sides of the river, and the co-operation of the people in the entire Canon City section will be necessary if they would meet with the best success in combating the pest.

#### OCCURRENCE IN OTHER PARTS OF THE STATE

Mr. T. C. Brockway, horticultural inspector for Larimer County, found a considerable number of egg patches near Timnath, early in the season. It is not known whether or not much injury was done to the orchard where they were found.

One large orchard, at least, in Montezuma County had considerable of its fruit destroyed in 1911, and this season the percentage injured or destroyed was very much greater.

In Montrose County leaf-roller was reported last season by one orchardist who had it in a fifty-acre tract of apples. Last spring the eggs were very common and hatched well. An early spray just after the blossom buds separated was applied, and probably was responsible for saving most of the fruit.

On June 14, 1912, Mr. L. T. Ernst, horticultural inspector of Delta County, reported a green worm eating the tips of both old and young trees. Specimens sent proved to be the leaf-roller. On June 28 a number of orchards were visited in the Paonia section, and the pest was found to be of general occurrence, but was not doing a great amount of damage.

Pueblo County suffered greatly from the attack of this insect in 1911, and again this season. J. N. Salter, horticultural inspector for this county, worked hard to get people to spray heavily for its control. A scarcity of spray pumps and negligence among the orchardists themselves were responsible for a very heavy loss, much of which could have been prevented by very thorough spraying.

It may be seen from this that the occurrence of the pest is quite general throughout the state, and it is to be hoped that this year's successful experimental work will encourage fruit-growers to take the necessary steps to control it where it has already become established, and prevent its spread to other sections.

#### EXPERIMENTS

The first experimental work that was done in Colorado to determine efficient methods for the control of the apple leaf-roller dates back to the years 1894 and 1895. At that time those who were growing fruit trees in the vicinity of Fort Collins and Greeley were experiencing considerable trouble with this pest. The first record of its occurrence at these places

was made in 1890, when the senior author began his work with the Colorado Agricultural College. A bulletin (No. 19) was published in 1891, giving a short account of the life-history of the fruit-tree leaf-roller and methods for its control, and in 1894 experimental work, both with contact sprays applied to kill the eggs and arsenical sprays to kill the larvæ while feeding upon the foliage, was carried out. Some interesting results were obtained at that time, which tend to substantiate some of those reached in this year's work.

In 1908 its occurrence in the Canon City section was noted, but no alarm because of its presence was felt until a couple of years later, when it had increased to such an extent as to be quite a serious pest. Not until the winter of 1912 did it become possible to carry on some further experimental work. The previous season the pest destroyed a large amount of fruit in certain parts of the Canon City section, and people became discouraged, saying that, unless some effective means of control could be discovered, they could not make any money growing fruit. The pest was so serious that plans were laid in January, 1912, for experiments, in hopes that something might be done to relieve the situation.

Previous experiments had shown that it is possible to kill the eggs with certain contact insecticides. The eggs are always on the trees during the late summer, and during the fall and winter months, and if practical means for destroying them could be found, the problem would be satisfactorily solved. Consequently, at the meeting of the Fremont County Horticultural Society, on December 12-13, 1911, it was announced that a series of tests would be made with various sprays to determine what would penetrate the tough covering over the egg masses and destroy the eggs within, and the people were asked to send a great many of these egg patches on pieces of bark cut from the trees, or on twigs. Several responded, and a goodly number of the patches were received at Fort Collins. In addition, trips were made to Canon City for an extra supply, and work was begun before spring came on. The eggs were kept in the insectary, which is artificially heated, where they hatched very early, so that the results of this preliminary work were secured before any orchard work was done.

The resistance of the egg masses to penetration and destruction by most of the ordinary contact insecticides was found to be remarkable, and the problem of finding a satisfactory spray was not at all an easy one. In 1894 and 1895 the following sprays were applied to egg patches, several strengths being used in most cases:

Kerosene emulsion.

Tobacco decoction.

Lime whitewash.

Paris green.

Whale-oil soap.

Corrosive sublimate.

Arsenic paste.

Crude carbolic acid.

Lye.

Tobacco and lye.

Kerosene emulsion and tobacco.

This year many of the same sprays were applied, and others in addition. Following is the list:

Lime and sulfur (home-prepared).

Lime and sulfur (commercial).

Lime whitewash.

Kerosene emulsion.

Black Leaf 40.

Black Leaf 40 and soap.

Nicofume.

Nicofume and soap.

Zinc arsenite.

Paris green.

Cooper's V<sub>1</sub> Tree Spray.

Aphine.

Soluble sulfur.

Black Leaf 40 and kerosene emulsion.

Fumigation with hydrocyanic acid gas.

The following table shows the number of experiments in all, and gives a short statement in regard to results attained. It may be seen from this table that out of the long list of sprays used very few gave encouraging results.

TABLE OF INSECTICIDES USED AND SHORT NOTES GIVING RESULTS IN INSECTARY EXPERIMENTS WITH EGG MASSES OF THE LEAF-ROLLER. WORK IN 1894 AND 1895 DONE BY C. P. GILLETTE; THAT IN 1912 BY GEORGE P. WELDON.

## HOME-MADE LIME AND SULFUR.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Jan. 26, 1912	1 lb. lime, 1 lb. sulfur, $\frac{1}{2}$ gal. water	25	More than 50% hatched.
Jan. 26, 1912	1 lb. lime, 1 lb. sulfur, 1 gal. water	25	More than 50% hatched.
Jan. 26, 1912	1 lb. lime, 1 lb. sulfur, 2 gals. water	25	Eggs hatched well.
Jan. 26, 1912	1 lb. lime, 1 lb. sulfur, 3 gals. water	25	Eggs hatched well.
Mar. 14, 1912	1 lb. lime, 1 lb. sulfur, $\frac{1}{2}$ gal. water	25	Little or no benefit.*
Mar. 14, 1912	1 lb. lime, 1 lb. sulfur, 1 gal. water	25	Same as preceding.
Mar. 14, 1912	1 lb. lime, 1 lb. sulfur, 2 gals. water	25	Same as preceding.
Mar. 14, 1912	1 lb. lime, 1 lb. sulfur, 3 gals. water	25	Same as preceding.

## KEROSENE EMULSION.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Jan. 26, 1912	50 % oil.....	25	Not a single egg hatched.
Jan. 26, 1912	33 $\frac{1}{3}$ % oil.....	25	50% of patches partly hatched.
Jan. 26, 1912	25 % oil.....	25	Not a single egg hatched.
Jan. 26, 1912	16 $\frac{2}{3}$ % oil.....	25	Very few hatched; good results.
Jan. 26, 1912	12 $\frac{1}{2}$ % oil.....	25	65% of patches partly hatched.
Mar. 14, 1912	33 $\frac{1}{3}$ % oil.....	25	Apparently no benefit.†
Mar. 14, 1912	25 % oil.....	25	Very few eggs hatched; good results.
Mar. 14, 1912	12 $\frac{1}{2}$ % oil.....	25	Little if any benefit.
Mar. 14, 1912	10 % oil.....	25	Very few eggs hatched; good results.
Mar. 14, 1912	5 % oil.....	25	Little if any benefit.
Mar. 29, 1895	66 $\frac{2}{3}$ % oil.....	4	No eggs hatched.
Mar. 29, 1895	33 $\frac{1}{3}$ % oil.....	4	No eggs hatched.
Mar. 29, 1895	16 $\frac{2}{3}$ % oil.....	5	No eggs hatched.
Mar. 29, 1895	8 $\frac{1}{3}$ % oil.....	5	No eggs hatched.
Mar. 29, 1895	4 1-6% oil.....	6	No eggs hatched.
Apr. 11, 1894	33 $\frac{1}{3}$ % oil.....	9	Two patches partly hatched.

\* Untreated eggs of this date did not hatch well, but a careful comparison indicates that the treatment was not effectual.

† An excess of soap was used in making this emulsion, and a heavy greasy coating, which seemed to help hatching, was left on the twigs.

## KEROSENE EMULSION.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Apr. 11, 1894	16 $\frac{2}{3}$ % oil.....	11	About two-thirds of the eggs hatched.
Apr. 11, 1894	11 1-10% oil.....		About three-fourths of the eggs hatched.
Apr. 11, 1894	7 2-5% oil.....		Nearly all the eggs hatched.
Apr. 29, 1895	16 $\frac{2}{3}$ % oil.....	3	No eggs hatched.
Apr. 29, 1895	8 $\frac{1}{3}$ % oil.....	2	Nearly all hatched.
Apr. 29, 1895	11 1-10% oil.....	3	No eggs hatched.
Apr. 13, 1895	33 $\frac{1}{3}$ % oil.....	7	No eggs hatched.
Apr. 13, 1895	16 $\frac{2}{3}$ % oil.....	6	Scattering eggs hatched.
Apr. 13, 1895	8 $\frac{1}{3}$ % oil.....	5	Four patches hatched.
Apr. 13, 1895	4 1-6% oil.....	6	All patches hatched.
Apr. 13, 1895	2% oil.....	6	All patches hatched.
Apr. 13, 1895	1% oil.....	7	Six patches hatched.
Apr. 13, 1895	11 1-10% oil.....	6	All patches hatched.
Apr. 13, 1895	5 $\frac{1}{2}$ % oil.....	2	Hatched partly.

## HEAVY LIME WHITEWASH.

Jan. 26, 1912	1 lb. lime, 1 gal. water...	25	Larvæ failed to emerge from well-coated masses.
Jan. 26, 1912	1 lb. lime, 2 gals. water...	25	Larvæ failed to emerge from well-coated masses.
Jan. 26, 1912	1 lb. lime, $\frac{1}{2}$ gal. water...	25	Larvæ failed to emerge from well-coated masses.
Mar. 14, 1912	1 lb. lime, 2 gals. water...	25	Larvæ failed to emerge from well-coated masses.
May 2, 1895	(Thick coating).....		Killed nearly all; worms ate through eggs, but not lime.
May 3, 1895	(Thin coating).....	9	About three-fourths of larvæ died in eggs.
Apr. 30, 1895	.....		Larvæ were nearly all destroyed in attempting to eat through the lime.

## LIME AND SULFUR (COMMERCIAL).

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Jan. 26, 1912	1 part to 1 part of water	25	All egg masses hatched partly, but not over 25% of all larvæ emerged; many died in shell; results with this excessive strength were poor.
Jan. 26, 1912	1 part to 3 parts of water	25	About 50% of all eggs hatched.
Jan. 26, 1912	1 part to 5 parts of water	25	Large percentage hatched; no benefit indicated.
Jan. 26, 1912	1 part to 7 parts of water	25	About 96% of patches hatched partly or altogether.
Jan. 26, 1912	1 part to 10 parts of water	25	Large percentage hatched; no benefit.
Mar. 14, 1912	1 part to 5 parts of water	25	Large percentage hatched; no benefit.
Mar. 14, 1912	1 part to 7 parts of water	25	Large percentage hatched; no benefit.
Mar. 14, 1912	1 part to 10 parts of water	25	Large percentage hatched; no benefit.

## BLACK LEAF 40.

Jan. 26, 1912	1 part to 100 parts of water	25	Eggs hatched freely; little if any benefit.
Jan. 26, 1912	1 part to 200 parts of water	25	Eggs hatched freely; at least 75%.
Jan. 26, 1912	1 part to 300 parts of water	25	Eggs hatched freely; no good.
Jan. 26, 1912	1 part to 400 parts of water	25	Eggs hatched freely; no good.
Jan. 26, 1912	1 part to 500 parts of water	25	Eggs hatched freely; no good.
Mar. 14, 1912	1 part to 400 parts of water	25	Eggs hatched freely; no good.
Mar. 14, 1912	1 part to 500 parts of water	25	Eggs hatched freely; no good.

## BLACK LEAF 40 AND SOAP.

Jan. 26, 1912	1-100 plus soap.....	25	Eggs hatched freely; no good.
Jan. 26, 1912	1-200 plus soap.....	25	Eggs hatched freely; no good.
Jan. 26, 1912	1-300 plus soap.....	25	Eggs hatched freely; no good.
Jan. 26, 1912	1-400 plus soap.....	25	Eggs hatched freely; no good.
Jan. 26, 1912	1-500 plus soap.....	25	Eggs hatched freely; no good.
Mar. 14, 1912	1-400 plus soap.....	25	Eggs hatched freely; no good.
Mar. 14, 1912	1-500 plus soap.....	25	Eggs hatched freely; no good.



## NICOFUME.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Jan. 26, 1912	1 part to 500 parts water . . .	25	Practically 100% of eggs hatched.
Jan. 26, 1912	1-500 plus soap. . . . .	25	Practically 100% of eggs hatched.

## ZINC ARSENITE.

Jan. 26, 1912	1 lb. to 20 gals. water . . . . .	25	Slight benefit.*
Jan. 26, 1912	1 lb. to 30 gals. water . . . . .	25	Slight benefit.*
Jan. 26, 1912	1 lb. to 40 gals. water . . . . .	25	No indication of any larvæ dying.

## PARIS GREEN.

Jan. 26, 1912	1 lb. to 35 gals. water . . . . .	25	Slight benefit indicated by dead larvæ.
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## PARIS GREEN AND FLOUR.

Jan. 26, 1912	1 lb. to 25 gals. water . . . . .	25	No indication of any larvæ dying.
Jan. 26, 1912	1 lb. to 50 gals. water . . . . .	25	No indication of any larvæ dying.
Apr. 13, 1894	1 lb. to 25 gals. water . . . . .	25	No benefit.

COOPER V<sub>1</sub> TREE SPRAY.

Jan. 26, 1912	½ pint to 3 gals. water . . . . .	25	Practically 100% of eggs hatched.
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## APHINE.

Mar. 14, 1912	1 part to 10 of water . . . . .	25	Practically 100% of eggs hatched.
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## W. H. BOGART'S SOLUBLE SULFUR.

Mar. 14, 1912	1 part to 8 of water . . . . .	25	Little if any benefit.
Mar. 14, 1912	1 part to 16 of water . . . . .	25	Little if any benefit.
Mar. 14, 1912	1 part to 20 of water . . . . .	25	Little if any benefit.
Mar. 14, 1912	1 oz. to 10 of water, salt 1 oz.	25	Perfect results; none hatched.
Mar. 14, 1912	1 oz. to 20 of water, kerosene† ½ oz. . . . .	25	A few eggs hatched; apparently much benefit.
Mar. 14, 1912	1 oz. to 20 of water, kerosene 2 oz. . . . .	25	Apparently no benefit.

\* A number of larvæ found dead after they had emerged, indicating that they eat the portion of the shell chewed off during emergence.

† A stable emulsion was made with the soluble sulfur, no soap being required.

## HYDROCYANIC ACID GAS.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Mar. 14, 1912	1 oz. cyanide of potassium, 2 oz. sulfuric acid, 4 oz. water, to 100 cubic feet of space.....	25	Eggs hatched freely after an exposure of one hour in a tight box containing the gas.

## BLACK LEAF 40 AND KEROSENE EMULSION.

Mar. 14, 1912	Black Leaf 40, 1-500 containing 2% kerosene....	25	Apparently no benefit.
Mar. 14, 1912	Black Leaf 40, 1-1000 containing 2% kerosene....	25	Little if any benefit.

## WHALE-OIL SOAP.

Mar. 30, 1895	1 lb. to 1 gal. water.....	.....	All eggs hatched; no benefit.
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## ARSENIC PASTE.

Apr. 5, 1895	1 lb. to 4 gals. water .....	.....	No benefit.
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## CORROSIVE SUBLIMATE.

Apr. 2, 1895	1-10 and 1-20 strength ...	.....	Practically all eggs hatched.
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## CRUDE CARBOLIC ACID.

Mar. 31, 1894	1 part to 50 parts water ...	.....	Very few eggs hatched.
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## LYE.

Mar. 28, 1895	Lye 1 lb. water 2 gals.....	3	All eggs hatched.
Mar. 30, 1895	Lye 1 lb., water 1 gal.....	3	Two out of three patches hatched.
Mar. 30, 1895	Lye 1 lb., water 2 gals.....	2	One hatched; other did not.
Mar. 30, 1895	Lye 1 lb., water 4 gals.....	2	All eggs hatched.

## TOBACCO AND LYE.

Mar. 30, 1895	Various strengths.....	21	All eggs hatched.
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## TOBACCO DECOCTION.

Mar. 23, 1895	1 lb. tobacco, 2 gals. water.....	.....	No benefit from either strength.
Mar. 23, 1895	1 lb. tobacco, 4 gals. water.....	.....	No benefit from either strength.
Mar. 28, 1895	1 lb. tobacco, 1 gal. water.....	.....	No benefit from either strength.
Mar. 28, 1895	1 lb. tobacco, 2 gals. water.....	.....	No benefit from either strength.

## KEROSENE EMULSION AND TOBACCO.

Date of Treatment.	Strength.	Egg Patches Treated.	Notes.
Mar. 30, 1895	66 $\frac{3}{4}$ % plus tobacco.....	10	None hatched.
Mar. 30, 1895	33 $\frac{1}{4}$ % plus tobacco.....	10	None hatched.
Mar. 30, 1895	16 $\frac{3}{4}$ % plus tobacco.....	11	Hatched partly.
Mar. 30, 1895	8 $\frac{1}{4}$ % plus tobacco.....	16	Hatched partly.
Mar. 30, 1895	4 1-6% plus tobacco.....	11	All eggs hatched.
Apr. 13, 1895	16 $\frac{3}{4}$ % plus tobacco.....	6	Two patches hatched.
Apr. 13, 1895	11 1-10% plus tobacco.....	6	Most of the eggs hatched.
Apr. 13, 1895	8 $\frac{1}{4}$ % plus tobacco.....	7	Four patches hatched.
Apr. 13, 1895	5 $\frac{1}{2}$ % plus tobacco.....		All eggs hatched.

## CHECKS.

Apr. 25, 1895	No treatment.....	20	Twelve patches completely hatched; three did not hatch at all, and the rest partly.
Jan. 26, 1912	No treatment.....	75	At least 75% of all eggs hatched.
Mar. 14, 1912	No treatment.....	50	At least 50% of all eggs hatched.*
Mar. 14, 1912	No treatment.....	25	Failed to hatch at all.

\* The last eggs gathered did not hatch as freely as the earlier ones, due probably to their getting too hot and scalding in insectary.

*Lime and Sulfur.*—It is surprising to note that lime and sulfur did not prove beneficial, even when applied very much stronger than it is ever used in the orchard for combating scales and other insects. Fifty egg masses were treated with the home-prepared lime-sulfur spray at six times the ordinary strength. Much to our surprise, these eggs hatched freely. In fact, they began hatching before those that received no treatment whatever, and did not cease until quite a large percentage of the larvæ had safely emerged. From this excessive strength down to the ordinary strength used in the orchard—viz., 1 pound lime, 1 pound sulfur, and 3 gallons water—the treatments were all unsatisfactory in their results, and while a few eggs were prevented from hatching by the stronger mixtures, there was not a large enough percentage destroyed in any case to justify a treatment with lime and sulfur. As mentioned previously, there seemed to be a tendency for lime and sulfur to hasten the hatching of the eggs, and all eggs in experiments with this material hatched more quickly than those treated with other preparations or not treated at all. On the other hand, the oil sprays seemed to have more or less of a retarding effect. In all cases this apparently held true, and while the reason for some sprays hastening the hatching time could not be determined, the fact is none the less interesting.

A commercial lime and sulfur preparation manufactured by The Dow Chemical Company was also applied. This material gave a density test of 34° Baume at 65° F., indicating that it was an excellent product. Yet it failed to kill more than 75 per cent of the larvæ, a few hatching from every egg mass treated with it at the excessive strength of equal parts of the lime-sulfur and water. When used at the strength of one part of lime and sulfur to three parts of water, there were close to 50 per cent of the eggs killed; weaker than this, it could not be seen that any good whatever was accomplished. These experiments gave absolutely no hope for this spray being of any use in the orchards, where it was, nevertheless,

tried just as carefully as though no preliminary work had been done with it. The same unsatisfactory results were attained, and are recorded later in this paper. The failure of so strong a spray to affect the eggs to any great extent was somewhat discouraging.

*Black Leaf 40 and Other Tobacco Preparations.*—It was thought that soap used with Black Leaf 40 would make it penetrate better and possibly destroy the eggs. There seemed to be no difference in using it with or without the soap, neither being able to penetrate the tough coating which covers the egg masses, though Black Leaf and Black Leaf 40 have been found to be quite effective in destroying eggs of certain of the plant lice.

*Arsenicals.*—While watching a number of larvæ eat their way from the eggs, it was thought that they ate more or less of the portion of the cap gnawed away in making the hole through which emergence of the worm would take place. If this was the case, it might be possible to coat the egg masses with a strong arsenical, so as to kill them. It will be noticed in the table that some benefit is indicated from the use of zinc arsenite at the proportion of 1 pound to 20 and 1 pound to 30 gallons of water. Many larvæ were found dead on the twigs after they had emerged from eggs treated in this manner, and in the case of the stronger mixture, 1 to 20, not a single living larva was seen at any time. In all cases where hatching was going on, there were a great many larvæ that could be seen hanging to their webs on the inside of the cages. This might be accounted for by the fact that quite a large percentage of the eggs in this cage failed to hatch for some unknown reason. At one time nine dead larvæ were taken from the cage treated with a 1-to-30 mixture. These were all on the bark of the twigs, close to the egg masses from which they had come.

While these experiments indicated that considerable good would result from an arsenical spray upon the egg masses, a subsequent test in the orchard failed to give any appreciable benefit. At least, the number of larvæ destroyed in this manner is not sufficient to justify a recommendation of the practice.

*Soluble Sulfur Compound (Bogart's).*—This material was sent to us for experimental purposes by the manufacturer, W. H. Bogart, of 24 Grove Street, New York. Absolutely nothing was known about its value, but it was tried along with other things. When diluted by itself, it did no good whatever, but in one case where twenty-five egg masses were treated with 1 ounce of compound to 10 ounces of water and 1 ounce of salt, not a single egg hatched. While the result seems decisive, we cannot draw a conclusion from the one test, and that was all that was made. In every other case, however, eggs treated at the same time, with different strengths of the same material without salt, hatched freely.

*Hydrocyanic Acid Gas.*—The effect of fumigation with the hydrocyanic acid gas was tested upon the eggs, principally because of the fact that nursery stock fumigation is required in Colorado by law, and it should be known whether or not the leaf-roller eggs could be killed by this fumigation.

A tight box was secured for the work, and twenty-five egg masses were treated with the ordinary strength of the gas—that made by using 1 ounce of cyanide of potassium, 2 ounces of sulfuric acid, and 4 ounces of water to 100 cubic feet of space. The box containing eggs was closed after generating the gas, for an hour. The eggs hatched quite freely, thus indicating that the ordinary fumigation of nursery stock is not sufficient to guard against the introduction of this pest into uninfested sections through the shipment of trees containing egg patches. It will be necessary to do further experimental work along this line before definite conclusions can be reached.

*Kerosene Emulsion.*—The most promising insecticide used in the insectary experiments was kerosene emulsion. The perplexing thing about

the treatment with this substance is the conflicting results attained with different treatments of the same material applied in practically the same way. In some cases, a certain strength was found to kill perfectly; in others, it would do little if any good. This may be accounted for partly by the fact that it is difficult to make a uniform emulsion, and while one batch may be just right, another may not be so satisfactory. This would not seem to be sufficient, however, to explain some of the conflicting results that have been met with in the work with this material.

Enough experiments were carried through so that it is reasonably safe to draw some definite conclusions and to say that kerosene emulsion may be successfully used in destroying the egg masses of this insect.

It may be seen from the foregoing table that strengths varying from 2 to 66 2-3 per cent oil were tried. Only in two cases did a strength greater than 16 2-3 per cent fail to give results, and in each case, strange to say, the failure was with a 33 1-3 per cent emulsion. In most cases a lower strength than 16 2-3 per cent did little good.

While results with kerosene emulsion were variable, the complete control that usually resulted from an emulsion that was just right made it seem worth while to follow up the egg experiments with oil emulsions in the orchard. This was done, and with what success is told later in this bulletin.

*Lime Whitewash.*—Hatching of eggs was largely prevented by an application of a thick coating of whitewash. The little larvæ were able to eat through the cap of the egg beneath the whitewash, but died in the attempt to gnaw through the lime with their mandibles. Egg masses that were completely covered with a coating of this material were examined after hatching time. When the lime was scaled off, the eggs appeared to the naked eye as though hatched, but there were no holes in the lime through which the larvæ could have escaped. An examination of such egg masses with a hand lens showed that in each egg there was the little dried-up body of a larva which had been killed in its attempt to escape from the egg.

Whether or not this method of combating the insect could be used to practical advantage in the orchard, we are unable to say. It is possible that by applying such a whitewash shortly before egg-hatching time, and using something in it to make it stick, the results would justify the treatment. It is very hard, however, to make a plain lime whitewash stick during showery weather, and unless it happened to be dry during the time that the spray was needed to coat the eggs, there would probably be little good accomplished. There are formulæ for making a whitewash spray that is quite tenacious, and it is possible that such might be of value in this work. Probably one of the best of these is the one known as the California formula, which is a mixture of quicklime, tallow, salt, and water, in the following proportions:

Quicklime .....	30 lbs.
Tallow .....	4 lbs.
Salt .....	5 lbs.
Water.....	Enough to make mixture flow well

(Copied from Paddock and Whipple's "Fruit Growing in Arid Regions.")

We have never tested this whitewash in our leaf-roller work in Colorado, and are not recommending it as a sure cure for this pest; but as it is certain that a heavy coating of whitewash does much good, there might be those who would want to try out this preparation.

*Checks.*—About 150 egg masses were left without treatment in the 1912 experiments, so that a comparison might be made between treated

and untreated masses. In January, when the first work was done, seventy-five of these masses were left without treatment, and again in March the same number was left. In each case twenty-five egg masses were kept by themselves, so there were six different lots of checks. Out of five lots practically all eggs hatched, but out of the sixth not a single egg hatched. The reason for this we were not able to determine.

The eggs which were treated on January 26, and which were taken from the orchard shortly before this time hatched well.

*Conclusions from Insectary Experiments.*—While some of the experiments were not extensive enough for definite conclusions, the following seem justifiable.

1. Leaf-roller eggs possess a remarkable resistance to injury by practically all of our well-known contact sprays.
2. Lime and sulfur preparations, either home-prepared or of commercial manufacture, give little, if any, benefit even when used in excessive strengths.
3. Kerosene emulsion containing 16 2-3 per cent oil, or more, usually kills the eggs well, but under certain conditions, which we cannot explain, higher strengths may fail to do so. On the other hand, a weaker strength will often do the work well.
4. A thick coating with a lime whitewash will keep the larvæ from emerging from the eggs. It must be sufficient to cover the surface of the egg mass entirely.
5. "Black Leaf 40," "Nicofume," and other tobacco preparations, used alone or with soap, were of no value.
6. Strong arsenical sprays used to coat the egg masses may be of some benefit, but probably not enough to justify their use.
7. Whale-oil soap, lye, corrosive sublimate, Cooper V<sub>1</sub> Tree Spray, Aphine, and hydrocyanic acid gas gave little or no protection.

#### ORCHARD EXPERIMENTS

The great abundance of eggs that were laid in Canon City orchards during the summer of 1911 made conditions most favorable for outdoor experiments during the spring of 1912. In searching for an orchard in which to conduct these experiments, the ideal in mind was the one containing the most egg masses. While there were other orchards in the vicinity besides the one chosen where eggs were abundant, none could be found where there seemed to be more on an average per tree.

This orchard was not sprayed at all during the season of 1911, and the number of egg patches was so great that, if a reasonable number of them should hatch, there would be enough worms to defoliate practically the entire orchard.

An idea of the abundance of these egg patches may be gained from figures secured by counting the number that occurred on the trunks and limbs of two ordinary-sized trees (about twelve years old), to a height of five feet from the ground. One tree had on it 200, and the other 305 egg patches. The number of eggs in twenty of these was counted, and was as follows: 26, 48, 48, 60, 65, 80, 55, 30, 55, 70, 78, 28, 52, 53, 51, 30, 54, 75, 23, 53; or an average of 51 eggs per mass. Multiplying the number of masses counted by the average number of eggs in a mass, we get the startling number of 25,755 worms which might hatch on the first five feet of the two trees. This number, however, does not nearly tell the real story; for, besides the patches on the first five feet of the tree, there were hundreds higher up, not only on the larger limbs, but on the small twigs as well. The abundance of egg masses on small twigs was noted in an orchard being pruned last spring near Pueblo. In this orchard there were more egg patches on the twigs than on the trunks and basal portion of the large limbs, and no doubt this condition is the usual one.

In figure of Plate I, thirty-five egg masses may be counted in a space of about twelve square inches. These eggs were photographed shortly after hatching time on the back of a tree in the experimental orchard.

These figures are given so that one may better appreciate the tremendous numbers of larvae that feed upon the foliage and fruit of badly infested trees. Of course, it is true that every egg does not hatch, but observations on the patches on untreated trees in the Canon City experimental orchard indicated that practically all hatched last season.

The plot where our experimental spraying was done at Canon City is situated in a location known as Lincoln Park, and is owned by Mrs. H. M. McDonald. Her father, Mr. Z. D. Barnhardt, manages the place, and he and his wife we shall frequently speak of it as the Barnhardt place. Many thanks are due these people for their kindness in giving us full charge of the spraying of their trees, as well as other favors shown during the time that our experiments were being conducted. Others who aided in the work, and who deserve public thanks are: County Inspector A. S. Taylor, whose practical knowledge of orchard work made him a valuable assistant; The Guthrie Chemical Company, of Grand Junction, which donated part of all of the arsenate of lead used in the experiment; The Sheehan-Wilson Company, for donations of lime and sulfur, lead arsenate, and zinc arsenite; The Kentucky Tobacco Product Company, for donations of lead lead oil; The Horticultural Chemical Company, of Philadelphia, for lead oil; and The California Spray-Chemical Company, for a sample of D.D.T.

A plan of a portion of the orchard used in experiment is shown in Plate III. The following tables give data, regarding treatments. By the use of the plan and the tables it may be determined when and with what material a tree was sprayed, and the percentage of leaf surface destroyed by the codling-moth.

NOTES ON EXPERIMENTAL ORCHARD

By the use of these records and the plan of the Barnhardt orchard (Plate III), the dates of spraying and treatments given every tree can be ascertained.

Row 1 and 2

Trees 1 and 2 sprayed on April 16 with Target Brand oil emulsion, 1 part to 10 parts water.

Row 3

Trees 3-5. No spray until May 25, when regular codling-moth calyx spray was applied.

Trees 6-7. Sprayed April 16 with Target Brand oil emulsion, 1 part to 10 parts water.

Trees 8-12. Sprayed April 16 with zinc arsenite, 1 pounds to 100 gallons water.

Row 4

Trees 1-3. No spray until May 25, when regular codling-moth calyx spray was applied.

Trees 4-7. Sprayed April 16 with Target Brand oil emulsion, 1 part to 10 parts water.

Trees 8-12. Sprayed April 16 with zinc arsenite, 1 pounds to 100 gallons water.

Row 5

Trees 1-5. Uncertain treatment.

Trees 6-10. Sprayed May 2 with zinc arsenite, 1 1/2 pounds to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with zinc arsenite, 2 pounds to 100 gallons water.

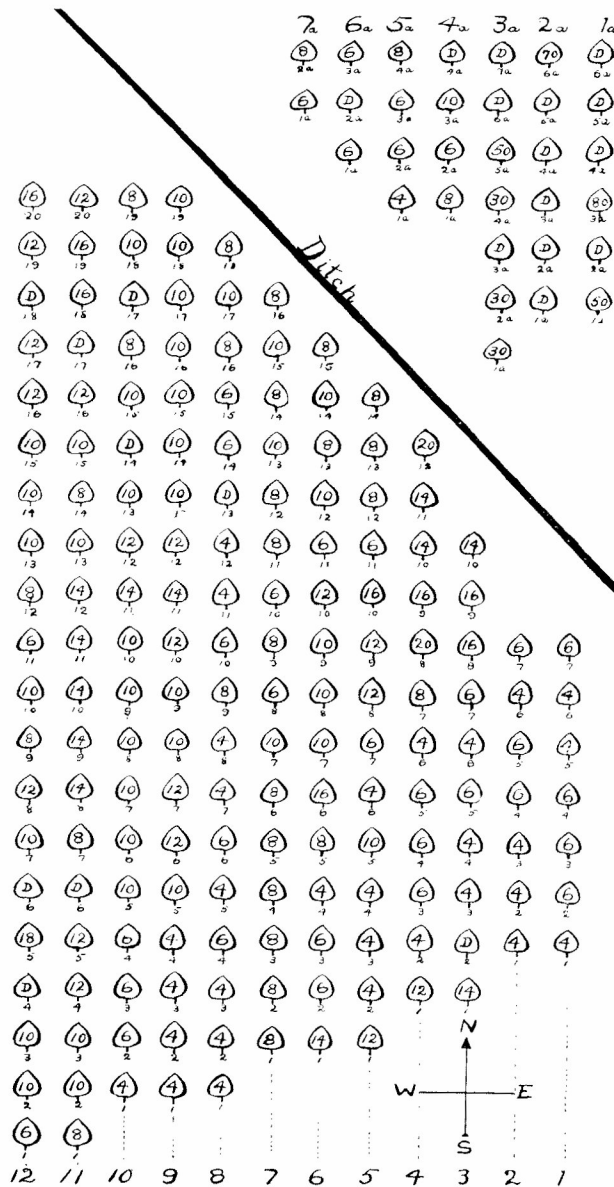


PLATE III.

The percentages of leaf surface destroyed are indicated by figures in the above characters representing trees. Rows of the orchard south of the ditch are numbered at bottom from 1 to 12. Rows of portion north of ditch are numbered at top from 1a to 7a. Each tree is numbered from south to north by a figure just underneath. D means that space either contains no tree or a dead one.

Trees 11-13: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

Tree 14: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

*Row 6*

Trees 1-10: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

Trees 11-13: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

Trees 14-15: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 treatment uncertain; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

*Row 7*

Trees 1-5: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 6-7: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 8-11: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 12-16: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with zinc arsenite, 1¾ pounds to 100 gallons water.

*Row 8*

Trees 1-5: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 6-9: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 10-13: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 14-16: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with zinc arsenite, 2½ pounds to 100 gallons water.

Trees 17-18: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1 pound to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.



*Row 9*

Trees 1-3: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 17 with Paris Green, 1½ pounds, and lime, 5 pounds, to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Tree 4: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Trees 5-10: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with zinc arsenite, 1½ pounds to 100 gallons water.

Trees 11-19: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.

*Row 10*

Trees 1-3: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1½ pounds to 100 gallons water; May 17 with Paris green, 1 pound, and lime, 5 pounds, to 100 gallons water; May 25 with lead arsenate, 6 pounds to 100 gallons water.

Tree 4: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1½ pounds to 100 gallons water; May 17 with Paris green, 1 pound, and lime, 5 pounds, to 100 gallons water; May 25 with zinc arsenite, 1½ pounds to 100 gallons water.

Trees 5-9: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water, and Black Leaf 40, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 4 pounds to 100 gallons water; May 25 with zinc arsenite, 1½ pounds to 100 gallons water.

Trees 10-11: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 2½ pounds to 100 gallons water; May 25 with zinc arsenite, 1½ pounds to 100 gallons water.

Trees 12-19: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water; May 17 with zinc arsenite, 2½ pounds to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.

*Row 11*

Trees 1-2: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 17 with Paris green, 1 pound, and lime, 5 pounds to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.

Trees 3-7: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.

Trees 8-13: Sprayed May 5 with zinc arsenite, 3½ pounds to 100 gallons water; May 25 with lead arsenate, 3½ pounds to 100 gallons water, and zinc arsenite, 1 pound to 100 gallons water.

Trees 14-17: Sprayed May 5 with zinc arsenite, 3½ pounds to 100 gallons water; May 25 with zinc arsenite, 2 pounds to 100 gallons water, and Black Leaf 40, ½ pound to 100 gallons water.

Trees 18-20: Sprayed May 5 with zinc arsenite, 1½ pounds to 100 gallons water, and Black Leaf 40, ½ pound to 100 gallons water.

*Row 12*

Trees 1-2: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 17 with Paris green, 1 pound, and lime, 5 pounds, to 100 gallons water; May 25 with lead arsenate (powdered), 3½ pounds to 100 gallons water.

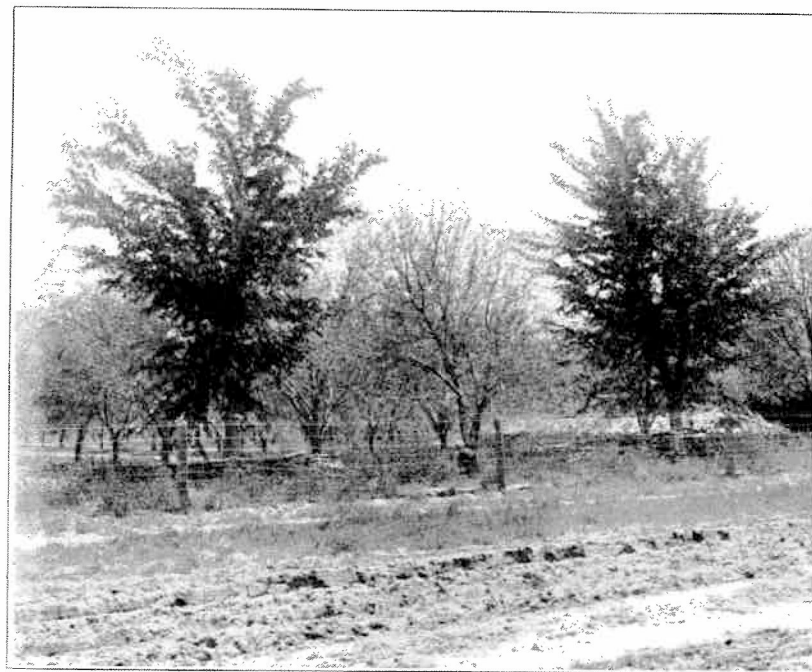
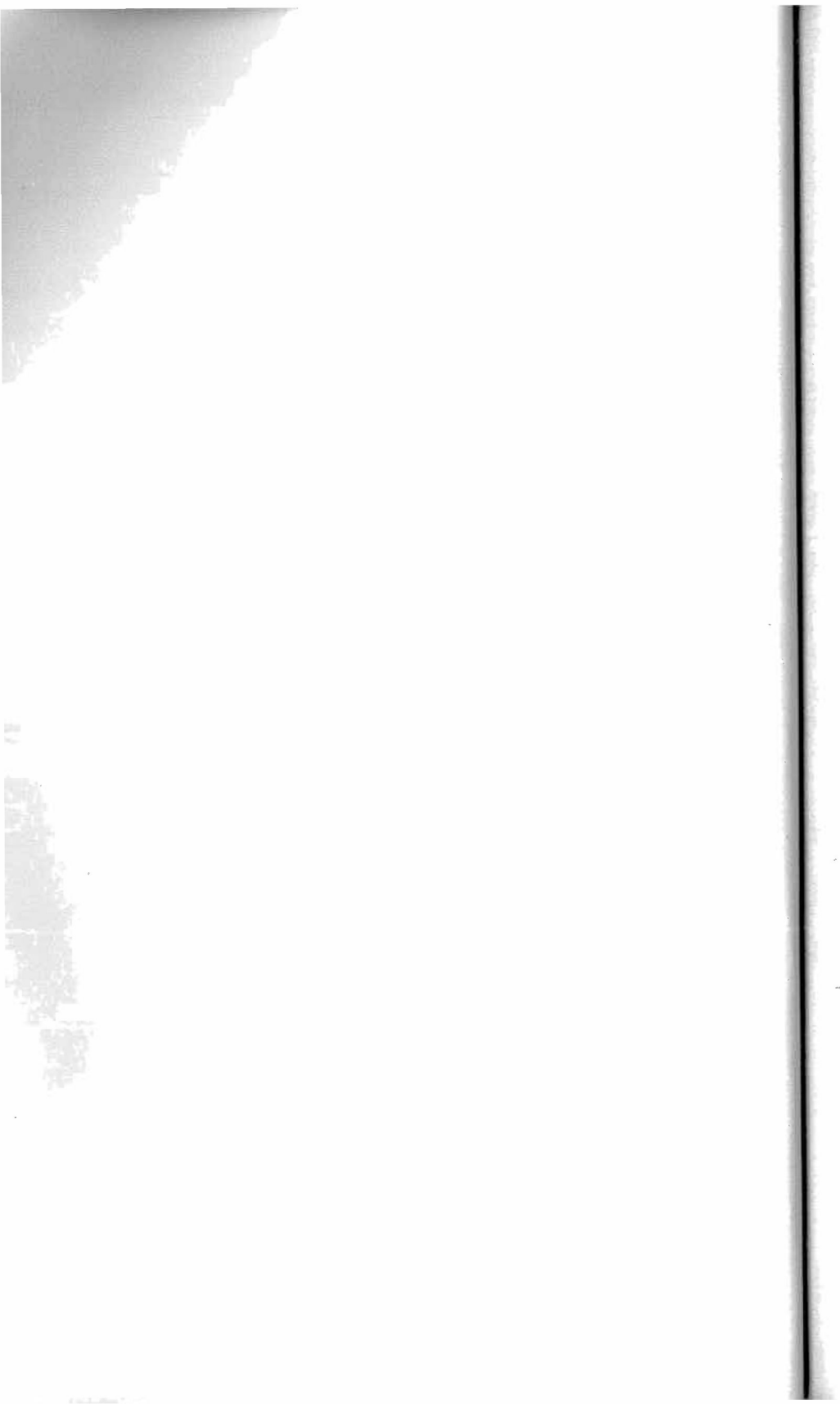


PLATE IV.

Upper picture, spraying in Barnhardt orchard on April 16, 1912; lower picture, general view of orchard in which tree in Plate VIII was photographed. The trees with heavy foliage are elms, and were not attacked by leaf-roller.



Trees 3-6: Sprayed May 5 with lead arsenate, 6 pounds to 100 gallons water; May 25 with lead arsenate (powdered),  $3\frac{1}{2}$  pounds to 100 gallons water.

Trees 7-11: Sprayed May 5 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with lead arsenate,  $3\frac{1}{2}$  pounds to 100 gallons water, and zinc arsenite, 1 pound to 100 gallons water.

Trees 12-17: Sprayed May 5 with zinc arsenite, 2 pounds to 100 gallons water; May 25 with zinc arsenite, 2 pounds to 100 gallons water, and Black Leaf 40,  $\frac{1}{2}$  pound to 100 gallons water.

Trees 18-20: Sprayed May 5 with zinc arsenite,  $1\frac{1}{2}$  pounds to 100 gallons water; May 25 with zinc arsenite, 2 pounds to 100 gallons water.

*Row 1a*

Trees 1a and 3a: Unsprayed.

*Row 2a*

Tree 6a: Unsprayed.

*Row 3a*

Trees 1a, 2a, 4a and 5a: Unsprayed.

*Row 4a*

Trees 1a-3a: Sprayed May 5 with Black Leaf 40, 1 pound to 100 gallons water; May 25 with Black Leaf 40, 1 pound to 100 gallons water.

*Row 5a*

Trees 1a-4a: Sprayed May 5 with Black Leaf 40, 1 pound to 100 gallons water; May 25 with Black Leaf 40, 1 pound to 100 gallons water.

*Row 6a*

Trees 1a-3a: Sprayed May 5 with Black Leaf 40, 1 pound to 100 gallons water; May 25 with Black Leaf 40, 1 pound to 100 gallons water.

*Row 7a*

Trees 1a-2a: Sprayed May 5 with Black Leaf 40, 1 pound to 100 gallons water; May 25 with Black Leaf 40, 1 pound to 100 gallons water.

Work began in the orchard on April 16, when applications of lime and sulfur, soluble oil, kerosene emulsion and zinc arsenite were made. Spraying was very carefully done with a "Friend" power sprayer (Plate IV), engaged especially for the experimental work. A discussion of these different sprays applied to the eggs follows:

*Lime and Sulfur.*—The failure of the lime-and-sulfur sprays to kill many eggs, when applied in the insectary, did not convince us that the same would hold true in the orchards, if an application were thoroughly made shortly before hatching time. Hence a barrel of concentrated lime and sulfur, donated to us by The Sherwin-Williams Company, was applied at the following strengths: 1-8 and 1-9. This material tested 33° Baume at a temperature of about 60°. As thorough an application as possible was made to a block of medium-sized trees, and from eight to ten gallons was used per tree. These trees were not over twelve to fourteen years old, and many were quite small, so the amount used was enough for very thorough work.

The results of this lime-and-sulfur test tallied exactly with those secured from the insectary work. So far as could be determined, there was absolutely no benefit from this material in killing leaf-rollers. Some of the sprayed trees had Putnam scale on them, so the material was probably not entirely wasted.

Many people in the infested region had previously used lime and sulfur, and claimed no benefit from the treatment, and while in most cases they did not use enough liquid for thorough spraying, their claims were undoubtedly well founded.

The lime-and-sulfur sprayed trees were in another part of the orchard than those treated with soluble oil and arsenicals, and are not included in the plat.

*Soluble Oil.*—The insectary experiments had indicated that the only material that would penetrate through the tough, almost impervious, coating of the egg patches was oil in some form or other. Ten gallons of Target Brand Scale Destroyer was donated for a test by The Horticultural Chemical Company of Philadelphia. Previous experience with soluble oils in Colorado had proven that they are not wholly miscible in water heavily impregnated with alkali. This material mixed splendidly with the ditch water we used in this case, which was probably not excessively alkaline. The ten gallons of oil was mixed with about 190 gallons of water, and twenty-five trees were sprayed with this amount, making an average of eight gallons applied per tree.

The result of this experiment was entirely satisfactory. When the eggs first began to hatch on other trees, it soon became apparent that they were not hatching on those sprayed with oil. Thinking that possibly the oil retarded their hatching and that they would hatch later, a careful watch was kept over them. On April 30, eighty egg masses were cut from these trees and taken to Fort Collins. An examination some weeks later showed that out of the total number of patches only 5 per cent began to hatch, and out of the 5 per cent in which some hatching took place only a very few of the eggs were good. While 95 per cent of the egg patches failed to hatch at all, much more than 95 per cent of the entire number of eggs were destroyed. A careful examination of these trees in the orchard from time to time during the season indicated that this percentage was nearly right, and that more than ninety-five out of every hundred eggs treated with Target Brand failed to bring forth a leaf-roller larva. On one tree, on a space of bark not more than twelve square inches in size, thirty egg masses were counted, and not a single egg had hatched from any of these. This tree is the one shown in figure 2, Plate V. No such condition could anywhere be found upon trees not sprayed with oil.

Unfortunately there was a very light crop of fruit set on trees in the experimental orchard, and the amount of fruit that was saved by the different sprays cannot be estimated accurately. On a few trees in this experiment there was considerable fruit, none of which was injured in the least by leaf-rollers. It may be safely stated that, had there been a good crop of fruit on these trees sprayed with the soluble oil, there would have been no appreciable loss from the leaf-roller.

A careful examination was made of each tree in the orchard on June 20, after the work of the rollers was practically over for the season, and the amount of leaf surface destroyed was estimated. While no very accurate means of making such an estimate could be used, the relative injury to the trees sprayed and those unsprayed could be estimated quite well in this way. Plates V and VI show four trees, two sprayed with Target Brand Scale Destroyer and two checks. Figures 2, Plates V and VI, are the sprayed trees; figure 2, Plate V, was estimated as having 4 per cent of its foliage destroyed, and figure 1, Plate V, 50 per cent. These trees appear in the photograph just as they did when the estimate was made, the picture having been taken on June 8. The other two trees show the same striking difference.

The plat of orchard (Plate III) shows the percentage of foliage destroyed on each tree in the orchard. By the use of the plat and the

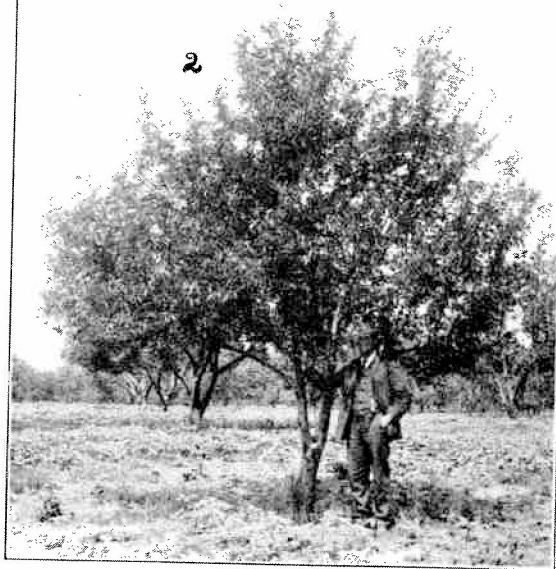
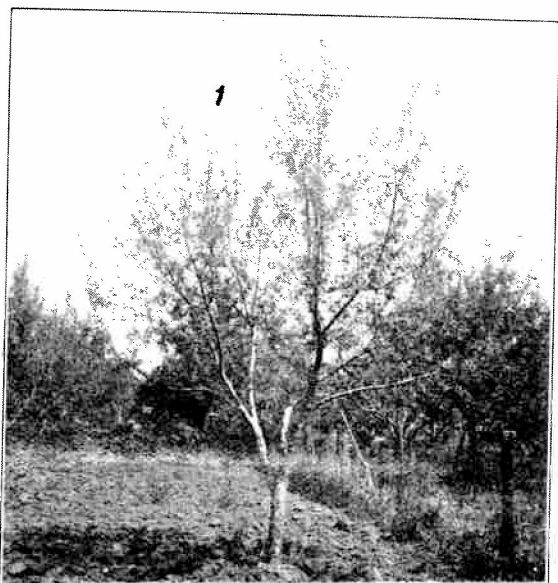
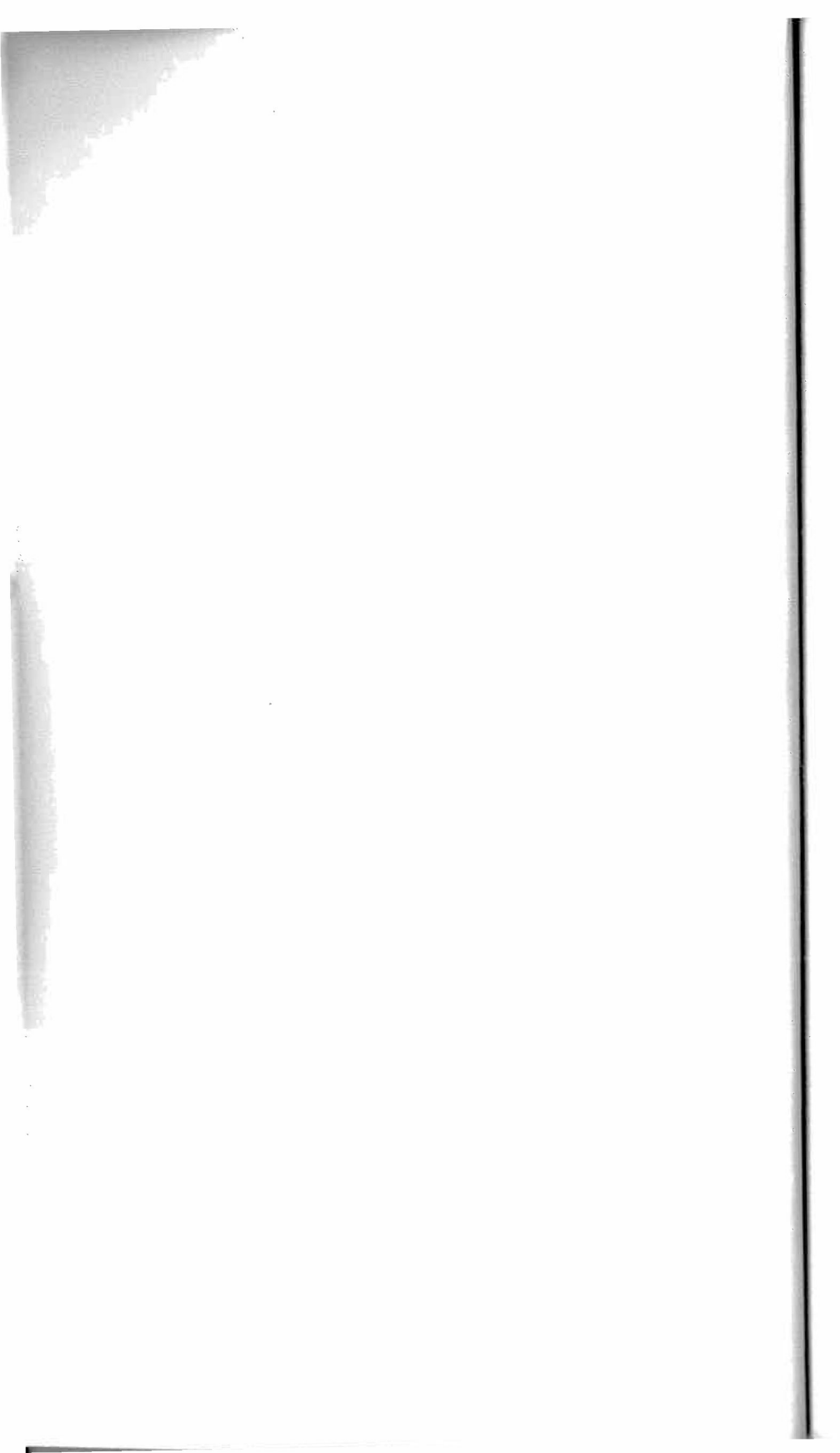


PLATE V.

Figure 1, unsprayed tree in Barnhardt orchard, photographed on June 8; figure 2, tree sprayed with Target Brand soluble oil, photographed on same date.



record of each tree which immediately follows, it may be seen that the twenty-three trees that received only a soluble-oil spray prior to the first arsenical spray for codling-moth were in splendid foliage when the damage was estimated, and this was at a time when the untreated and poorly sprayed trees presented the worst appearance of the season. The pictures in figures 1 and 2, Plates V and VI, were taken twelve days earlier, and the foliage of the sprayed trees remained as good throughout the season as it was when photographed. The last visit was made to this orchard on August 9. A few of the trees were then found to have considerable fruit, practically all of which was uninjured by the leaf-roller, but badly injured by the codling-moth.

Dr. Allan Bell, who owns an orchard in Lincoln Park, sprayed a few trees in the early spring with Scalecide soluble oil, using it at two strengths—viz., 1-12 and 1-15. Both strengths killed the eggs well, and, considering the fact that only about five gallons of spray per tree was applied to large, lightly pruned, fifteen-year-old trees, when about twice as much should have been used, he got remarkably good results. A 20 per cent kerosene emulsion was also used in this orchard and was put on in the same manner, and good results followed this treatment. The oil-sprayed trees could be quickly picked out from among the others, because of their much denser and greener foliage.

*Kerosene Emulsion.*—Fifty gallons of an oil emulsion spray containing 10 per cent kerosene was applied to a few trees. Personal supervision of the spraying with this material was impossible at the time, and while those in charge tried to do thorough work, and possibly did, yet it seemed as though there was not quite enough liquid used per tree.

The results of this treatment were quite satisfactory, for about 75 per cent of the eggs were destroyed. The large percentage killed indicated that a heavy spraying would have killed practically all of them.

A commercial brand of kerosene emulsion was donated for use in the experiment, but for some reason or other it would not emulsify and finally had to be discarded.

*Zinc Arsenite.*—The indication that a strong zinc arsenite or Paris green spray would kill quite a number of the larvæ as they emerged from the eggs made it seem worth while to try out an experiment in the orchard. Zinc arsenite was used at the strength of 4 pounds to 100 gallons of water. A very thorough spraying was given to eight trees. The results were far from satisfactory, but the trees nevertheless did not show nearly so much injury as those untreated in the orchard. We estimated that on an average only 16 per cent of the foliage was destroyed on these, while the seven check trees showed an estimated loss, on an average, of 49 per cent of their foliage. None of the trees in this experiment received any further spraying until the first codling-moth spray was applied on May 5. This was too late to do any appreciable good for the leaf-roller.

*Sprays Applied to Kill Larvæ After Eggs Had Hatched.*—A determined effort was made to kill the larvæ before they got to be of much size. Arsenical sprays of arsenate of lead, zinc arsenite and Paris green were used at various strengths, and spraying was begun on May 5. At this time the trees had a small amount of foliage out (figs. 1, and 2, Plate VII), and the individual blossoms in the clusters had just separated one from another (fig. 3, Plate VII), but the blossoms had not yet begun to open up. Many larvæ had already eaten their way into these unopened buds. A great many of them, when examined carefully, would be seen to have a small, round hole on the side, and when cut into, the tiny occupant could be found. It was planned to apply the first arsenical spray just as the very first larvæ were hatching, and before they would have

had time to eat their way out of reach of a poison. In this we were unsuccessful. On April 29 many larvæ were found feeding in the buds, but on May 3 practically every leaf or blossom bud picked had from three to five larvæ feeding in it. Delay in getting a spray outfit to do the work gave the worms a few days' start, which interfered materially with the most successful control. Spraying was done as thoroughly and carefully as possible, an average of ten gallons of the liquid being used per tree. Some trees were quite small and much less wet them thoroughly, while others required as much as fifteen gallons. It could very soon be seen that the number of larvæ was diminished by this spray. In examining the leaves and blossom buds a few days after the application, large numbers of dead larvæ could be found, and it was estimated that the one spray of arsenate of lead, Paris green, or zinc arsenite had killed at least 75 per cent of the total number of worms; but there were 25 per cent left, and most of them were beyond reach of a poison.

A second spray was applied to part of the trees on May 17. This spray did much good also, but was put on when the trees were practically in full bloom—a practice which cannot be recommended because of the serious injury in killing off the bees which must inevitably follow such a practice. Spraying at this time was practiced extensively in the worst-infested leaf-roller section, and as a result, dead bees could be picked up by the handful in front of hives in that section.

Many people, in their eagerness to control the leaf-roller pest, used an exceedingly strong spray. Such strengths as 3 pounds of arsenate of lead mixed with 4 ounces of Paris green were quite commonly used to 50 gallons of water. As a result of these strong mixtures, there was much spray-burned foliage. The use of Paris green along with arsenate of lead seems to be of no advantage whatever, and 6 pounds of the latter to 100 gallons of water, if carefully and heavily applied, will do just as much good as the stronger sprays of the same material, or mixtures of it and Paris green or other arsenical. Arsenate of lead was not tested at weaker strengths than 6 pounds to 100 gallons, and it is probable that, because of the character of insect to be dealt with, it should be used that strong. Arsenite of zinc proved to be a valuable spray, but apparently did no more effective work than arsenate of lead.

From the work done with arsenicals it must be admitted that it is possible, but not an easy matter, to control the leaf-roller by heavy applications at the proper time. Previous to this season, little spraying was done before the regular codling-moth spray was applied when the calyces were open; this season the first application was generally made about ten days earlier. There must be, however, for the best work, an application still earlier than this. No date can be set, but this season about April 28 would have been right at Canon City; another season it might vary from this date a week or two. The object of this early spray is to kill the very earliest worms that hatch, before they have a chance to get into the buds, and it should be put on just as soon as the buds begin to burst and the larvæ begin feeding on them. The eggs hatch quite early, and in order to keep ahead of the worms the very earliest green foliage must be coated with the poison. Then a second spray to correspond to our first this season, applied when the blossom buds in a cluster separate one from the other (see fig. 3, Plate VII), should be ample, with the regular codling-moth spray for the calyx, for almost complete control. By making the second application at the time stated, the spray may be made to cover the blossom buds on all sides, which could not be done while they are held together in the cluster.

*Black Leaf 40*—This material was found to be very effective in killing the larvæ while they were small. A few trees were sprayed twice—once on May 5 and again on May 25—with Black Leaf 40, using it at the



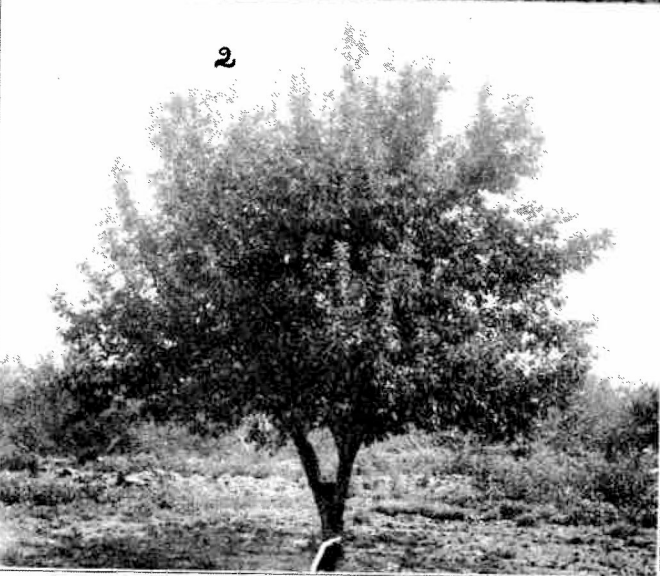
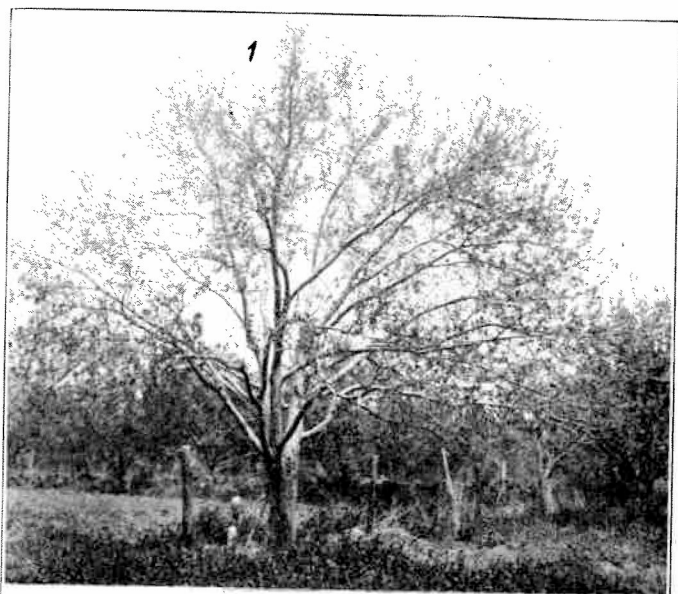


PLATE VI.

Figure 1, unsprayed tree in orchard joining the Barnhardt place;  
figure 2, tree sprayed with Target Brand soluble oil in Barnhardt  
orchard.



strength of 1 pound to 100 gallons of water. It was also used in combination with lead arsenate at two strengths—viz., 1 pound to 100 gallons, and 1½ pounds to 100 gallons. In the orchard plot the rows sprayed with Black Leaf 40 only are north of the ditch, and are numbered 4a, 5a, 6a and 7a. None of the trees were at all badly injured. They were in the same block as the check trees, and their green foliage presented quite a striking contrast to that on the checks, which was more or less brown and badly injured. In combination with arsenate of lead, this material did not seem to give any more protection than would either insecticide by itself. After applying the Black Leaf 40 and arsenate of lead (mixed spray), on May 5, the results were closely watched, and the following note was made at that time: "A great many of the larvæ are killed in the folded leaves, where it would not seem possible that the spray could reach them." On May 6, the following day, this note was made: "Results from the Black Leaf 40 are not so apparent today. It is possible that a small amount of the nicotine has a stupefying effect and the worms appear as dead for a time." These notes were made from trees to which a combined spray of Black Leaf 40 and arsenate of lead was applied, and, as we previously mentioned, the results were no better in many cases than where an arsenical alone was used. The small block sprayed with Black Leaf 40 alone showed such excellent results that there seems no question but that this contact spray will kill a large percentage of the larvæ while they are small. When they become half-grown or larger, its use does not give much benefit. Two early sprays of this material might be used to practically as good advantage as an oil spray for the eggs or an arsenical for the worms.

A table giving a summary of the percentage of leaf surface destroyed in the different tests in the experimental orchard follows:

TABLE SHOWING LEAF SURFACE DESTROYED IN DIFFERENT EXPERIMENTS IN BARNHARDT ORCHARD.

Spray Applied.	Times Treated.	No. of Trees.	Percentage of Leaf Surface Destroyed.	Date of Spraying
Arsenicals (Paris green, lead arsenate and zinc arsenite).....	2	16	12	May 5, May 25.
Arsenicals (Paris green, lead arsenate and zinc arsenite).....	3	66	9	May 5, May 17, May 25.
Mixed spray of arsenicals and Black Leaf 40..	2	15	11	May 5, May 25; Black Leaf used on latter date.
Mixed spray of arsenicals and Black Leaf 40..	3	35	8	May 5, May 17, May 25; Black Leaf used only on first date.
Black Leaf 40.....	2	11	7	May 5, May 25.
Soluble oil (Target Brand Scale Destroyer)....	1	25	5	April 16.
Zinc arsenite applied to eggs.....	1	8	16	April 16.
Kerosene emulsion and arsenicals.....	4	8	6	April 16, May 5, May 17, May 25; kerosene emulsion used only on first date.
Checks.....	None	7	49	

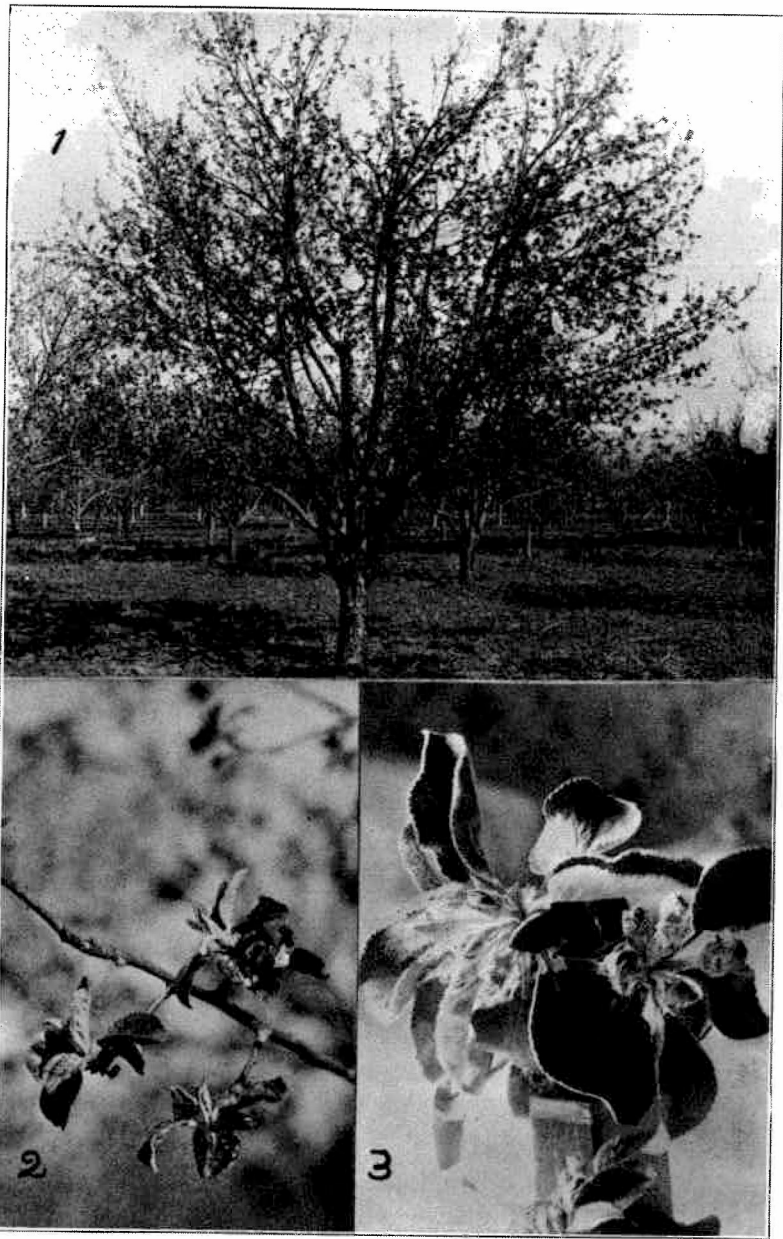
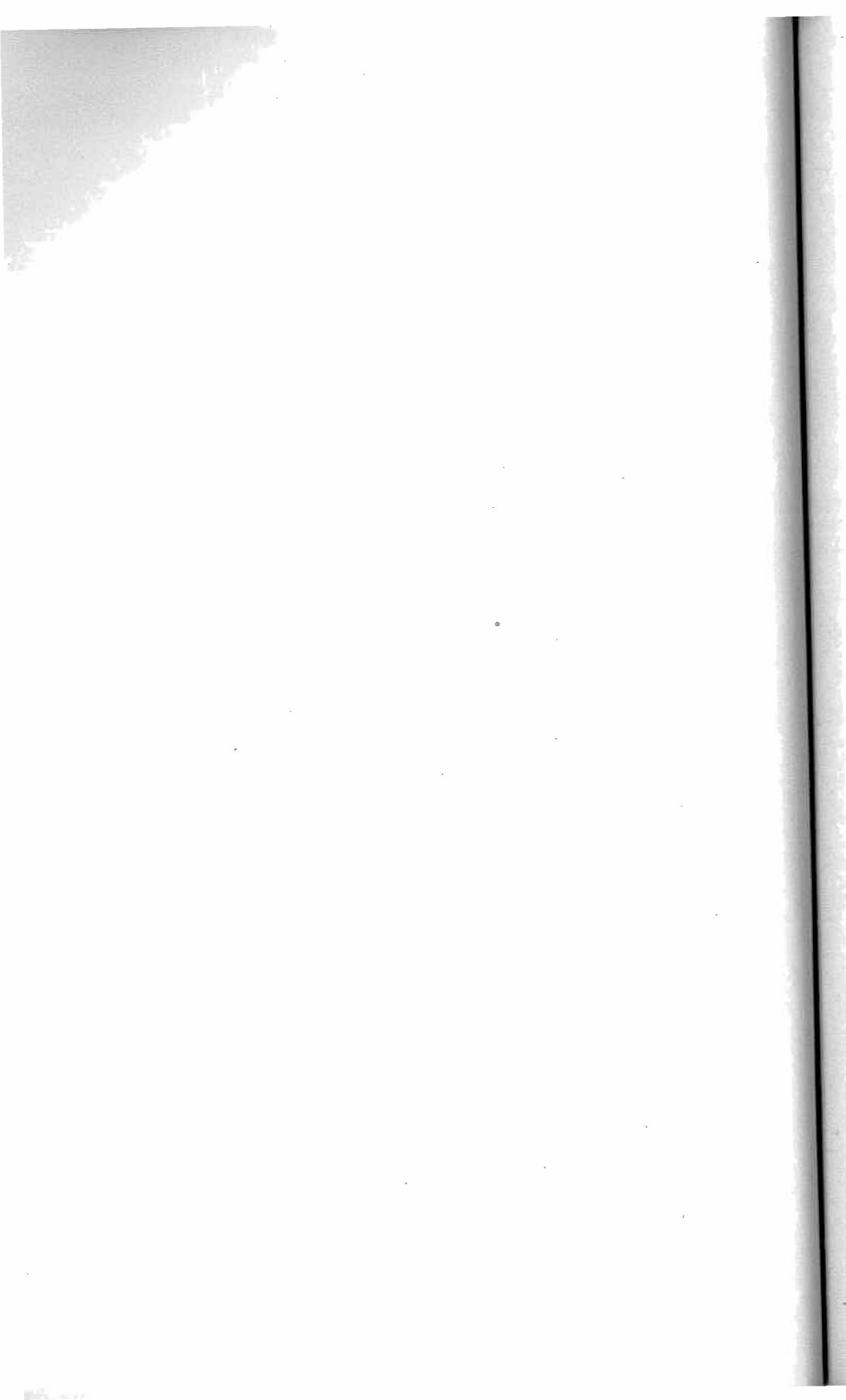


PLATE VII.

Figure 1, general appearance of trees in Earnhardt orchard on May 5, when first arsenical sprays were applied for the control of the leaf-roller; figure 2, appearance of leaf buds on same date; figure 3, condition of blossom buds on same date. Notice that the five buds in cluster have separated.



This table does not include the lime and sulfur treatment, because on the block of trees sprayed with this material eggs were hatching just as freely on May 5 as where nothing was applied.

It seems quite certain that the spray applied on May 25, at the time for the first regular codling-moth spraying, did very little good for the leaf-roller. At this time the larvæ seemed to devour large quantities of sprayed foliage without any discomfort. A careful examination of trees after this spray was applied failed to indicate that it was of much importance in destroying the larvæ. A comparison of the foliage on sprayed and check trees in the orchard certainly showed the great value of the other sprays applied.

An orchard just across the fence from the one experimented upon had practically all the foliage destroyed from most of the trees. This orchard was sprayed, but not thoroughly.

Another orchard less than one-fourth of a mile from the Barnhardt place was not sprayed at all during the season. On June 8 the foliage was practically all (estimated 99 per cent) brown, and the larvæ were feeding upon all kinds of vegetation that they could find in the orchard. The trunks of many of the trees were heavily covered with webs, so that they appeared white at some distance away. Plate VIII shows a trunk covered with the webs, and between two of the large branches in the crotch may be seen a solid mass of web which, when photographed on June 8, was full of larvæ. Note the alfalfa at the base of the tree, which has been webbed to the ground by the worms.

Plate IV, lower picture, was taken on June 20, and shows how the apple trees in this orchard appeared at this time in comparison with the elms which were not fed upon by the rollers. There was absolutely no chance for any fruit to mature in this unsprayed orchard, so bad was the attack. No doubt the foliage at least, and much fruit if there was any, could have been saved in this orchard with arsenical sprays, as it was saved in many others. On July 24 this orchard was again visited. The new foliage had come out, and the trees were making a good growth after their severe injury.

Figure 1, Plate IX, shows injury to apples when they were from five-eighths to three-fourths of an inch in diameter. These were picked on June 8, and photographed a couple of days afterwards. Figure 2, Plate IX, shows apples picked from the same orchard on August 9. They were then about two inches in diameter. While the injury was not great enough to destroy all scarred fruit entirely, it rendered it unfit for market purposes.

*Light Traps.*—Unlike the codling-moth, this leaf-roller flies quite readily to a light, and, while it is probable that it could never be controlled by means of light traps, they might be used to advantage in connection with other remedial measures. On account of not being in the Canon City section when the moths were at their height, light traps were not tried out until it was too late to test their value as a means of control. Many of the residents of that section did try them, and probably none with greater success than Mr. J. H. Holzfaster. For four nights he burned crude oil in circular pans containing one gallon each. In order to have a small flame that would not consume too much oil, Mr. Holzfaster placed on the surface of the oil a small square piece of board having a tin cylinder in the center. This cylinder was about one inch in diameter and two and one-half inches long. A piece of flannel or cotton waste was put in for a wick. When visiting the place on July 25, we were shown a three and one-half gallon bucket practically full of oil-soaked moths, most of which were leaf-rollers. This represented part of the catch that had been made. It was estimated that the bucket contained at least 80,000 leaf-roller moths. While this number could only be

a mere fraction of the entire number of moths that were flying in the orchard at that time, yet it was great enough to make one feel that there is really some virtue in good light traps, well cared for, during the time that the moths are flying.

#### CONCLUSIONS FROM ORCHARD EXPERIMENTS

1. The leaf-roller eggs may be killed by a very thorough spraying with a soluble oil while the trees are dormant. This spray should probably be applied prior to, but as near hatching time of the eggs as possible.
2. Very careful and heavy spraying with arsenicals early in the season will result in almost complete control. The first application should be made shortly after the eggs begin to hatch, which will be when the first green foliage is showing on the trees, and the second as soon as the blossom buds have separated in the clusters. A blossom spray is, in all probability, not necessary, and is dangerous, in that it poisons the bees.
3. Black Leaf 40, carefully and thoroughly applied about the same dates as the first two sprayings with arsenicals, will give good results.
4. A mixed spray of Black Leaf 40 and lead arsenate is little more satisfactory than either one of the insecticides used alone. Furthermore, the cost of such spray would be too great for practical purposes.
5. Three pounds of lead arsenate to fifty gallons of water is sufficient for successful control, and there is no advantage to be derived from mixing Paris green with it, as many have done.
6. Not less than ten gallons of spray, on an average, should be applied to trees from twelve to twenty years of age. Very large trees may require even more.
7. Failure to control this pest with arsenicals has been due in most cases either to a failure to spray early enough and at the correct time, or to put enough of the liquid on the trees.



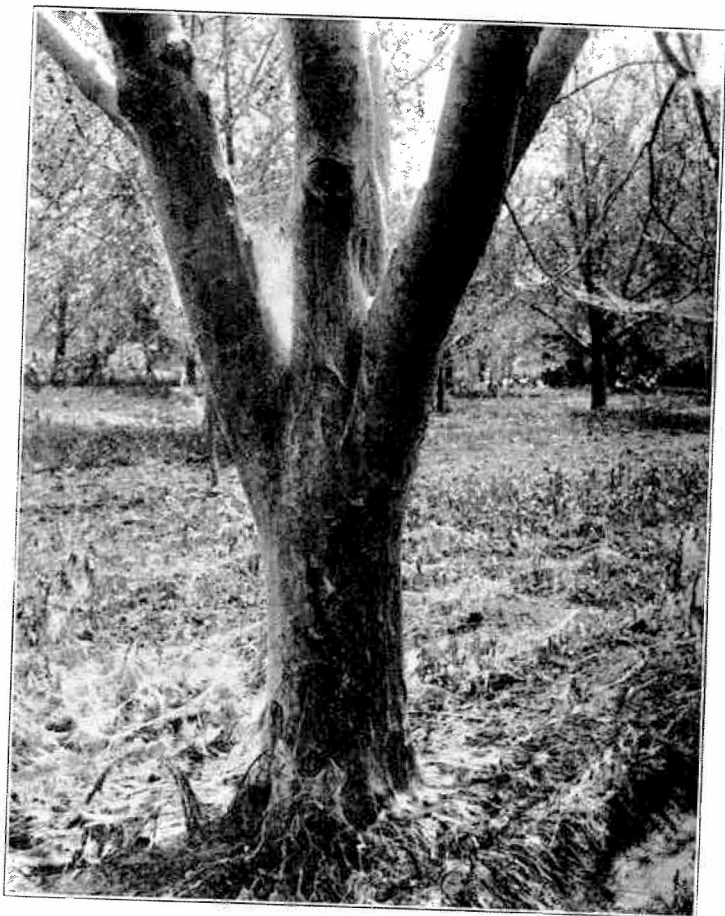


PLATE VIII.

Photograph taken in an unsprayed orchard about one-quarter mile from the Barnhardt orchard, showing a trunk covered with webs; also the alfalfa at base of tree is matted down with them. All the foliage in this orchard was destroyed.

ESTIMATED COST PER TREE FOR INSECTICIDES WHEN THOROUGH SPRAYING IS DONE.

Insecticide.	Price	Strength to Use	Number of Sprayings.	Number of Gals. per Tree.	Cost per Tree.
Soluble oil. . . . .	50c per gallon. . . . .	1 gal. to 19 gals. water.	1	10	25c
Lead arsenate. . . . .	12½c per lb. . . . .	6 lbs. to 100 gals. water.	2	10	15c
Black Leaf 40. . . . .	\$1.25 per lb. . . . .	1 lb. to 100 gals. water.	2	10	25c
Zinc arsenite. . . . .	16⅔c per lb. . . . .	3 lbs. to 100 gals. water.	2	10	10c

## RECOMMENDATIONS

1. All orchards where this leaf-roller has been at work, and where it is indicated that spraying must be done for its control, should be heavily pruned, and the wood which is removed destroyed, before April 1, if possible.

2. Make a spring application of a good soluble oil shortly before the hatching of the eggs.

3. Should the soluble oil fail, for any reason, to kill the eggs, two early sprays of an arsenical, or Black Leaf 40, should be applied, as recommended above.

4. More failures to control any insect pest with sprays that are known to be effective are due to poor spraying than anything else. Instead of applying from three to five gallons of spray to ordinary-sized trees, apply from eight to twelve; and instead of using an excessively strong spray, use either six pounds of lead arsenate or three pounds of zinc arsenite (the California brand of this product is known as Ortho 40), depending upon the quantity of liquid, rather than excessive strength, to give results. The spray may be ever so strong—if it only coats half of the leaf surface, little good can be expected from it. A spray that is applied strong enough, and made to cover every portion of the leaves and blossoms, is the one that is sure to accomplish the desired purpose.

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## RODENT INVESTIGATIONS FOR 1912

BY W. L. BURNETT, DEPUTY PEST INSPECTOR

The three prairie-dogs and ground squirrel that form the subject of this report are the most important from an economic standpoint. In certain sections they cause a loss to the farmer and ranchman of many thousands of dollars every year by their destruction of hay, grain, and garden vegetables. A number of species and subspecies of ground squirrels are found in Colorado, but the greatest pest is the Wyoming spermophile, or picket-pin gopher, which has a restricted distribution in the northwestern counties of the state.

Of the three species of prairie-dogs found in Colorado, the plains dog, *Cynomys ludovicianus*, is the worst pest on account of its general distribution throughout the arid portions of the state. Wherever it is possible to get water on the land, they can be held in check by flooding, but in what is known as the dry land districts there are two principal methods of control; viz., either the use of poisoned grain or carbon bisulfid. It is not known to take water, and it destroys more than it eats just to get the moisture from the vegetation. As the land is tilled, the dogs leave their food of native grasses and roots for the more nutritious grains and tubers of the cultivated lands.

In the early part of the year experiments were carried on in the vicinity of Fort Collins to determine the cheapest and best methods for the destruction of prairie-dogs.

The results of these early experiments were as follows: Improved methods of preparing the old formula, No. 6, were worked out, with satisfactory results, and a new formula for this rodent was perfected and thoroughly tested. This is now known as Colorado Formula No. 15. Later on in the season ten days were spent in experimental work on the ground squirrel found in the northwestern part of the state. These experiments were made in the vicinity of Elkhorn post-office, Larimer County, with headquarters at the ranch of Mr. Willis Miller. Some four

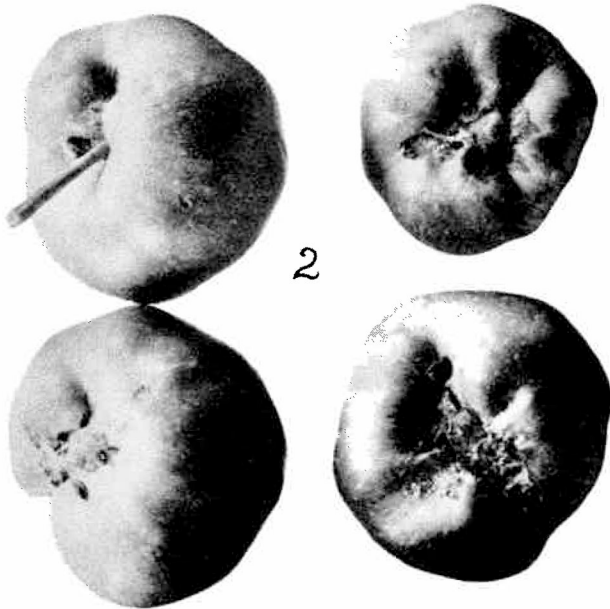
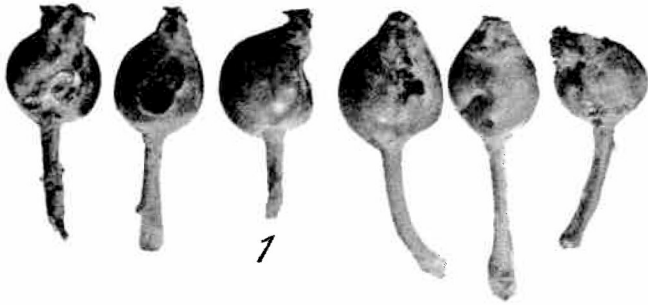


PLATE IX.

Figure 1, apples picked on June 8, when they were from five-eighths to three-quarters of an inch in diameter, showing the characteristic injury from the leaf-roller; figure 2, apples picked from same orchard on August 9, when they were about two inches in diameter.



or five different formulas were tried, but by far the most satisfactory results were obtained from Colorado Formula No. 12.

All three of the formulas mentioned are found in another place in this paper. The writer is indebted to Mr. Daniel Heckert, of Virginia Dale, for the suggestion to use salt in Formula No. 12. In conversation with him last winter he informed me that this ground squirrel was very fond of the taste of salt and would eat what he put out for his stock. After various trials, we found that the proportion as given in this formula was the right one to thoroughly coat the grain. We found that the squirrels would eat this preparation much more readily than any of the others.

We earnestly urge the forming of pest districts, and the hearty co-operation of all the ranchmen in the infested districts; for only by co-operation can these pests be exterminated.

If one man cleans them from his place, and his neighbor is negligent in the matter, it is only a question of a few days until the land that has been cleaned will be infested again from the neighboring fields.

From January 1 to October 1, 1912, 240 letters of inquiry concerning prairie-dogs and ground squirrels were received at this office. These were answered either by letter or circular giving the desired information. These letters were from thirty-one counties and ninety-five localities. The majority of these inquiries were concerning prairie-dogs.

Inspection was carried on in portions of the following counties: Larimer, Weld, Logan, Phillips, Jackson, Routt, Moffat, Summit, Mesa, Delta, Montrose, Gunnison, Costilla, Rio Grande, Yuma, and Morgan.

#### Plains Prairie-Dog, *Cynomys ludovicianus*

*Distribution.*—This is the prairie-dog of the plains of eastern Colorado, where it is found in greater or less abundance in all the counties lying east of the base of the mountains, and in the foothills. It is seldom found above 6,000 feet elevation. In fact, that altitude may be called the western limit of its range in the state.

This species is reported common in the Arkansas Valley, where it destroys alfalfa and grain. On Boggs Flats, near Beulah, it is said to be very destructive to small grain, and it also digs up the corn and squash seeds after they are planted. Not found to any extent in the cultivated fields in the Platte Valley around Atwood and Sterling, but common on the high, dry sand hills on both sides of the Platte.

Around Holyoke this prairie-dog is mostly confined to the raw lands.

There is a pure-white specimen of this prairie-dog mounted in the office of the W. C. Harris Land Company, at Sterling. It was killed a few years ago just north of Stoneham. Three more were reported this spring near the same place.

This species is not uncommon around Wray, Yuma County, and is reported to be on the decrease; but this is not the case in other sections of this county. In the vicinity of Idalia it is increasing rapidly. New towns are being formed, and dogs are very abundant all through that locality. There are some large dog-towns near this place. One is estimated to cover 1,000 acres of pasture land.

Prairie-dogs are very abundant in the vicinity of Hale, Yuma County, on the Republican River. They show a preference in this locality for sugar cane, making their burrows in the fields and working on the cane, making a circle around the burrows sometimes twenty feet across.

Around Akron, Washington County, prairie-dogs are common. They are distributed in suitable localities all over the county.

In Morgan County I found them not uncommon at Fort Morgan, Vallery, and Wiggins, where they are confined mostly to pasture lands. At Vallery I noticed one pasture, in particular, where the grass had been almost totally destroyed.

In Weld County prairie-dogs are very abundant in some localities. They are common along the Burlington Railroad at Crest and Rogens. From Hudson, eight miles east to the Benson ranch, they are more abundant than in any other locality I have visited. On both sides of the road, as far as one can see, in grain fields or pasture lands, it is one continuous dog-town.

Mr. A. D. Lloyd, who owns several sections of land near Keenesburg, spent \$250 about five years ago for poison and labor, and exterminated all the dogs on his lands; but today they are back again as abundant as ever. This land is now partly under cultivation, but a few years ago it was all pasture land. Mr. Lloyd estimates that at that time the dogs destroyed about half the grass that grew on this land.

On the ranch of Mr. A. L. Parker, six miles south of Wray, we tested the use of Pintsch oil for the destruction of prairie-dogs, using it the same as carbon bisulfid, with the exception that we used two tablespoons to each burrow in place of one of the carbon bisulfid. The soil was sandy, but very wet, because of a hard rain on it the night before, and one two days before, making soil conditions ideal for a test of this kind. The results obtained from this, our first try-out for this oil, were very satisfactory, as 85 per cent of the dogs were killed. This oil has an advantage over carbon bisulfid by it being cheaper. Carbon bisulfid now costs, in five-gallon cans, \$1.00 per gallon, and the price of Pintsch oil in the same amount is 35 cents per gallon; but there is only a difference of 30 cents per gallon, because we use twice as much of the Pintsch oil as we do of carbon bisulfid. If Pintsch oil is purchased by the barrel (fifty gallons), the price is very low—15 cents per gallon.

The same precautionary measures should be taken in the use of this oil as in the use of carbon bisulfid. We are not in a position to recommend this oil in the place of carbon bisulfid, but we feel confident that, when soil conditions are right, it can be used with satisfactory results.

Gunnison Prairie-Dog, *Cynomys gunnisoni*  
(Named for Captain Gunnison.)

This species is found in suitable locations in the following counties: Park, Teller, Lake, Chaffee, Costilla, Custer, Fremont, Saguache, Mineral, Gunnison, San Miguel, Montezuma, and part of Montrose.

I found it common in the vicinity of Blanca, Costilla County. Some few were found on the low lands along the creek bottoms, but they were more abundant on the higher, sandy ground. In July I visited this section, and found the dogs destroying a great many oats by cutting the stalks in the fields.

Mr. George R. Smith, on his ranch two and one-half miles south of Blanca, had some ten or twelve acres of oats about in the center of his field that were badly damaged by the prairie-dogs. We put out about two quarts of Formula No. 15 pretty thoroughly over the infested area. As a rule, when green food is abundant, the results obtained from the use of poisoned grain are very unsatisfactory, but Mr. Smith wrote me in a week or two that he was more than pleased with the result. Besides what dogs died in the burrows, he found a number dead outside.

I was somewhat surprised to find prairie-dogs inhabiting this land, for the reason that the water is only from four to six feet below the surface, and there is very little, if any, need of irrigation. I found them very abundant in the chico (*Sarcobatus*) and sage-brush (*Artemisia*) flats along the railroad between Blanca and Mesita, and on the cultivated lands their heads could be seen sticking up out of the alfalfa and grain fields in all directions. About a half-mile south of Mesita I saw a black dog. Several more were reported near there. At Monte Vista and vicinity they seem to do very little damage, as the dog-towns are mostly above the ditches. These large ditches seem to form a barrier which they do

not cross. They are not uncommon on high land around Del Norte. They are common at Moffat, Saguache County, but are most common north-west of there, toward the town of Saguache. They were seen along the Denver & Rio Grande tracks north, almost to Salida.

They are not uncommon on the meadow and higher lands surrounding Gunnison, Gunnison County, but as there is only a small amount of grain raised in this section, they do very little damage outside of the destruction of native grass. In the town of Gunnison there is a vacant block between the railroad tracks which is honeycombed with dog burrows, where they sit up and bark at you without fear.

#### White-tailed Prairie-Dog, *Cynomys leucurus*

*Distribution.*—This is the prairie-dog found throughout the mountain parks and valleys of northwestern Colorado, in Routt, Jackson, and Moffat Counties.

It is also found in Rio Blanco, Eagle, Mesa, Delta, Ouray, and parts of Montrose Counties. I found it common in Routt and Moffat Counties, down the Bear River valley as far as Lay post-office. It is also reported abundant at Maybell. The sagebrush sand hills along the stage-road between Craig and Lay are alive with the dogs. Here they do but little damage, as there is scant vegetation outside of the sage-brush. Along the Bear River, between Hayden and Craig, the grain and alfalfa fields were badly infested with them. I also found them common in the valleys of the Elk and Fortification Creeks. This dog is not found in the mountainous portions of eastern Routt County, nor in the extreme eastern part of Rio Blanco County. It does not occur in either Grand or Summit County. In Jackson County it is not uncommon on the high grounds.

Jackson County—or North Park, as it is commonly called—has an area of about forty miles wide by sixty miles long. A large portion of this land is a natural meadow that lies along the numerous streams for which this park is noted. These streams flow in a northwest direction, where they empty into the Platte.

On these meadow lands the ranchmen depend to a large extent for their supply of native hay. With an abundance of water, they practice excessive irrigation, for the reason that the seasons are short, and to insure good crops of hay the grass must be forced by the use of water. This excessive use of water drives the prairie-dogs to the high lands, where they feed on the grain; but they do very little damage to the native grass.

They are abundant on the mesas surrounding Palisades, Mesa County, where they are injurious to corn, cantaloupes, beans, and other garden truck, and also damage the peach, apple, and pear trees. Some of the ranchmen treat their trees with a mixture of blood and sulfur to protect the bark from injury; but the dogs dig below the surface and attack the roots. These pests have heretofore been confined to the mesas, but this season they have appeared on the bottom land along the streams. Prairie-dogs were not uncommon on the sand hills along the Interurban line between Grand Junction and Fruita. No dogs were seen along the railroad between Grand Junction, Delta, and Hotchkiss. On Rogers Mesa, near Hotchkiss, Delta County, prairie-dogs are common, but as a rule are confined to the native lands, from where they visit the cultivated fields near by and cause havoc to alfalfa, grain, and sugar beets.

On the mesas around Paonia they are not uncommon, but are more common on Stewart, German, and Bowen's mesas. The chico and salt-brush (*Atriplex*) hills and flats are alive with them. Mr. J. B. Barnes, who resides on Stewart's Mesa, reports a loss of ten acres of grain this season from dogs on a piece of land where he had destroyed these pests last fall, but they came in from the raw lands off the side-hills. In the orchards on this mesa they do considerable damage by destroying the



roots of the trees. The writer was shown a number of trees that had burrows down by the roots. They also destroy a great many potatoes in this section. In the vicinity of Montrose, Montrose County, dogs are not uncommon on the mesas. They are abundant on some parts of Spring Creek Mesa west of the town. On the farm of Mr. F. A. Fetz they destroyed about ten acres of wheat this past season. They commenced to work on it as soon as the grain sprouted. Joining this field of wheat was a field of oats, which they did not touch, thus showing in this case their preference for wheat. In a young apple orchard on this place a great many of the trees had burrows at the roots, thereby causing more or less injury. On the adjoining land is a dry hill which is honeycombed with prairie-dog burrows, from which they came down to a potato field and destroyed the majority of the hills around the edge of the patch, besides making a few burrows between the rows. Along the railroad between Montrose and Cerro Summit dogs were not uncommon. Professor Gillette reports seeing them out running about on the summit March 9, 1912.

Wyoming Spermophile, *Citellus elegans*  
(Lat.: "neat, elegant.")

*Distribution.*—This ground squirrel has a unique distribution in the state. The first record of its occurrence was made by Vernon Bailey in 1893, in "The Prairie Ground Squirrels of the Mississippi Valley." He gave the distribution at that time as a small area on Fish Creek along the northern border of Larimer County; but at that time very little work on the rodents had been done in the state, so this was not the true status of their distribution. For over twenty-five years they have been known as an abundant animal in North Park; and what is true of this park is no doubt true of all the mountain parks and meadows of northwestern Colorado. The species is now found in Larimer, Grand, Routt, Moffat, Jackson, Rio Blanca, Eagle, and Summit Counties, and E. R. Warren, of Colorado Springs, reports a small colony near Empire, Clear Creek County. In Larimer County they are common from the Dale Creek schoolhouse up the valleys of Dale and Fish Creeks, to Table Mountain.

On Deadman Creek they are common on the Gealow ranch, but do not seem to occur down the creek beyond this ranch; also found on the ranches near Twin Mountain, near where Box Elder Creek heads; also on Trail Creek near Diamond Peak, and down some of the tributaries of Crow Creek. They do not occur in Estes Park, but are abundant on the Laramie River, thence south to Westlake, Log Cabin, Elkhorn, Rustic, and South Fork of the Poudre River.

In Jackson County they are distributed practically over the entire country outside of the low meadow lands along the creek bottoms. They are not so abundant in this county as in the adjoining counties of Routt and Grand. Nevertheless, they do a vast amount of damage to the grain fields and gardens. Some years they are reported to be more numerous than in others. This seems to be true throughout their range. The dry seasons seem to be an important factor in relation to the abundance of this species.

They are found in Routt County in the Bear and Elk River valleys, and the valleys of the smaller tributaries to these streams.

The sage-brush flats between Craig and Lay, Moffat County, are alive with them; also the meadows and cultivated lands in the Bear River valley and up Fortification Creek, where they vie with their cousin, *Cynomys leucurus*, to see which can do the greater amount of damage.

While carrying on experiments at Elkhorn with this squirrel, we found it out common at the middle of April, running about on four inches of fresh snow, and in some places the burrows came up through a drift of old packed snow two feet deep. The first squirrel seen out at Elkhorn this spring was on the first day of April. When we put out the

poisoned grain, we scraped away the snow with our feet, and placed the grain on the bare spots. One day we found a squirrel dying within fifteen minutes after the burrow had been treated, and in an hour or two we found the dead squirrels lying around over the fields, and the live ones feeding on them, eating through the skull to the brain first, then devouring the rest of the body.

I observed a trait in this squirrel, while at Virginia Dale, that I had not seen before. I saw one lying flat on its stomach on the ground, like a frightened rabbit, and it allowed me to watch it from a distance of a yard, and only scampered off after I had made a move toward it.

At times they travel some distance from their homes. Mr. Daniel Heckart tracked one across the snow for over two miles before it went down its burrow. This probably does not occur except in the rutting season.

Dillon, Summit County, is about the southern limit of their range. I visited this section about the middle of August, and found most of the squirrels in hibernation. Their burrows were abundant on the sage brush lands between the Blue and Snake Rivers. I heard one, but did not see it. One was seen in a meadow between Dickey and Frisco.

#### FORMULAS MENTIONED IN THIS PAPER

##### Formula No. 6

Wheat .....	12	quarts
Strychnine (alkaloid powder) .....	1	ounce
Saccharine .....	1	teaspoonful
Starch .....	$\frac{1}{2}$	pint
Water .....	$1\frac{1}{2}$	pints

##### Colorado Formula No. 15

Barley or wheat.....	12	quarts
Strychnine (alkaloid powder) .....	1	ounce
Saccharine .....	1	teaspoonful
Flour .....	$\frac{3}{4}$	pint
Fine salt .....	$\frac{1}{2}$	pint
Water .....	2	pints

##### Colorado Formula No. 12

Barley or oats.....	15	quarts
Strychnine (sulphate powder) .....	1	ounce
Saccharine .....	1	teaspoonful
Fine salt .....	$1\frac{1}{2}$	pints
Starch .....	$\frac{1}{2}$	pint
Water .....	$2\frac{1}{2}$	pints

Directions for mixing the above formulas are as follows:

Add the strychnine, saccharine, and starch or flour to the amount of water called for in the formula; beat thoroughly with a Dover egg-beater until strychnine is dissolved; put over the fire and bring to a boil, or heat until starch or flour begins to thicken, stirring constantly.

Pour the poisoned solution over the grain, thoroughly mix, spread, and dry.

One teaspoonful of the poisoned grain is sufficient for each burrow. This should be placed on dry, hard surface outside the mounds.

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## STATE APIARY INSPECTION DURING 1912

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### REPORT OF WESLEY FOSTER, DEPUTY BEE INSPECTOR

The winter of 1911 and 1912 was severe on bees in Colorado. The heaviest losses were sustained in Crowley and Otero Counties, where whole apiaries of hundreds of colonies were wiped out. The loss was probably caused by suffocation from a heavy, wet snow, and a poor quality of stores. However, the season of 1912 opened up favorably, and the bees showed remarkable recuperative powers. Swarming began early, and before the season was well begun a large percentage of the losses had been regained.

The 1912 crop was somewhat better than the 1911 crop, taking the state as a whole, and the prices obtained for honey have been fair.

In northern Colorado during July and August frequent rains interfered with honey-gathering, and probably caused a darker grade. The causes for honey being darker in color in a wet season are not yet well understood.

Heavy losses in bees were suffered in Fremont, Mesa, and Delta Counties from fruit-tree spraying. The losses in Fremont county were largely caused by spraying during full bloom to control the leaf-roller pest. As the control of this pest is now better understood, it will not be found advisable to spray during bloom for the leaf-roller.

More general cover cropping of the orchards in the fruit-growing counties with alfalfa, alsike, red clover, and sweet clover has caused trouble where five to seven sprayings have been applied. Some of the sprayings fell upon the bloom beneath, and the bees were poisoned that way. This loss can be remedied by the clover being cut before spraying is done, or the clover cut before coming in bloom.

Inspection work has been carried on largely in the counties supporting county inspectors. The following counties have co-operated with this office in the prosecution of the work: Adams, Fremont, Otero, Crowley, Bent, Prowers, Montezuma, Montrose, Mesa, and Garfield. Several interested bee men have donated, free of charge, several days' work each in Delta County, so that some work has been done there. The same has been done in Logan, Weld, Adams, Jefferson, and Arapahoe Counties to a greater or less extent.

The counties in northern Colorado have some foul brood, but the conditions are fairly well under control, watchfulness and a small amount of inspection work being required.

A feeling of optimism is noticeable in the counties where disease has been the most severe in its ravages; viz., in Montrose, Delta, and Montezuma Counties. In Montezuma County bees are in demand on account of past losses from foul brood, and a feeling that now the control is sufficiently understood, so that bee-keeping may again be a source of profit. The inspection has been carried on in co-operation with the county inspectors. The following counties have inspectors, although a few of them are serving gratuitously:

Prowers County—D. C. Polheums.

Bent County—Charles Cheek.

Otero County—V. O. W. Hopper.

Crowley County—H. E. Ingalls.

Pueblo County—M. V. Gallaher.

Fremont County—F. W. Brainard.

El Paso County—C. D. Duvall.

Adams County—Walter Martin.

Montezuma County—G. D. Taylor.

Montrose County—R. E. Foster.

Delta County—George Lester, R. W. Ensley, H. E. Hutchinson,  
Charles V. Alton, Frank Childs.

Mesa County—William Harkleroad.

Weld County—Charles Adams.

Denver County—L. F. Jouno.

Garfield County—O. V. Coulter.

Boulder County—W. C. Dyer.

The most inspection work has been done in Adams, Otero, Fremont, Montezuma, Montrose, Delta, and Mesa Counties. The reduction in percentage of diseased colonies from that found in the 1911 inspection has been gratifying in all these counties.

Adams County shows a reduction of from 4 to 2 per cent of inspected colonies diseased.

Otero County inspection has reduced the percentage from 5½ per cent in 1911 to 1¼ per cent in 1912.

Fremont County shows a reduction of from 19 to 6¼ per cent.

Montezuma County holds the same percentage, but the work done in 1912 covered practically the whole county, where inspection has not been done thoroughly for nearly ten years. Conditions will probably show a great improvement another year, as has been the case in other counties where a thorough cleaning-up has been done.

Montrose County inspection has reduced the percentage of disease from 12 to 3¾ per cent.

Delta County shows a reduction of from 21 to 11½ per cent since 1911.

Mesa County, which has had the disease very well under control, shows an increase in number of colonies inspected of over 3,000, and a reduction in disease from 1.6 to about 1 per cent.

Foul brood is known to exist in the following counties to the extent that thorough work should be done next season to protect the industry: Boulder, Logan, Weld, Larimer, Arapahoe, Jefferson, Denver, Pueblo, La Plata, and Garfield. Little work in some of these, and none in others, has been done the past season, and it is hoped that the work may be organized in these counties another season.

The detailed report which follows is of inspection done by the state inspector and the county inspectors. The inspection work was carried on co-operatively with the county men in charge; so the report is not segregated except by counties.

## FREMONT COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
F. W. Biddix.....	4
Mr. Mills .....	9
Mr. Wright .....	14
H. E. Turner.....	13
Mrs. W. C. Marion.....	1
C. G. Boyd.....	1
M. Simpson .....	2
R. A. Dilley.....	2
J. Norris .....	45
Frank Duffy .....	27
A. C. Norman .....	2
E. W. Hitt .....	2
F. D. Beard .....	1
J. J. Schultz .....	1
H. Russell .....	1
E. E. Edwards .....	2
A. E. Montgomery .....	1
N. Parker .....	2
Geo. Vanwye .....	2
H. E. Gribble.....	2
Frank Turney .....	2
R. A. Nelson.....	14
A. Green .....	21
C. J. Fredrickson .....	8
Mr. Emley .....	7
Jesse Knowles .....	2
G. L. Padgett.....	2
Wm. Bottenfield .....	4
C. E. Zingheim .....	7
W. C. James .....	4
F. B. Hoffman .....	3
E. R. Culver .....	6
M. T. Gillen .....	8
P. R. Allison .....	1
Wm. Worley .....	3
Mrs. H. C. Beltz .....	24
J. C. Payne .....	3
H. R. Corning .....	1

J. D. Sheets .....	1
Ellen Daver .....	1
W. G. Wright .....	39
J. G. Johnson .....	4
Otis Richardson .....	50
J. Culver .....	2
F. B. Cook .....	8
S. P. Jones .....	13
Thos. Walters .....	6
J. F. McDowell .....	7
C. T. Chapman .....	4
Lawrence Larson .....	1
J. M. Cunningham .....	8
D. R. Sullivan .....	4
D. Miller .....	1
J. H. Galland .....	2
Geo. Diebert .....	4
J. Huston .....	2
Cora Lewelen .....	3
Mrs. Mina Brown.....	1
O. Sheets .....	5
A. A. Gebhart .....	1
Wm. Babberger .....	30
W. L. Amick .....	14
M. Simpson .....	4
W. N. Worley .....	2
Park Allison .....	1
Nelson Brothers .....	2
A. H. Peterson .....	2
A. B. McFalls .....	3
D. T. Kimmel.....	5
Wm. Tonney .....	11
J. Hamilton .....	2
A. E. Clark .....	1
Mr. Davis .....	1
Wm. Kaywood .....	14
Mr. Gladden .....	4
E. G. Wetherell .....	1
E. B. Chance .....	1
Geo. Butler .....	2
E. B. Waite .....	5
Nathan Spencer .....	15

W. L. Amick .....	12
S. M. Rice .....	2
J. Wilson .....	5
Frank Maynard .....	3
F. W. Brainard.....	100
G. C. Gibbs .....	4
H. C. Beltz .....	25
H. E. Turner .....	13
A. A. Gebhardt .....	2
R. W. Johnson.....	3
A. M. Hill .....	3
Denis Sullivan .....	5
D. Millar .....	1
E. Snyder .....	1
G. T. Wilson .....	4
J. Knowles .....	1
Charles Emley .....	9
S. B. Hoffman .....	3
E. B. Weatheral .....	2
V. P. Cutler .....	50
Mr. Davis .....	3
Wm. Wright .....	42
C. J. Fredrickson.....	8
L. Green .....	20
Cora Lewellan .....	3
M. T. Gillen .....	11
J. N. Cunningham.....	11
F. W. Brainard .....	100
Geo. Hayner .....	13
F. Maynard .....	4
James Miller .....	14
J. F. McDowell.....	9
C. T. Chapman .....	3
John Culver .....	2
Wm. Tony .....	30
F. B. Cook .....	11
A. H. Peterson .....	3
B. Montgomery .....	4
Thomas Walters .....	17
Geo. N. Dibert .....	6
A. B. McFall .....	3
F. P. Jones .....	12

J. H. Galand .....	2
E. E. Edwards.....	4
J. D. Skeels .....	1
N. Parker .....	4
T. E. Spencer .....	14
J. C. Payne .....	5
Henry Sporhase .....	2
C. E. Zingheim.....	7
J. Norris .....	45
W. C. James .....	4
Frank Duffy .....	27
S. B. Hoffman .....	3
A. C. Norman .....	2
Mr. Heavenridge .....	6
A. H. Peterson .....	2
J. Culver .....	2
A. B. McFalls .....	3
F. B. Cook.....	8
D. T. Kimmel.....	5
Wm. P. Jones .....	13
Wm. Toney .....	11
C. T. Chapman .....	4
Thos. Walters .....	6
W. T. Amick .....	16
J. T. McDowell .....	9
Mr. Davis .....	3
John Hamilton .....	2
Apiaries inspected .....	150
Apiaries diseased .....	46
Colonies in apiaries inspected.....	1,328
Colonies in apiaries diseased.....	85
Percentage of inspected apiaries diseased.....	30
Percentage of inspected colonies diseased.....	6.33
Colonies destroyed .....	21

## LOGAN COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
J. H. Landrum .....	3
Ed Davis .....	4
J. H. Horton .....	10
Jonas Cashner .....	25



Apiaries inspected .....	4
Apiaries diseased .....	..
Colonies inspected .....	42
Colonies diseased .....	..

## DELTA COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Thomas Jaquiss .....	16
Mr. Hester .....	20
Chas. Taylor .....	13
Frank McFarland .....	45
A. R. Bruce .....	20
H. L. James .....	70
George Tabler .....	12
Chas. V. Alton .....	85
H. E. Hutchinson.....	100
Fred Heidenreich .....	14
John Platt .....	37
Mr. Heater .....	10
Philip Claypool .....	55
Mr. Dutchin .....	16
George Lester .....	6
O. W. Courtney.....	36
J. H. Burns .....	4
George Horn .....	1
Mrs. Huffington .....	5
Mr. Poundstone .....	1
Mrs. Franz .....	2
Mr. Christy .....	5
B. F. Hoke .....	65
George Lester .....	175
S. A. Bent .....	105
C. W. Heater .....	8
L. C. Jones .....	2
W. A. Davis .....	5
James Baxter .....	85
Philip Claypool .....	61
A. A. Park .....	10
B. E. Wheeler .....	7
A. A. Park .....	8
Mr. Dutchin .....	20

S. Conroy .....	1
George Lester .....	105
George Lester .....	44
Apiaries inspected .....	37
Apiaries diseased .....	21
Colonies in apiaries inspected.....	1,274
Colonies in apiaries diseased.....	152
Percentage of inspected apiaries diseased.....	57
Percentage of inspected colonies diseased.....	11.5

ADAMS COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Hermann Rauchfuss .....	50
T. J. Beyers .....	7
Mr. Luellan .....	4
A. Hurst .....	40
Henry Dierks .....	3
Albert Ludwig .....	7
M. J. Garhart .....	100
George Jorgenson .....	3
C. P. Wahlstrom .....	4
A. F. Soloman .....	22
Mary A. Whipple .....	7
George H. McNeill .....	100
A. G. McAllister .....	10
J. W. Harper .....	30
Theodore Lohf .....	80
L. A. Stueland .....	40
E. B. Moore .....	4
W. Martin .....	150
Adam Ginther .....	10
I. W. Michael .....	14
Apiaries inspected .....	19
Apiaries diseased .....	7
Colonies in apiaries inspected.....	685
Colonies in apiaries diseased.....	13
Percentage of inspected apiaries diseased.....	37
Percentage of inspected colonies diseased.....	2

ANNUAL REPORT  
MONTROSE COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
S. J. Harris	60
W. O. Moore	1
W. S. Holland	50
Will Nelman	2
T. J. Heath	91
Mrs. George Cleveland	24
A. A. Toothacher	5
J. C. Knifer	18
T. Cuppy	3
Otto Peterson	2
I. Wright	16
George Nichols	72
Fred Sherman	80
J. E. Bureh	75
Dr. Bell	26
Lily Godman	35
Robert Stites	50
Mr. Snyder	33
Philip Claypool	100
James Neilsen	40
Wm. McClelland	16
Sidney Pope	1
S. A. Scott	22
J. D. Shiply	9
George Cone	1
L. G. Felix	32
C. F. Jennings	11
Mr. Fisher	42
J. T. Huston	6
George S. Warren	6
Lon Wright	60
Mr. Underwood	6
Bert Willis	19
S. J. Harris	129
S. J. Harris	46
Wm. Easton	90
Hubert Miller	3
A. H. Baxter	46
J. C. Mathews	92

## BOARD OF HORTICULTURE, COLORADO

J. T. Heath	100
Mr. McRae	5
Tom Neal	7
E. E. Willis	12
M. J. Corey	24
C. P. Foster	59
Mrs. George Cleveland	69
Will Atchley	90
Robert E. Foster	80
Robert E. Foster	19
F. B. Hill	10
Apiaries inspected	50
Apiaries diseased	18
Colonies in apiaries inspected	1,886
Colonies in apiaries diseased	70
Percentage of inspected apiaries diseased	34
Percentage of inspected colonies diseased	3.60

## OTERO COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
J. Allison	30
R. A. Gordon	62
Mr. Lyngar	18
Mr. Dameron	3
C. K. Boyd	2
Swink Estate	120
Swink Estate	125
W. H. Bartleson	65
George Harrison	40
George Cooper	250
B. W. Hopper	100
Joe Beeler	31
J. A. Goodner	11
C. E. Darragh	3
A. S. Parson	113
W. W. Spencer	21
A. Lee	3
A. D. Isherwood	26
A. Lehman Estate (F. E. Richmond, Manager)	69
B. W. Hopper	115
Guy Woods	37

O. J. Baxter.....	3
A. S. Parsons.....	20
George Harrison .....	29
Dan Coyle .....	79
J. M. Purdy .....	55
Lehman Estate .....	39
T. A. James .....	24
C. R. Goodner .....	2
P. Mounts .....	54
D. W. Call .....	33
W. O. Victor .....	47
A. S. Parsons .....	160
E. S. Whitcomb .....	4
Lehman Estate .....	76
Mr. Bailey .....	36
A. Waddington .....	75
F. E. Richmond .....	109
F. E. Richmond .....	96
E. E. Livesay .....	46
W. O. Victor (two apiaries) .....	110
Apiaries inspected .....	42
Apiaries diseased .....	7
Colonies in apiaries inspected.....	2,331
Colonies in apiaries diseased.....	30
Percentage of apiaries diseased.....	23.75
Percentage of colonies diseased.....	1.25

## JEFFERSON COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Hermann Rauchfuss .....	80
Herman Rauchfuss .....	40
M. Sparks .....	40
Apiaries inspected .....	3
Apiaries diseased .....	1
Colonies in apiaries inspected.....	160
Colonies in apiaries diseased.....	3
Percentage of inspected apiaries diseased.....	33.33
Percentage of inspected colonies diseased.....	1.86

DOUGLAS COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
J. H. Perry .....	101
M. J. Carhart .....	15
Apiaries inspected .....	2
Apiaries diseased .....	1
Colonies in apiaries inspected.....	116
Colonies in apiaries diseased.....	1
Percentage of inspected apiaries diseased.....	50
Percentage of inspected colonies diseased.....	0.9

WELD COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
A. B. Pickett.....	4
A. J. Rowe .....	21
P. J. Lajere .....	30
Apiaries inspected .....	3
Apiaries diseased .....	3
Colonies in apiaries inspected.....	55
Colonies in apiaries diseased .....	13
Percentage of inspected apiaries diseased.....	100
Percentage of inspected colonies diseased.....	23.5

ARAPAHOE COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Hermann Rauchfuss .....	40
J. D. Tucker .....	6
Ella Speer .....	27
W. J. Locke .....	21
Apiaries inspected .....	4
Apiaries diseased .....	4
Colonies in apiaries inspected.....	94
Colonies in apiaries diseased.....	10
Percentage of inspected apiaries diseased.....	100
Percentage of inspected colonies diseased.....	10.6

## GARFIELD COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Abe Cohn .....	40
Apiaries inspected .....	1
Apiaries diseased .....	1
Colonies in apiaries inspected .....	40
Colonies in apiaries diseased.....	40
Colonies in apiaries destroyed.....	40

## CROWLEY COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Bert Hostler .....	59
Jasper Duncan .....	4
H. E. Farr .....	24
Mrs. L. W. Durham.....	8
A. O. Wickstrom .....	17
Apiaries inspected .....	5
Apiaries diseased .....	..
Colonies in apiaries inspected .....	112
Colonies in apiaries diseased.....	..
Colonies in apiary diseased.....	..

## BOULDER COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
T. J. Marchant .....	38
J. G. Heinz .....	6
J. A. Hairell .....	35
W. B. Walcher.....	65
W. P. Collins .....	30
A. F. Foster .....	75
W. B. Walcher .....	65
W. B. Walcher .....	60
W. B. Walcher .....	15
Mrs. T. C. Conger.....	7
Apiaries inspected .....	9
Apiaries diseased .....	7
Colonies in apiaries inspected.....	396

Colonies in apiaries diseased .....	22
Percentage apiaries diseased .....	78
Percentage of colonies diseased.....	.5

NOTE—Fourteen of the diseased colonies were in one small yard. This yard was practically all diseased. A small amount of foul brood was found in six other apiaries.

## BENT COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
E. E. Butcher .....	40
E. E. Butcher .....	36
Apiaries inspected .....	2
Apiaries diseased .....	..
Colonies in apiaries inspected.....	76
Colonies in apiaries diseased.....	..

## WASHINGTON COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
Frank Dickerson .....	60
Frank Dickerson .....	9
Leo Dunham .....	100
W. A. Cheek .....	125
R. J. Evans .....	8
Frank Tanburg .....	15
Apiaries inspected .....	5
Apiaries diseased .....	3
Colonies of apiaries inspected.....	317
Colonies of apiaries diseased.....	63
Percentage of inspected apiaries diseased.....	60
Percentage of inspected colonies diseased.....	19.66
Colonies destroyed .....	62

## MESA COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
George Newberry .....	70
Julius Fessler .....	12
J. T. Brown .....	16
Terrice Lotz .....	3
H. M. Cannon .....	1

E. J. King .....	3
A. L. Stone .....	2
J. A. Truesdale .....	9
Luther Nelson .....	3
Lee Nugent .....	3
F. C. Henzger .....	1
J. H. Yessen .....	2
M. C. Hobson .....	2
E. S. Swayne .....	7
Roy Tait .....	85
Roy Tait .....	71
J. A. Green .....	64
Ralph Santy .....	6
Wm. Carter .....	1
E. L. Hewett.....	1
Nels Muhr .....	10
A. W. VanHelen .....	2
H. Haynes .....	3
F. P. Eno .....	50
J. W. Board.....	12
E. Duval .....	2
Harry E. Harris .....	65
E. Kennedy .....	80
A. L. Sewell .....	4
Mrs. Mary Boyd .....	50
William Harkleroad .....	90
J. E. Fluckey .....	18
A. L. Gourley.....	4
C. G. Walz .....	3
John H. Wasson .....	3
J. W. Fidel .....	1
Wm. H. Durham .....	6
A. L. Zellers .....	7
Beaman Fox .....	1
William Rettig .....	19
O. O. Felows .....	1
H. M. Baltosser .....	4
Dr. Lockett .....	8
Sarah Eastman .....	13
Steve Nickola .....	1
V. Black .....	65
W. H. Hamontree.....	2



L. A. Hunnell .....	11
Alva Douglas .....	4
S. M. Wagler .....	1
Willis Cline .....	16
C. S. Griffin .....	9
R. E. Diggles .....	23
A. L. Hutchinson .....	6
J. A. Greeh.....	33
Henry Wertz .....	3
Clay Simpson .....	41
E. M. Hetzel .....	3
E. E. King .....	40
W. B. Woodworth.....	2
Iris Roth .....	7
Edward Holden .....	14
G. H. McCloskey.....	10
T. S. McCoy .....	2
D. C. Graham .....	1
H. D. Conner.....	10
Frank Smith .....	4
Edward Munson .....	5
John Jenkins .....	3
Tony Coach .....	6
James Santy .....	16
T. J. Lynch .....	1
J. W. Shide .....	12
N. C. Mounson .....	70
G. M. Akenan .....	1
A. N. Burson .....	7
C. W. Cain .....	14
J. D. McKinney.....	1
John Sherrod .....	55
E. Kennedy .....	81
E. Kennedy .....	64
S. W. O'Conner .....	7
Valley Commercial Co. ....	50
T. J. Campbell .....	14
William Fitterling .....	25
H. L. Albers .....	6
Cris. Peterson .....	2
G. G. Gerkie .....	2
W. H. Lee .....	4

W. E. Hill.....	6
F. Burkett.....	27
Mrs. Mary Holt.....	7
A. L. Gnagy.....	13
H. Lee.....	8
Mrs. R. B. Veitch.....	5
W. V. Page.....	4
Mrs. M. C. Black.....	20
Wm. Dodds.....	1
A. V. Sharp.....	25
F. E. Hammond.....	17
F. M. Douglas.....	19
D. S. Maxson.....	3
C. F. Walker.....	9
Oliver Tebedo.....	1
W. R. Hastings.....	22
W. H. Harrison.....	5
G. V. Gimple.....	4
John Hanson.....	57
F. B. Hill.....	70
F. B. Hill.....	75
J. A. Hoodenpyle.....	11
Dell Rollman.....	24
O. A. Bliven.....	3
John Pelstrun.....	1
Bert Cord.....	8
Nels Pritchard.....	2
F. Perry.....	30
George Evans.....	2
Harvey Groves.....	14
E. M. Downer.....	3
Frank Berg.....	16
Mils Nelson.....	5
Ala Rice.....	3
J. A. Green.....	24
J. R. Penniston.....	22
William Silzell.....	2
William Coffman.....	65
John Goldsby.....	77
H. W. Smyres.....	1
A. J. McCabe.....	40
William Van Buren.....	4

Joe Deep.....	4
Henry Gerry.....	27
A. L. Smith.....	47
David Galleon.....	7
John Sherrodd.....	79
W. H. Scott.....	2
A. R. Armstrong.....	34
Avery Burford.....	15
Dr. Blair.....	26
Jack Boyington.....	2
Todd & Son.....	83
Mrs. E. R. Sullivan.....	19
J. J. Rober.....	31
J. O. Berry.....	16
Gale Murray.....	15
J. A. Laurant.....	21
Sam Ashley.....	87
R. T. Anderson.....	15
E. E. Chambers.....	92
M. C. Black.....	26
J. F. Bonman.....	3
John Wallace.....	69
Elmer Ingram.....	2
Willis Kline.....	18
Ernest Taylor.....	2
G. W. Conrad.....	2
F. E. Adams.....	12
Ralph Santos.....	16
J. R. Stotts.....	2
J. A. Wilson.....	2
George Miller.....	1
Annie Griffin.....	1
Colon Hewitt.....	3
F. B. Hill.....	75
F. B. Hill.....	75
C. G. Meyers.....	16
W. E. Douglas.....	4
J. S. Carnahan.....	52
W. Magenson.....	2
John Goven.....	75
C. E. Reesor.....	4
C. Goodrich.....	3

Lem Taylor .....	2
Mac Ewen .....	25
Judd Barton .....	1
George Holowell .....	1
Lois Peterfano .....	1
Ralph Todd .....	43
John Robinson .....	4
J. A. Larimore .....	3
Frank Berelkeimer .....	26
Charles Rinderley .....	9
C. G. Sargent .....	2
John Gessberg .....	4
Mary Simpson .....	3
J. C. Peters .....	25
Josephine Long .....	7
Ira Goss .....	71
J. Baders .....	1
Joseph Innis .....	6
John Sherrod .....	55
John Metz .....	4
James Nelson .....	10
Bryant Evans .....	3
Wm. Van Pelt .....	35
Todd & Son .....	84
Ira Vincent .....	5
Robert Bowan .....	6
F. O. Berry .....	85
William Ternahan .....	8
W. T. Stephens .....	51
Sam Ashley .....	87
Mrs. Ida Timer Sawyer .....	90
Mike Holland .....	1
J. Vandemore .....	20
A. T. Johnson .....	1
Charles Werling .....	20
Dr. Coltrin .....	1
W. S. Long .....	13
M. R. Speer .....	2
C. T. Walker .....	13
Ernest Frohn .....	8
Jim Santos .....	33
Osborn Brothers .....	4

Joshua Barnes .....	43
Alfred Cross .....	8
J. L. Foster .....	38
L. C. DeCamp .....	35
P. F. Johanson .....	4
Thomas Pitts .....	40
Erwin Stewart .....	7
Joe Barber .....	34
J. F. Sanford .....	15
Willard Foster .....	83
Robert Ingram .....	5
John Ellsbury .....	89
Isaac Sawyer .....	65
J. R. Robinson .....	2
Ben Wassen .....	4
J. W. Dyer .....	1
Henry Robins .....	7
August Grundl .....	79
J. R. Sisaac .....	103
Sigg and Ceiss .....	80
J. Y. Roger .....	1
Charles Munroe .....	14
Reugh and Son .....	2
K. G. Hall and Son .....	100
K. G. Hall and Son .....	100
John Hall .....	100
Elmer Cromer .....	5
Frank Nickolai .....	9
John McCue .....	5
A. A. Wood .....	90
John Place .....	90
F. M. Snyder .....	100
J. H. Harris .....	25
Joseph Sonworth .....	100
J. L. Pewett .....	50
E. Hardy .....	80
Deloss Cory .....	100
Deloss Cory .....	100
C. R. Parks .....	100
C. R. Parks .....	50
Thomas Fitzpatrick .....	100
F. D. Barney .....	50
	12

M. E. Gentry .....	3
D. S. VanCleve .....	1
W. S. Thompson .....	3
L. N. Grant .....	6
W. E. Fisher .....	2
Gertrude Reuss .....	30
Joe Benson .....	4
Mrs. G. N. Powell.....	10
George Evans .....	6
Frank I. Lee .....	3
Wm. Durham .....	7
William Rettig .....	41
J. C. Peters .....	33
A. W. Van Heulen .....	2
William Dingman .....	57
Henry Wertz .....	4
R. L. McCall .....	80
H. Edington .....	1
John Atwell .....	15
Henry Dingman .....	2
John Brown .....	4
Ezra Bell .....	9
Willard Foster .....	81
Ray Sisaac .....	10
J. D. Sawyer .....	60
R. Brook .....	2
Andy Sanders .....	3
William Dittman .....	14
William Soeske .....	6
A. Lippincott .....	6
George McQuary .....	39
J. R. Sisaac .....	100
Sigg and Ceiss .....	85
Charles Kitson .....	13
W. H. Clark .....	14
John Wolf .....	5
K. G. Hall and Son.....	49
K. G. Hall and Son.....	100
John Hall .....	100
Salem Beery .....	14
Fred Galyeon .....	21
Cris Lood .....	5

Mat McKee .....	15
A. A. Wood .....	90
F. M. Snyder .....	100
J. H. Harris .....	100
Joseph Somworth .....	50
Joseph Somworth .....	100
C. W. Simmons .....	22
Ernest Cook .....	90
Deloss Cory .....	100
Deloss Cory .....	40
C. R. Parks .....	100
Thomas Fitzpatrick .....	100
Waite and Webb .....	60
D. G. Harkins .....	2
J. A. Clark .....	7
H. C. Daughters .....	1
George Smallwood .....	15
W. S. Gordon .....	3
G. Hagner .....	1
M. S. Patterson .....	7
W. A. Darby .....	7
William Dingman .....	84
M. M. Shores .....	1
Hill Brothers .....	13
M. A. Holt .....	10
W. J. Long .....	15
Mr. Juttens .....	19
N. C. Mounson .....	82
Clay Simpson .....	26
Isaac Sawyer .....	101
John Barnes .....	44
Mrs. P. F. Johnson .....	3
James Brooks .....	3
William Ditman .....	21
J. R. Sisaac .....	100
August Grundel .....	69
Willard Foster .....	100
A. Kitson .....	10
John Ellsbury .....	68
L. McCall .....	85
Seigg and Celss .....	105
A. M. Burson .....	9

J. A. Green .....	40
E. M. Hetzel .....	5
L. A. Hunnel .....	9
Earl King .....	4
C. S. Griffen .....	16
M. C. McClaunskey .....	14
J. Anderson .....	7
Mary Black .....	23
Mary Boyd .....	62
Herbert Gaines .....	83
C. L. Hoodenpyle .....	14
E. Kennedy .....	105
E. Kennedy .....	100
J. A. Truesdale .....	18
John Sherrod .....	83
A. R. Armstrong .....	69
Wm. Silzoll .....	3
J. A. Pennington .....	41
R. L. McCall .....	38
Lee Wells .....	43
J. R. Sisaac .....	10
John McQuarry .....	34
P. Foster .....	97
J. R. Sisaac .....	101
Hill Brothers .....	10
Willard Foster .....	61
W. Utterback .....	100
A. Clark .....	13
L. McCall .....	85
F. P. Eno .....	65
W. T. Brown .....	16
A. L. Stone .....	2
E. A. Mackley .....	1
E. E. King .....	58
William Douglas .....	10
R. E. Diggles .....	33
H. M. Baltasser .....	7
Fred Burkett .....	47
Rosa Veach .....	7
E. A. Loomis .....	14
A. L. Smith.....	63
E. Kennedy .....	100

E. Kennedy .....	105
Henry Gerry .....	41
M. C. McCuen .....	21
John Sherrod .....	84
J. Larimore .....	2
J. Birelheimer .....	30
L. A. Wells .....	42
Apiaries inspected .....	389
Apiaries diseased .....	58
Colonies in apiaries inspected.....	11,423
Colonies in apiaries diseased.....	114
Percentage of inspected apiaries diseased.....	15
Percentage of inspected colonies diseased, less than	1

MONTEZUMA COUNTY

Name of Beekeeper	No. Colonies in Apiary Inspected
H. M. Barber .....	85
John Bauer .....	50
Mrs. Wattles .....	24
E. C. Smith .....	3
Charles Lamb .....	8
N. A. Decker .....	1
J. D. Lamb .....	20
Ritchey Brothers .....	3
Thomas Cox .....	1
P. M. Mellott .....	6
Alfred W. Kermode .....	8
James Galloway .....	5
W. P. Dennison .....	3
R. P. Gordon .....	4
Sam Pruden .....	2
J. D. Hall .....	40
George King .....	91
T. O. Wilkerson.....	34
Clark Hickman .....	3
C. J. Scharnhorst .....	20
W. J. Marshall .....	2
W. J. Marymee .....	4
Charles Schalles .....	5
C. F. Francis .....	18
J. S. Wilson .....	1

A. J. Tozer .....	6
Mrs. Wattles .....	18
Louis Paquin .....	4
Frank Graybeal .....	2
Mrs. Scharf .....	4
A. D. Burr .....	1
John Hammond .....	3
T. L. Lamb .....	8
D. V. Hamilton .....	11
Ellsworth Porter .....	9
Mrs. S. M. Holley .....	71
George J. Ashbaugh .....	38
Ernest Hall .....	1
Charles Rowe .....	1
James Brumley .....	3
Harry Parsons .....	2
Frank Meyers .....	3
G. D. Taylor .....	26
Frank A. Taylor .....	42
William Carlyle .....	1
J. C. Townsend .....	1
Daniel Goff .....	11
James Totten .....	22
J. M. Dobbins .....	6
McElmo Orchard Co. ....	9
J. V. West .....	4
J. W. Galloway .....	6
Herbert Luce .....	30
Charles Mann .....	42
S. W. Bryant .....	9
George McMillian .....	8
All. Hammond .....	6
Mr. Rutherford .....	8
D. J. Christy .....	1
Mr. Canfield .....	6
D. J. Griffith .....	1
Mr. Culp .....	2
F. M. Goodykoontz .....	3
E. H. Hill .....	15
Mr. Burris .....	1
M. B. Deluche .....	2
Riddle Thompson .....	3



Max. McClure .....	2
Will Veach .....	3
Mr. Walters .....	reinspected
Mr. Kitell .....	5
Mr. Milligan .....	1
J. M. Dolan .....	3
J. B. Rose .....	23
J. R. Jordan .....	4
E. L. Guillet .....	4
J. M. Dobbins .....	2
Charles Schalles .....	3
O. E. Stone .....	20
W. H. Goodall .....	1
Mr. Glenn .....	1
W. C. Miller .....	7
Charles Melvin .....	2
F. Morgan .....	1
Mr. Guildford .....	1
Mr. Van Atta .....	16
James Treece .....	10
Thomas Fowler .....	15
Richard Baker .....	2
Mr. Ismay .....	6
W. N. Meadows .....	5
Will Miller .....	16
George Elliott .....	4
Mr. Todd .....	8
George Lyons .....	12
Mr. France (Kreuger place) .....	1
Thomas Coppinger .....	19
Mr. Hanks .....	3
Arthur Lyons .....	4
Robert Scott .....	17
W. H. Harliss .....	29
A. J. Tozer .....	2
C. F. Francis .....	8
McElmo Orchard .....	3
A. P. Green .....	5
J. M. Dolan .....	1
Mr. Scharf .....	5
Wm. Harless .....	27
Thomas Fowler .....	14

Mr. Deluche .....	2
A. B. Lovingood .....	3
James Casey .....	4
Mr. Dennison .....	reinspection
E. Hall .....	1
John Wilson .....	6
Frank Taylor .....	46
R. P. Gordon .....	3
John Lill .....	4
J. D. Hall .....	4
Mr. Bales .....	1
A. Hall .....	2
Gus Bircher .....	2
Mr. Armstrong .....	1
E. C. Smith .....	4
Mrs. Wattles .....	21
Frank Graybeal .....	1
H. S. Allen .....	2
A. D. Burr .....	1
George Carr .....	1
Wm. Coppinger .....	5
John Rose .....	22
T. R. Jordan .....	5
E. L. Guillet .....	4
Lewis Ismay .....	6
Wm. Meadows .....	2
Mr. Hass .....	2
Herman Thomas .....	2
Thomas Cox .....	1
James Galloway .....	11
Jesse West .....	3
T. G. Wilkerson .....	41
Samuel Pruden .....	3
John Brumly .....	reinspection
C. W. Wilkerson .....	5
M. B. Parson .....	8
M. W. Faunce .....	27
E. Elberta .....	1
John Bauer .....	reinspection
Frank Halford .....	5
Louis Paquin .....	5
William Ellis .....	1

N. A. Decker .....	2
Charles Brown .....	32
H. A. Freeman .....	2
Mrs. T. W. Wattles .....	50
Mr. Englehart .....	1
Henry Lupke .....	14
William Ellermeyer .....	5
Frank Ritter .....	1
Charles Wilson .....	3
James Treece .....	10
Martin Tighe .....	2
Mr. Wyman .....	5
John McLean .....	2
Mr. Prothero .....	13
E. Porter .....	3
I. J. Christy .....	reinspected
Mr. S. W. Wycoff .....	1
Wm. Coppinger .....	10
Jasper Hall .....	3
Chris. Wilkerson .....	5
Joe Cummings .....	reinspected
Mr. Bird .....	reinspected
Henry Snodgrass .....	1
Mr. Wiggans .....	15
W. B. Elbert .....	1
Henry Royce .....	9
Mr. Duncan .....	63
Mrs. Lynch .....	2
Apiaries inspected .....	179
Apiaries diseased .....	108
Colonies in apiaries inspected .....	1,729
Colonies in apiaries diseased .....	1,038
Percentage of inspected apiaries diseased .....	60
Percentage of inspected colonies diseased .....	60
Colonies destroyed .....	673

NOTE—Many colonies of diseased bees were dead when the inspection was done. They are counted in this list the same as live colonies that were diseased.

## GRAND TOTAL

Apiaries inspected .....	904
Apiaries diseased .....	285
Colonies inspected .....	22,074

Colonies diseased .....	1,654
Colonies destroyed .....	796
Percentage of apiaries diseased.....	31
Percentage of colonies.....	7.5

## INSPECTION IN COLORADO, 1911 AND 1912

County		Colonies		Apiaries	
		Inspected	Inspected	Diseased	Diseased
Mesa	1911	8,075	240	130	53
	1912	11,367	390	113	58
Delta	1911	971	61	201	34
	1912	1,274	37	152	21
Bent	1911	22	2	..	..
	1912	76	2	..	..
Boulder	1911	575	4	2	2
	1912	201	9	22	7
Washington	1911	..	..	..	..
	1912	317	6	63	3
Logan	1911	..	..	..	..
	1912	42	4	..	..
Arapahoe	1911	..	..	..	..
	1912	94	4	10	4
Jefferson	1911	..	..	..	..
	1912	160	3	3	1
Douglas	1911	..	..	..	..
	1912	116	2	..	1
Adams	1911	675	30	28	8
	1912	681	20	13	7
Weld	1911	..	..	..	..
	1912	55	3	13	3
Crowley	1911	..	..	..	..
	1912	50	5	..	..
Otero	1911	2,437	51	138	29
	1912	1,783	43	30	10
Montrose	1911	9,433	213	682	119
	1912	2,307	64	93	25
Garfield	1911	383	17	61	4
	1912	40	1	40	1
Montezuma	1911	246	11	148	10
	1912	1,883	110	1,248	81
Fremont	1911	987	102	184	54
	1912	1,365	150	67	36

Prowers .....	1911	1,295	20	..	..
	1912	..	..	..	..
		<hr/>	<hr/>	<hr/>	<hr/>
Totals .....	1911	25,099	751	1,575	313
	1912	21,811	853	1,867	258

FINANCIAL STATEMENT

There being no receipts to account for during the year, the financial statement consists entirely of disbursements, which are as follows:

STATE ENTOMOLOGIST FUND

Salary of state entomologist.....	\$ 499.92
Per diem of deputy.....	1,063.75
Stenographic services .....	165.00
Expenses .....	1,441.63
	<hr/>
	\$3,170.30

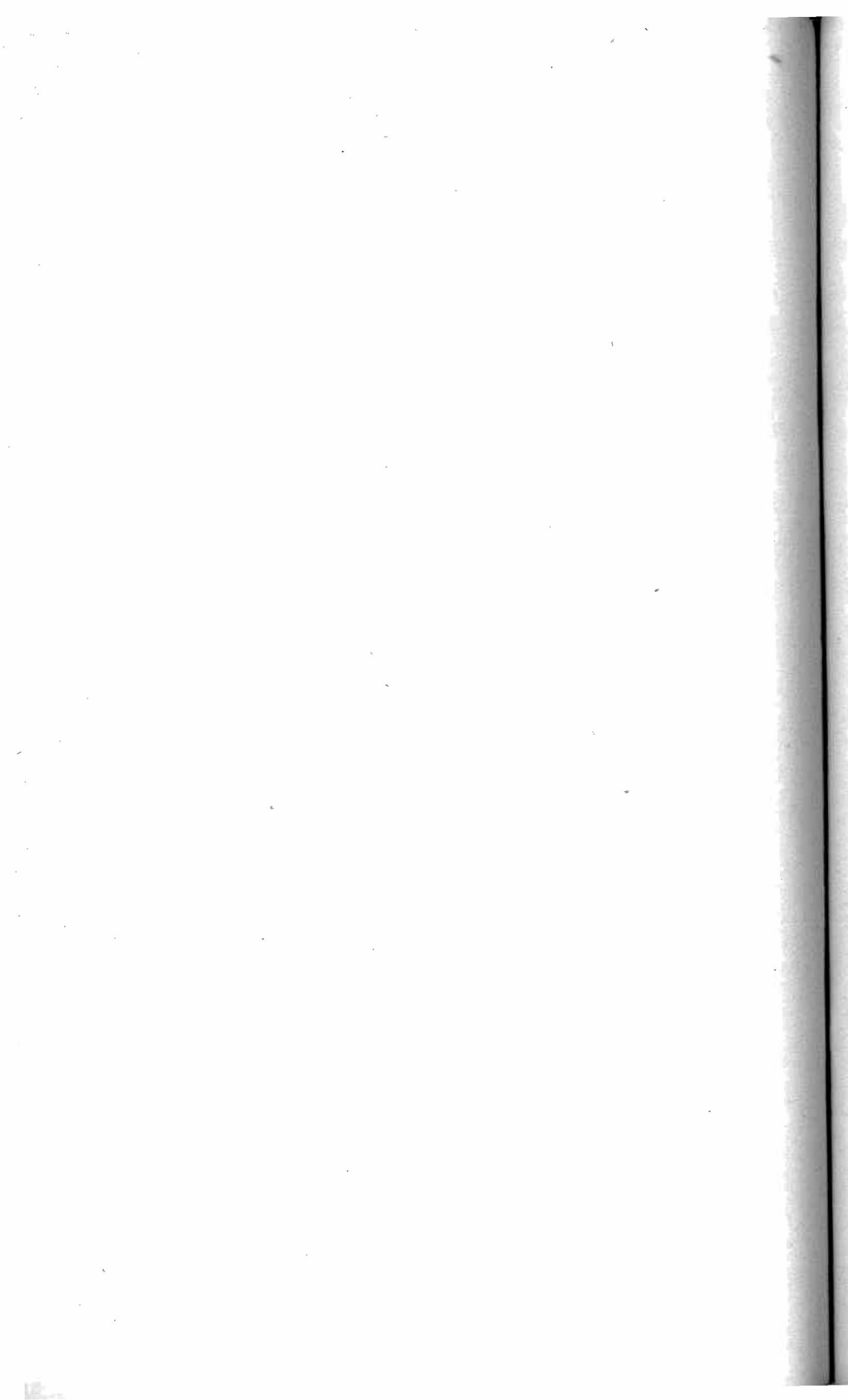
PEST FUND

Salary of state entomologist.....	\$ 499.92
Per diem of deputy.....	708.00
Stenographic services .....	15.00
Expenses .....	524.20
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	\$1,747.12

APIARY INSPECTION FUND

Per diem of deputy.....	\$ 665.00
Expenses .....	322.01
	<hr/>
	\$ 987.01

C. P. GILLETTE,  
State Entomologist.



PROCEEDINGS

OF THE

Thirty-third Annual Convention

OF THE

Colorado State Bee-Keepers'  
Association

HELD IN

DENVER, COLORADO

AT

The Auditorium Hotel

DECEMBER 12-13, 1912

#### OFFICERS

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President—W. P. COLLINS.....Boulder  
Vice-President—N. L. HENTHORNE.....Platteville  
Secretary—WESLEY FOSTER.....Boulder  
Treasurer—MRS. RACHEL RHODES.....Milliken  
Member Executive Committee—HERMAN RAUCHFUSS.....Englewood

PROCEEDINGS  
OF THE  
Colorado State Bee-Keepers'  
Association  
DENVER, COLORADO

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MORNING SESSION

DECEMBER 12, 1912

Opening of convention 10:30 a. m.; President Collins in the chair.

Reading of minutes.

President Collins: The first number on the program is a paper on "Exhibiting Honey at Fairs," by Mr. N. L. Henthorne.

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EXHIBITING HONEY AT FAIRS

N. L. HENTHORNE, PLATTEVILLE, COLORADO

Some two years ago, up in our county, we had our first annual county fair, and at that time I think there were three pounds of honey on exhibition. Well, the next year I got busy and made a small exhibit, and, while not a financial success on my part, it created considerable interest, and the stockholders of the fair association were interested enough to double the premiums. They offer now a premium list of about \$100, and this year I entered an exhibit; but, the weather being cold and bad, very little benefit was derived from it. There were two other exhibitors besides myself, but it was so cold that we could not handle bees in a wire cage at all. Every day, with the exception of one, was too cold for the bees to fly at all. Still, considerable interest was shown, and I believe the main thing brought out by exhibiting at fairs is the fact that very few people ever give honey any thought until they see it on exhibition.

As far as creating a market for honey is concerned, I do not think it is absolutely necessary to exhibit; yet the good I have derived from it personally in Weld County is that I have created a demand for honey, and have been able to sell a considerable amount of off-grade honey at home that will not sell readily when shipped. The home people, as a rule, do not want to buy the first grade, but will buy a cheaper grade. At the fair this fall I took orders for fifty or sixty cases of No. 2 honey. So that, in the city of Greeley, which used to be considered no market at all,



I believe that, since exhibiting there, I could sell every pound that I could raise. Many of these people never thought of using honey until they saw it on exhibition.

This is one of the benefits derived from these local exhibits, that we could probably work off the lower grades of honey, as they do not sell very well in carloads; and most bee men, like myself, have more than they can ship readily. Of course, our Fair Association does not feel as though it could give premiums large enough to make it any great object to make exhibits for the premiums alone. While the premiums amounted to \$100, the expense of my exhibit amounted to some \$50 or \$60. Of course, I lost a whole week's time; but one should not expect to go to the fair with just the view of what he gets out of it, if he does not naturally like the work of exhibiting, and the advertising he can get out of it. Personally, I like to go to the fair and exhibit, and get acquainted; and it is interesting to me to hear the questions that are asked at these fairs, as it brings out points that one never thought of. A great many people do not know but what comb-honey can be made and manufactured. I have a chance to enlighten a good many people on this and other subjects, and have shown them that it is absolutely impossible to manufacture a single pound of comb-honey.

#### DISCUSSION

Mr. Foster: Do the premiums received generally pay for the cost of making the exhibit?

Mr. Henthorne: Well, yes; usually I think they do.

Mr. Foster: So that what honey you sell is, you might say, clear profit; that is, there is no selling expense?

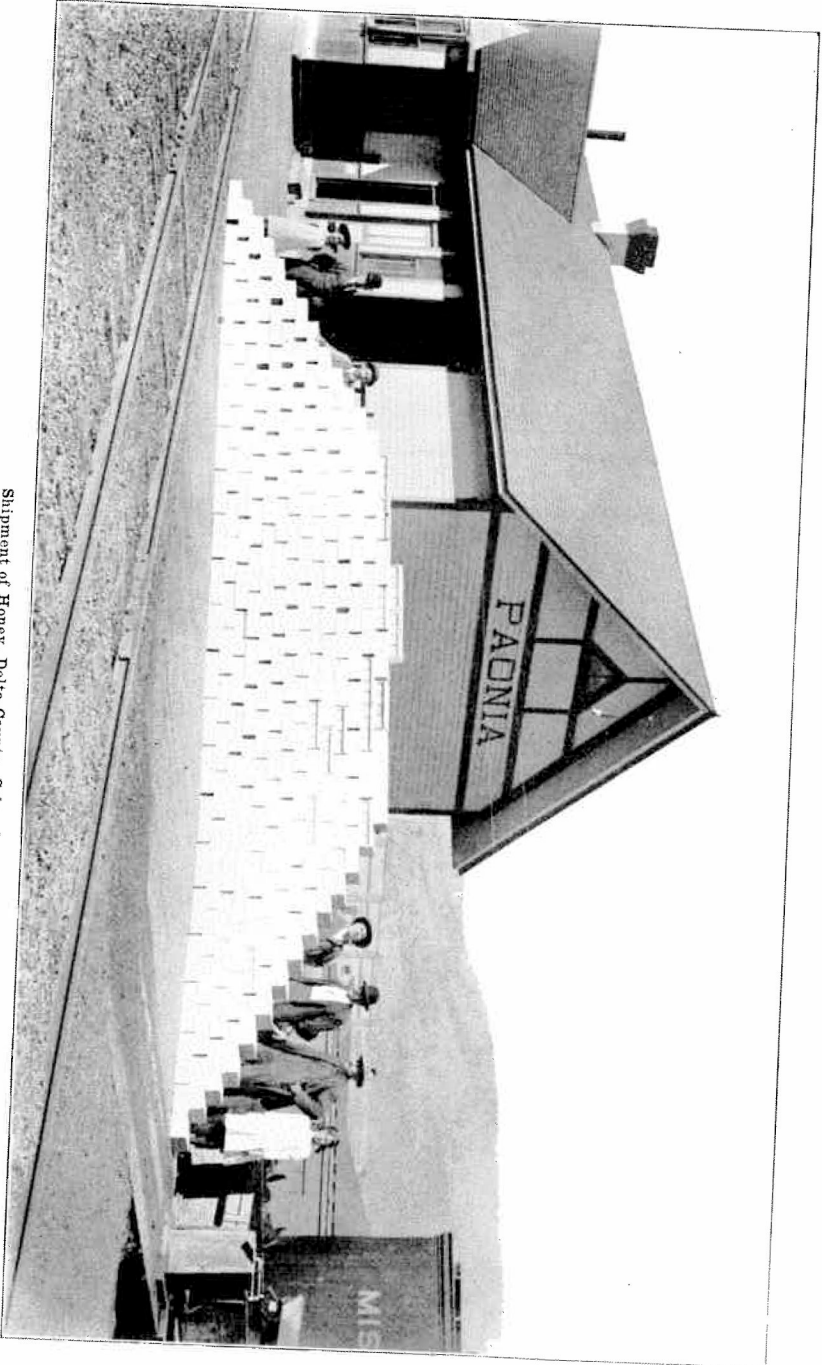
Mr. Henthorne: Yes.

Mr. Polhemus: If it is so the Fair Association can pay out, it is all right; but in our county the Fair Association runs behind every year, and has cut down all premiums, so that honey premiums do not amount to over \$30, which, when divided up, amounts to but very little.

Mr. Henthorne: It is a fact that the association hasn't been a success, owing to conditions. This year the weather conditions were strictly against it. It was absolutely impossible to make it a success in such weather; so I have not very much hope of the success of our fair, and they will either have to get on a different basis, or discontinue the fair altogether. I do not think it is possible for them to give very high premiums and make it a financial success. The only real good that comes from exhibiting at fairs is to the local man who lives in the vicinity of the fair, for what advertising he gets out of it, and to sell his low-grade honey; but an outside man could not afford to do it. And, at the same time, it is a good thing for the industry, as it advertises our product and bee-keeping in general.

President Collins: I would ask a question of Mr. Henthorne, or for any of you to answer, based on conditions in the city of Indianapolis last May. I saw honey for sale at the market place, which extends under a whole block. I found what I think was Colorado honey, labeled California honey, and all the cull-honey was labeled "Colorado." If the fair advertising could do away with shipped cull-honey and have it consumed in our own state, do you think advertising will do it; and, if it will not, is there any way to prevent the condition I have mentioned?

Mr. Henthorne: I will state, for your information, that during the last season there were quite a number of people from other states at our fair; and they wanted to get honey from me, because they knew absolutely that it was Colorado honey. I know I sold to parties from Oklahoma, and from Indiana and Alabama. One man said he had heard of Colorado honey, and he had bought so-called Colorado honey, but that what he had purchased for Colorado honey was nothing like what I had on exhibition. I think advertising might have a tendency to establish



Shipment of Honey, Delta County, Colorado



the superiority of Colorado honey, and exhibiting at fairs is a good way to advertise. Of course, ordinarily people do not bother to go to honey-producers' associations, or even to stores; and if they do, they do not know whether it is Colorado honey or not; but when they buy it from a producer, they know it is.

Mr. Walcher: I have shipped honey to Illinois, Missouri, Kansas, and Oklahoma, and there has been perfect satisfaction all the way around. They seem to think it is at least as good as the best honey they ever had, and the demand for it there is increasing steadily. I shipped to Oklahoma about \$250 worth of honey this season, and to one place in Kansas I have shipped close to \$100 worth, and small quantities to other places; and it appears that the demand is increasing steadily wherever placed.

Mr. Henthorne: I should like to ask the question whether or not the exhibiting or handling of bees, and these discussions on handling bees in wire cages, are a benefit or a detriment to bee-keeping in general.

Mr. Jouno: I believe that they are detrimental.

President Collins: If so, why?

Mr. Jouno: I think, as people become more familiar with bees, and they learn how to handle them, especially boys, we have more trouble having bees stolen. We suffer considerably from thieves.

Mr. Foster: I think the trouble with thieves among bee-hives is considerably smaller than it is from any other line of goods exposed around the country. It has been a surprise to me that they have not been molested more. We have had yards near Boulder, and we have had just three instances of stealing, and they never got more than \$3 worth at any one time. Some people near Denver have had a great deal heavier losses, I will admit, but I doubt if Mr. Jouno's statement, that the greater knowledge of bees among people would tend to more stealing, would hold over all the country. We have not enough good bee-keepers in Colorado at the present time. There may be a few well-stocked districts, and others not so well; but if the colonies were well distributed, I am sure we could support three times as many as we have. In northern Colorado there are very few districts that are overcrowded; so many have moved out that there is room for many more. There is room for a few more bees near Boulder, and it would be better if we could ship more honey from there. There would be better conditions if we had more bee-keepers and better bee-keepers. I think a general knowledge of the better bee-keeping practices is one of the great needs of Colorado. I had a letter the other day from Professor Hinman, superintendent of extension work at the State Agricultural College, stating that the college would send out an agricultural train about the middle of February, and wanting to know if the association could not prepare an exhibit to be placed on the train. I think that is an opportunity. I believe that it is a good opportunity to circulate more knowledge on the control of foul brood, and to show people the better bee-keeping appliances, especially in western Colorado. About half of the bees are in old boxes. All the people need is a realization of the money that can be made out of them, to have different hives. The fruit-growers realize that bees are valuable in the pollination of their fruit trees; but for that purpose they think an apple box is as good as a frame hive.

A Voice: Isn't it as good for fruit work?

Mr. Foster: It may be as good for fruit work, but it is not so good for the bee-keepers living near, who get foul brood from those hives. We have been able to secure the transfer of several hundred this year, but did not get to everyone. Wherever inspectors worked, we secured the transfer of many box hives.

Mr. Jouno: I should like to ask Mr. Foster if the \$3 would cover the loss. Did the thieves get \$3 worth, or did you lose that amount? I understood Mr. Foster to say that more producers put their bees in box

hives, and I think they did better than they would have done in buying hives, because the majority do not get any honey anyway. I have been inspector for twelve or fifteen years, and my experience is that it does not pay to keep one or two, or ten or twelve. They get a little run of honey and get excited; then they buy a good many more and forget them, and in the course of time the inspector has to burn them up. The fact is, there would be no need of an inspector if bees were not kept as a side issue.

**Mr. Henthorne:** I should like to mention, in connection with exhibiting at fairs, that we have succeeded in one thing, and that is, grading honey—comb-honey. In the vicinity of Greeley, when I first exhibited there, honey was honey—it was not graded. These farmer bee-keepers just sold it for No. 1 honey, with anything in it. I have established the fact that there is a difference in the grade of honey, and the grocers in that town will not buy the farmers' honey unless it is absolutely up to grade; they know there is a difference, and these farmers bringing in off grades find there is no market for it. I know there are farmers in our vicinity who want \$3 for their honey, and it is not even No. 2. The ungraded honey is dear at any price.

**Mr. Lyons:** While they are exhibiting bees, shaking foul hives into clean hives, they show them something practical, so that these farmers who do want to clean up their hives know how to go about it. In regard to having bees stolen, it is not only the honey they get, but they tear the hives partly open and cut out a comb or two of honey, thus disturbing the honey in the middle of the winter. If thieves would let the bees alone, we would be willing to give them the honey.

**Mr. Polhemus:** With us this stealing has been periodical. I think, in our case, it comes mostly from newcomers—such as beet-pullers, railroad men, etc. They do a great deal more harm than just the value of the honey amounts to. They do ten or fifteen dollars' worth of damage in spoiling the bees.

**President Collins:** Is it your opinion that the exhibitions and the training of the public at the fairs have a tendency to increase that, or not?

**Mr. Polhemus:** I do not believe it makes any difference. We have had less trouble this year than ever before, but attribute it mostly to taking better care of our yards. We had better fences, gates, etc. By doing this, they do not seem to bother them much.

**Mr. Walcher:** Where I am located, I had something like twenty-eight or thirty supers taken off early in July, and there is no question in my mind but that it was a regular honey-thief, with a machine, who drove in and took the honey. It was \$100 worth of honey, or very nearly that. The only experience I have had in the way of having bees stolen from hives east of town was with the school children, and they made it right with me.

**President Collins:** I do not think that the fair question had anything to do with it.

**A Voice:** When we had a reward posted this year, we did not have any trouble.

**Mr. Henthorne:** I should not like to have the idea established that educating the people along that line causes this stealing; that the more we educate them, the more they take our bees and destroy them.

**Mr. Foster:** There are two phases to this question of discussing bees before the public. One is to popularize the use of honey, and the other is to get the people who have only one or two swarms, caught when they happened along and lit, familiarized with better bee-keeping practices. I hardly know how to handle the latter of these questions, because the tendency of the times is all toward specialization. If one bee-keeper stocks a neighborhood, he will produce more honey and get more wealth than if two or three hundred bee-keepers had one or two hives each in

the neighborhood. In the good bee districts of Colorado the swarms get away, and everybody gets bees. When that happens, the proposition is a problem. In some places they have thought that by doing away with all bee inspection they would discourage these people with a few colonies. That has succeeded to a certain extent where they had poor crops; but in Montrose, Delta, and Montezuma Counties foul brood would not even discourage these small bee-keepers, and the foul brood caused the specialists more trouble than the beginners, because they did not pay much attention to them anyway, and if they all died in the winter, they did not lose much. I should like to hear an expression on this from some of the other members present.

Mr. Lyons: I should like to say that in my locality, six or eight years ago, every farmer had a few stands. Then poor seasons came, and foul brood, and now very few have bees. But, as you say, if a few good seasons come, very few have bees, leaving it in the hands of the specialists.

Mr. Polheums: I do not believe that the exhibiting of bees at fairs has anything to do with this stealing that is going on, any more than having people come around and watch you work has. They get a great deal more information in that way than they do in seeing these exhibits; so I do not think that has anything to do with the stealing at all.

President Collins: My personal view is that the more Colorado instructs in bee-producing, and the more good bee-keepers we have, the better their sales will be. People go to the potato district to buy potatoes—western slope of northern Wisconsin; they don't go to Missouri. The more you make the locality known as a district for a particular commodity, the greater will be the number of buyers who will visit that district for it; so that the more instruction given, and the more good bee-keepers there are, the easier it will be to make sales.

Mr. Jouno: As I understand it, these exhibitions were not held to teach the people, or to show foul brood, or the way of handling these; they were held as a curiosity, to show what could be done with the bees. There was no education to it, judging from what I have seen.

Mr. Henthorne: I take exception to Brother Jouno. In all the exhibiting I have done I have never tried to "pull off stunts." I started by explaining how to open bee-hives; how to lift the combs, and how to handle them; and then I explained about the brood, age of bees, how long it took to mature a queen, about swarming, etc. Then I explained foul brood, and how to shake them into clean hives and burn out the infected hives. I believe personally that "pulling off stunts" is a detriment to the bee-keeping industry. And I believe that the onlooker gets some benefit from my instructions, whether he is a specialist or a farmer.

President Collins: I wish to state that during the two seasons that I acted at the Inter-State Fair, in Denver, there were no "stunts" in bee-handling "pulled off." There may have been some the following year, when they advertised a bee wizard, but not while I was present.

Meeting adjourned until 1:30 p. m.

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#### AFTERNOON SESSION

DECEMBER 12, 1912

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#### THE AUTOMOBILE SESSION

President Collins: We have with us this afternoon Mr. Wimbush, of the Ford Motor Company, who will tell us of the advancement made in the manufacture and use of automobiles for all purposes.

Mr. Wimbush: In twenty years the automobile has advanced from a rather unsatisfactory plaything of rich men to a reasonable, reliable, economical convenience for the man of ordinary means. When the first automobiles were sent out, they were not very reliable; but now they have been so perfected that they will do almost anything. One man made a tour last February from Phoenix, Arizona, to Buffalo, New York, and others from places as far east as the Atlantic to Los Angeles. One man here in Denver made a trip to Seattle and back.

The automobile has also been reduced in price to such an extent that everybody who has use for a vehicle can afford one. To show to what extent the automobile is being used, I will say that the company I represent was organized in 1903, nine years ago, and this year they are manufacturing 225,000 automobiles. This car (showing a picture) sells for \$650, fully equipped, and anyone having use for a car can surely afford one at such a figure.

The question arises: Is a car of this price reliable? Talk to men using these cars, and who have used them for several years, and they will convince you. Several things go to make this low price of cars possible—chiefly the tremendous output of factories such as ours. When cars are turned out at the rate of 700 per day, you can realize that they can be produced at a much lower price than if only a few cars were being manufactured.

Mr. Foster presiding, temporarily.

#### DISCUSSION ON AUTOMOBILES FOR BEE-KEEPERS

Mr. Foster: I have asked Mr. Herman Rauchfuss if he will give us a talk on his experience in operating an automobile.

Mr. Rauchfuss: The cost depends on the man who is running the car, and the car. No matter how good a machine you may have, if it is not handled intelligently, you will have a great deal of trouble and expense. If the machine is left without oil, it will be ruined. The question of tire expense is also one of great importance. If you overload a tire, it will be ruined in a short time. About the first of August I bought new tires, used them with heavy loads, and made fast trips, and in less than three months those tires were worn out. Running the machine fast will cut the tires; and starting it on the jump, throwing the brakes so the wheels will slide, wears the tires. If you do not adjust your spark properly, you will use twice as much gasoline as you ought to use. All these things add to the expense.

A great deal depends on the driver. I have been running a machine for several years, and have never needed a team to pull me out, except once. I ran one car several thousand miles, at an expense of three cents a mile, including repairs, gasoline, and everything.

Most of the expense of a car is in the first cost. You can hardly lose anything in buying a small machine like the Ford. And if you buy one, buy a new one, for a second-hand one costs from one to two hundred dollars more than it is worth. You can replace the worn-out parts only when the machine is in fairly good condition. After a car has been run several thousand miles, almost any part is liable to give out when you least expect it.

Mr. Polhemus: We use a different make of car from the one used by Mr. Rauchfuss, but he has covered the ground fully. I would say that the expense depends mostly on the driver—the way he handles the car and how it is taken care of. I do not think I can add to that; but in using pneumatic, as well as solid, tires, we find that a high-wheel solid tire gives little hesitation in pulling through sand and mud, while we cannot get through on a low wheel.

President Collins: What difference in the expense of a high and low tire—that is, the original expense?

Mr. Polhemus: There was not much difference in the first cost of the Ford and the International, but the cost of keeping up the tires was more with the pneumatic than with the solid tires. We have not used our pneumatic tires long enough to estimate the expense, but we have used the solid tires for two years without any additional expense.

Mr. Rauchfuss: There is one thing that should be taken into consideration: The car should have a certain amount of clearance. When you come to run a car, you will find that you will strike a rock and break the car, if you are not careful; and that is one disadvantage of the low-wheeled machine. The solid tires jar too much for me, and I do not like them.

Mr. Polhemus: It was not on account of the axle striking the ridges or stumps that we preferred a high-wheel car, but because it runs easier and pulls more. The International low wheel comes like a solid tire, with only about six inches between the axle and the ground. It takes some power to move, too, while the high wheel takes less and runs much better. Notice the difference between the high and low wheel in the matter of jolting, and you will find that the high wheel jolts but very little.

Mr. Rauchfuss: It is the solid tire that I object to.

Mr. Henthorne: I have it figured out like this: If you are going to pay only six or eight hundred dollars for a car, the price is immaterial. I use an International wagon, and it has given perfect satisfaction. I have had it two years, and have run it between eight and ten thousand miles. I figure that it has cost me \$865. If it lasts another year and keeps in good condition (with the regular amount of repairs), I figure that I am even. That is, I shall save approximately \$15 a month over and above the cost of keeping up a team and wagon, and \$150 a year on hired help. Thus, if it lasts for three years, I have saved enough in help, etc., so that it will not cost me anything at the end of that time.

President Collins: What distance from your home is your farthest apiary?

About twelve miles, and it costs me two cents per mile to run my machine.

President Collins: Is there anyone here, who has used an automobile in connection with bee work, who would think of getting along without one now?

No reply.

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## PRODUCTION OF COMB-HONEY

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PRESIDENT W. S. COLLINS, BOULDER, COLORADO

Comb-honey has been my work in connection with the bees almost altogether. I have never owned more than one small honey-extractor, and that I bought new; the rest I have, came with two or three small apiaries I have bought.

From my observations during the last four years, I am more than ever convinced that a honey-producer whom I knew back in Wisconsin typifies the perfect bee-keeper. He ran all of his hives two stories high—always had one story raising the young queen to supersede the old one. The result was that he always had a queen to start in the month of April from the brood of the previous season. With a prime queen of that kind, vigorous and strong, which had been given unlimited food, he averaged, for twelve years, a little over three hundred pounds of ex-



tracted honey per colony. I am thoroughly convinced that comb-honey can be produced best with two stories.

When you have reached the honey flow, or just before reaching it, put the queen down on the empty combs, allow the upper one to stand eight days, and then remove it, leaving the whole working force on the old stand. In that way you get the working force at the right time, which prevents the inclination, in a large, prolific swarm, to swarm until the honey flow comes on, and by the removal of the brood at this time you have eliminated the swarming of the colony for at least three weeks. I am not sure that it will work as a practical proposition, but believe it is the only method to follow to get a large crop of honey from each colony.

I am going to say right now that I believe that, by doubling two swarms of bees to eliminate old queens, you will get more surplus next season than you possibly could with two hives—one with an old and one with a new queen—and also a better quality of honey. We should get to a more concentrated system of work in the bee-hives, and to the proposition of raising more per colony, on an average, than we have in the past. When I first came here, we had several years of large crops, and an old neighbor once said that thirty or forty pounds of honey was a good yield. I laughed at that time, because I had not seen a bee-keeper in Colorado until then who did not come up to that. I would not laugh now, for I think it is a fairly good yield; but I do think it can be increased greatly by concentrating the force, by producing large amounts of food, perfect queens, and then breaking down the brood-nests. If you can remove all of the brood and put the queen in on full combs, and have stopped all swarming, they will go to work in the supers at once, and there is little danger of swarming following it. Maybe some of you here have some other method of preserving your swarm intact. De-queening would be the only method I could suggest, and I do not know whether that is a feasible one or not, as I have not followed it up enough to know. Last spring I doubled them up, and I got more honey for each pair than I did from any two that I did not double up. The hives were full when I broke them in two. They raised a young queen, and they are right there now with the young queen and twice the stores. I believe we make a mistake in taking off the honey too close. Unless some method is used, they will swarm and throw the old queen out into the air; and if you drive them back in, the chances are she gets killed. In any event, they always get a new queen. Large colonies are entirely due to the young queens and a perfectly inexhaustible amount of food. Where whole hives or boxes are filled to their capacity with food, you have the bees in quantity.

When I have taken full sheets of foundation to build, and have tried to get a two-story hive started in the spring, I have gotten my drawn combs. Drop the sheets in April or May, or as soon as the bees can reach out and begin to gather; drop full sheets at the side of the brood-nest to feed the bees, and remove them when half drawn. After you begin in the latter part of April, you can have a full set of combs drawn without a great deal of food, as I believe the food comes back—and more too.

#### DISCUSSION

Mr. Jouno: I should like to inquire if there are a great many sagged cells in the sheets that have dropped down, and if they make imperfect cells up in the middle of the brood-frame.

Mr. Walcher: I have never had any trouble that way, and we wired them with three wires.

President Collins: I would state that when you wish to build combs, you will eliminate all bad cells by putting in the sheet of foundation at the side of the brood-nest; they will not get on the hives enough to stretch

them. I have had bees hatch in the top cells next to the top bar, so there can be perfect worker combs built on full sheets of foundation.

Mr. Jouno: We have never tried dropping down the combs so early in the season.

President Collins: If you drop them earlier, you must see that there is some honey coming, or they will cut the wax out and use it somewhere else.

Mr. Lyons: How do you feed the bees at that time? Early in the spring?

Answer: Yes, after apple-blossom time.

President Collins: I bought a small lot of bee supplies, about three years ago, that had a feeder on the front of the hive to put a Mason jar over. I discovered that by feeding in there I could make a very cheap feeder and at the same time a good one. By taking the friction top can and punching four or five holes in the top, turning it bottom side up, and then taking a board, one-fourth by one-half inch, and beveling it to slip into the hive at the entrance, entirely enclosing it, I can feed the bees without ever opening the hives, and do it without using a smoker. There is only one way to get under the friction top can, and that is through the hole in the center of the brood. One swarm of bees gets it, without danger of robbing bees getting to the feeder. I have about two hundred of these friction can feeders around the apiary at Boulder, and they are as good as any twenty-five-cent feeder you can buy. You can feed syrup in this kind of can, and the bees will take it out and handle it, and do well on it and increase.

Mr. Jouno: How much feeding is necessary for a colony per day or week?

President Collins: I did not feed every day. Last spring I took a quart- or two-quart can and fed eighty swarms of bees about twice a week; and they increased rapidly, developing into the most populous hives of bees I have ever raised. At the time I started feeding, the weather was so cold that I did not, at times, clean the hives out as often as twice a week.

Mr. Walcher: About what time last spring did you put on the top stories?

President Collins: I could not say exactly, but it was about the 25th of June that the supers were put on. The top stories of the hive were put on when they began to feed. Just as soon as the hives were full to the out walls, I put on the top stories and began to change places. I do not want it understood that I spread a brood-nest, for that is not the case. I let them spread. I spread the comb to get the foundation sheets next to the brood-nest, but gave the queen room and feed, and let her spread her own nest.

Mr. Foster: I was thinking of the practice a good many use, of putting away a number of sealed combs for use in the spring. Some of us need combs of pollen about as much as combs of honey, and I should like to have someone, who knows how to get combs of pollen, let us know how he does it.

Mr. Walcher: I have practiced feeding flour in the spring ever since I have been in Colorado, and I have never found any left. I think that I fed over two hundred pounds of flour to 190 colonies last spring, and I think it helped.

Mr. Lester: I have practiced that, too. I gave seventy-five pounds to 215 swarms, and that kept them going until pollen came.

Mr. Rauchfuss: I think we should keep the bees away from the neighbors, as they are a bother to them. I have fed my bees a great deal of flour, meal, shorts, and, in fact, almost anything, and I could not see that it did much good. You winter your bees in the two stories, and you have a two-story colony in the spring to start with. You commence

to put on the sheets of foundation, and the little feeding you do does not amount to anything. It will take eight or nine combs of honey to raise a large colony of bees. In putting on old combs or foundations, put two colonies together, and you will find that you have plenty of pollen.

President Collins: The statement is probably correct from the location Mr. Rauchfuss has, but in the foothills we have no trouble in getting pollen. They were bringing in pollen the 17th of November this year and putting it into the hives at Boulder; and they will start bringing it in there the last of February or beginning of March; so you see we have no trouble there.

As to feed: If you will fill the two-quart can twice a week during the last of April, you will have put in enough feed for the extra colony. If you put in the feed to make it, and break the comb off, I know it can be done. I have done it next to one that was put up with two stories, with the feed in both hives. You have to get the feed to them.

Mr. Jouno: Do you cover your hives, or how do you arrange to keep them warm?

President Collins: I do not leave the tops off. I have a very tight top on at that time of year.

Mr. Jouno: Did you put any honey in, or just common sugar syrup?

President Collins: I have fed both. I fed in the last of April with clear sugar syrup and nothing else, and made some strong colonies, which produced immense quantities of brood. Where we get plenty of pollen, we feed in that way and get plenty of food.

Mr. Jouno: We had four colonies, and I put a fence around them and moved them home. I commenced in March to feed them warm sugar syrup every day. About the 15th of June I did not have any more brood in there than I had out where I had several hundred colonies.

President Collins: I wish to tell you of an experience of Mr. Howard's. Three years ago last summer he had about eighty swarms of bees, and he fed them regularly through August and September—filled his hives and fed them sugar syrup. My loss that season was about 50 per cent, and I fed nearly two tons of sugar; Mr. Howard's loss was ten out of his eighty swarms. He had produced young bees and filled his hives with brood, and all he used for feed was syrup. Since that time foul brood has bothered them, but he did not lose from loss of food or by reason of the bees being old, and he got young bees through the winter when the rest of us lost on account of the age of our bees.

Mr. Jouno: I know it is contrary to all writers. I suppose I don't understand the feeding.

Mr. Martin: Does it always pay to feed? You make this preparation for a large number of bees, not knowing when the honey flow is going to be. Suppose you get your bees in overflowing condition for gathering honey, and the honey flow is a failure. How will your bees fare?

Mr. H. Rauchfuss: I prefer to have mine running over with bees, whether the honey flow comes or not. There is such a thing as getting the colony in the right condition at the right time. If you have them too strong ten or twelve days before the honey flow, your results will not be satisfactory. But when the colonies get there at just the right time, you will get results. Two years ago I had young bees out east of here, and I wanted to take some bees to Fort Lupton; and so I took most of the bees and moved them off, and they did finely. There were no prospects of getting honey out there; so I let them go. They had a great many bees and lots of food, but I think the season has a great deal to do with it.

President Collins: Then you would not contend that that would be a normal season condition?

Mr. H. Rauchfuss: Not at all.



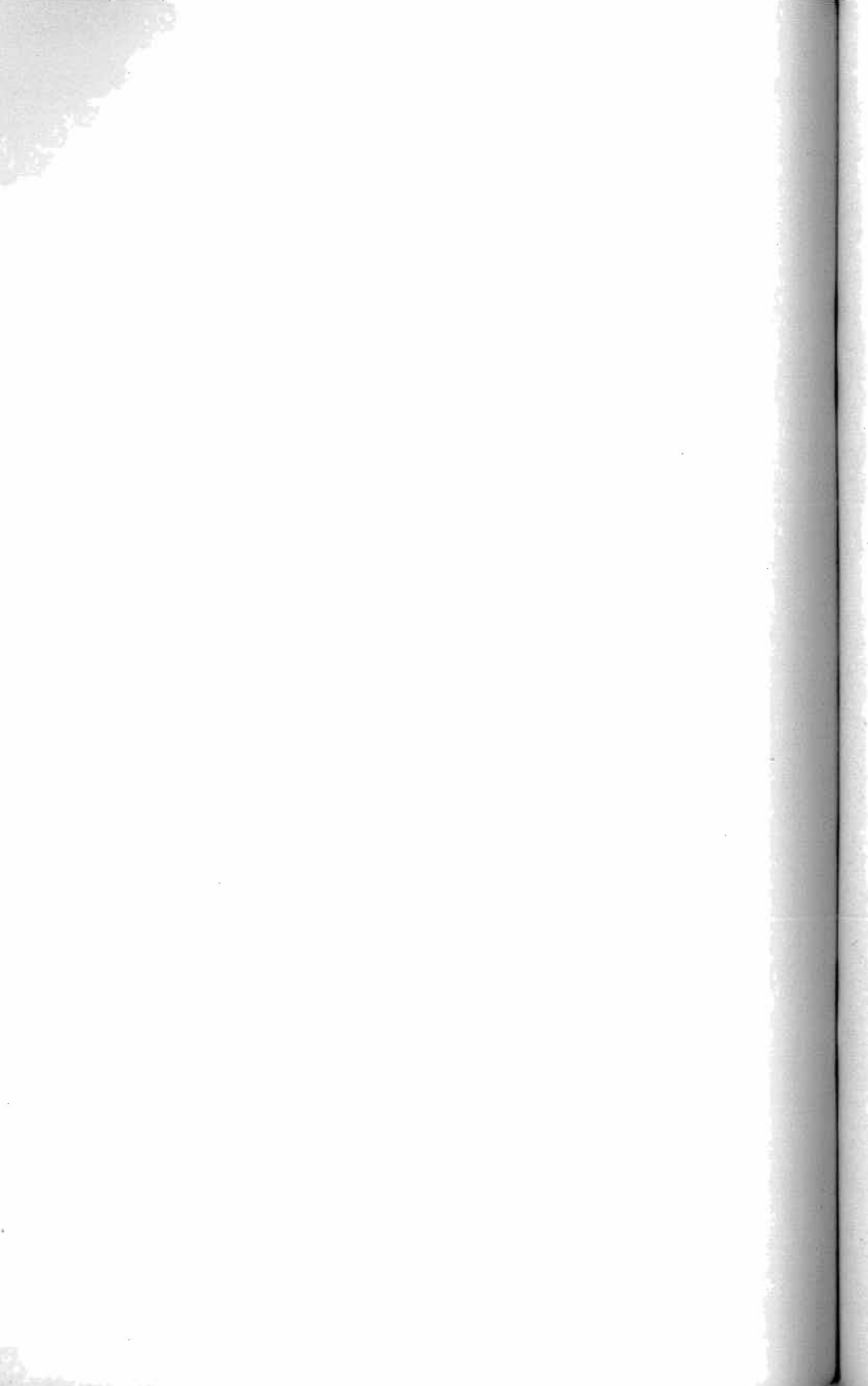
**A Model Apiary in Colorado.**

Photo by Wesley Foster, Boulder, Colo.



**An Apiary Needing Improvement—Box Hives and Disorder Lose Money for the Bee-Keeper.**

Photo by Wesley Foster, Boulder, Colo.



Mr. Martin: My experience has discouraged me from ever feeding my bees anything. Of course, I am not a large bee-keeper, but I might have been a better one if I had not fed once. I had my bees in poor condition and began to feed early. In June, about a week or ten days before the honey flow should be, I had a pound or two of bees on the outside. They were in as fine a condition as they ever were; had full hives of honey when I started to feed. I fed enough to cause them to consume most of the honey in the hives; and it left them with hives and empty combs and bees. About that time the honey flow started, and the eighth of June we had a hailstorm, which tore things up in general and cut practically all of the alfalfa off; and the bees that did not die (about 50 per cent of them made enough to live on) actually starved in what I expected to be the best of the honey flow. Had I not fed those bees, and had let them consume the honey normally, I should have had 50 to 75 per cent of them, because I used ten frame hives. As it was, I consumed all my honey, and I lost over 50 per cent.

President Collins: Had you not had that hailstorm, and things had been normal, would your bees not have been in better shape?

Mr. Martin: I am sure that they would, but, as it was, I lost some ten or fifteen hundred dollars.

Mr. Jouno: Will a colony that is real strong in April or May give as good results that season, with requeening with the same old queen, as one which did not come up until some time in June?

Mr. H. Rauchfuss: I do not think that the results would be so good from the strong colony as from the weak one. I have found that if a colony is too strong at the wrong time, it does not give proper results; but if you have a strong colony of bees, and see that there are too many, you can put on another story—but also put in plenty of honey. I would not depend on the old queen, but would expect the best results from the young queen. You might get results from an old queen the latter part of August. I would not have an old queen in the weak colony, but double up the strong colonies with the weaker ones. The strong colony is able to take care of the honey and pollen, and the strong colony also raises brood in those combs, and you will have more bees in the one colony than you would have in two.

President Collins: If the old queen was not a year old until June, July, or August, would you replace her with a new and younger one?

Mr. H. Rauchfuss: The bees will contract swarming fever, and under those conditions you will get very little honey.

President Collins: Will it not tend to curtail swarming to select from the two-story hives all of the side frames that have no brood in them, and drop them down and put the queen down as I suggested?

Mr. H. Rauchfuss: If you had a large number of colonies, I do not think that there would be anything gained by it; just slip the queen in between the two, and that would do it better. Be sure to have plenty of food where the queen is, so she can lay; and do not put her where there are not young bees. The bees make the queen lay, and as soon as they withhold the food from the queen she stops laying. She needs to be fed prepared food to make her lay, as she is not able to digest the honey and lay too. The queen has nothing at all to do with it but to be vigorous and strong.

President Collins: I agree with Mr. Rauchfuss that the full combs are better than the feed, but I gave those directions for the benefit of the man who has not the full combs and does not want to cut down his number of bees.

Mr. H. Rauchfuss: If a man followed your suggestion, he would be kept poor buying foundation and hives. Some bee-keepers invest most of their money in bee-hives, and you can go over the state and get them for nothing. That is the reason that bee-keepers are not better off. I have a great many surplus supplies and have made mistakes myself.

President Collins: My remarks were based on the supposition that a man knows enough to stop buying supplies when he has enough. I believe that the retrogression of the average bee-keeper is due less to increasing his numbers, and more to his failure to look after his queens and food properly. He must supply those queens and food, or he is bound to go backward.

Mr. H. Rauchfuss. If you unite them every fall, you will not lose any, and you will have them every year.

President Collins: I set them right together this fall, and have saved my young queens. Some of them are in one and one-half story hives, and others in two-story hives, but in each of them I have a young queen.

Mr. Martin: I think that the real trouble is in controlling the honey flow, or rather in securing a honey flow.

Mr. Henthorne: Do you put any protection between the hives, in uniting them in the fall of the year?

Mr. H. Rauchfuss: A piece of paper.

President Collins: Where do you keep the queen you expect to be killed—above or below?

Mr. H. Rauchfuss: I do not pay any attention to that. I do not believe that the queen who gets killed stays in there. If the young queen should be a poor one, the old one will stay in there; the better queen will supersede the poorer one.

President Collins: My method is to put the queen who I think will be killed above, so, if the bees get away from her, she would be the one, especially if old, to be killed.

Mr. H. Rauchfuss: I do not think that that has anything to with it. It is just as much her home as the home of the other.

President Collins: Did you unite them before the honey flow was over, or after?

Mr. H. Rauchfuss: I have done both.

Mr. Martin: Is there any danger of smothering the top hives if you use a paper between the two?

Mr. H. Rauchfuss: Cut a little hole in the paper, so that they can get through.

President Collins: Tear off one corner so that they can get out if they wish to.

Mr. Foster: Again I wish to ask: What is the best method of securing combs of pollen in the spring? There are certain localities where combs of pollen would be quite an advantage.

Mr. Frank Rauchfuss: Keep bees in Boulder.

Mr. Martin: I have never been bothered that way. Plant a patch of corn, or something like that.

Mr. Foster: In every locality there are seasons of the year when bees can get plenty of pollen. What method do you use to get them to store a surplus of it?

Mr. Jouno: Take the queen away from them.

President Collins: It would stop that, because it would stop the raising of young bees.

A Voice: Pollen is often gathered when they are queenless.

President Collins: Take out combs and set them aside, then.

Mr. Jouno: They will gather as much pollen without the queen as with her, but they will not use any.

Mr. Henthorne: I believe that the best indication that the queen is laying well is to see the bees getting a great deal of pollen. When the queen is gone you do not see that.

President Collins: I make this test in April: If a colony is bringing pollen, I decide that it has a laying queen; and if it does not, I find it queenless ninety-nine times out of a hundred. If plenty of bees are coming in with pollen, I know that there is a queen in the hive.

Mr. Jouno: You take a queenless colony, and you will find pollen stored away.

President Collins: Was not that stored while they had a queen, and afterward, when they had no queen, they did not use it up? The young bees are the ones that take the pollen.

### QUESTION BOX

Is the pollen good for brood-rearing after it has been in the hives all winter and has become hard?

Mr. H. Rauchfuss: Sometimes the young pollen is just as good. In the weak colony the bees cannot use it at all after it becomes hard. In the stronger colonies the pollen does not spoil, as a rule. There is generally a certain amount of honey in with it, and that preserves it in the winter-time. When ice forms over the combs, it takes the honey out and the pollen will spoil. We take the combs and store them away to get pollen.

Mr. Henthorne: I have tried that with great success.

Mr. Foster: The reason that I brought that question up is that I believe that we are not paying enough attention to stores of pollen in certain localities. We have never saved any combs of pollen. While some might have more than they need, others might be short.

Mr. H. Rauchfuss: I have seen times, before the honey flow, when I could not find pollen in the hives, and the young bees were actually starving. I found plenty of eggs, however. It is of great importance to have pollen at the right time of year.

President Collins: When a man's hives are in the condition you describe, is not flour better than nothing?

Mr. H. Rauchfuss: I have not found it so. I have fed syrup and done everything. When the time came to put on supers, where I had not opened the hives they were in better condition than where I had uncapped honey. Whenever you open a hive, you injure the hive in the spring of the year. The bees get cold and become weak, and as a consequence the whole colony is weakened. Give them plenty of food in the fall, and then do not open them.

President Collins: I agree with Mr. Rauchfuss; so I have adopted the feeder, with which I eliminate the necessity of opening the hive, and I get better results.

Mr. Walcher: Mr. Foster and I were talking about the dead brood that is found in the hives along in May. I had hives that got very weak in June. There were great patches that looked almost like foul brood. What is the cause?

Mr. Foster: Feeding flour, perhaps.

Mr. Frank Rauchfuss: Which shows how little we have progressed in bee-keeping.

Mr. H. Rauchfuss: I asked Dr. Phillips, an authority, and he said: "I don't know." He said there are only two diseases, and they are the European and the American foul brood. When it comes to bee diseases, they have not even commenced to investigate. There is very little known about bees.

President Collins: When I first came to Colorado, I had about twenty-five swarms. I set my empty hives out, and the Colorado bees came along and filled them. The next year I had a great deal of dead brood; so I sent for Mr. Foster's father, and he said that the bees had



gotten chilled or pickled brood, because I had opened the hives. A few days later I opened a hive (a chaff and a double-walled hive) which had not been opened before, and it was the worst of all.

Mr. Henthorne: In regard to the molesting of apiaries: I have had some molested—more this last summer than ever before. During the summer I had the hives opened, and after all the honey had been taken off, I closed the hives and put them away again. The following spring I found that they had been disturbed. It might be that we could get together and put up some bonus money and prosecute the thieves to the full extent of the law. I offered a \$25 reward, but it did not interest anybody, and the trouble continued.

Mr. Polhemus: It seems to me that if we were to take this matter up as a state organization, we could accomplish something. We have been bothered considerably. Put up notices as members of the State Bee-Keepers' Association and offer a reward.

Mr. Jouno: We offered \$50 and were troubled with thieves just the same.

President Collins: Frequently we knew who the guilty parties were, and even then we did not prosecute.

Mr. H. Raufhuss: I believe that the bee-keepers are considerably to blame themselves. If bee-keeping is such a poor industry that we cannot afford proper enclosure, we must expect to suffer. Often nothing better than a two-wire fence is the only protection that keeps the marauders away. If a bee-keeper will set good, solid posts around his yards, put up a good fence with three or four hog wires on top, and of sufficient height so it would not be a temptation to young fellows to steal, he would be immune from annoyance, and probably save many a young fellow from taking his first step in crime.

Mr. Polhemus: Since we have put up a good fence we have not been disturbed so much.

Mr. Cornelius: We had a little trouble this fall at Sterling, but it was caused by the old-timers. I fixed a fence, and one day, as I approached on my way back from town, I noticed that everything had been disturbed. Some hives—combs, honey, and all—were carried away. I investigated and found that a neighbor had said that the bees should all be destroyed. I went down to the hives and found bees all over the place—found honey right in the house. If we have money in the treasury, I believe that it would be a good thing to offer a small reward; but if we watch carefully, I think we can locate the source of our own trouble.

President Collins: I believe that we should appropriate a certain amount for this purpose, whether we use it or not; that is, if we have it to spare.

Mr. Henthorne: I agree with Brother Collins. What is an association for? We get little enough as it is. The association must stand for something, and if we could have it back, each one of us, with the assurance that it would give \$25, it would have its weight; and if the association is not in condition, I would be willing to give \$2 toward a fund, if we could be assured that prosecution would take place.

President Collins: One object of this national association, I understand, is a protection of this kind, and our votes this evening may decide whether we will affiliate with the national or not.

Mr. H. Raufhuss: If our state association has not the funds, and if there are enough members willing to have this protection, I do not see what prevents us from giving those that contribute a certain amount of money into a certain fund for such purposes.

Mr. Foster: I do not think that the national association, even if we should affiliate, would take any action in trying to catch a thief who stole honey down at Sterling. I think that is of a more local nature, and I think that our state association can handle that. The state associa-

tion can get out the cards for posting, and, if we need a fund, we can start it, and each one can subscribe money when needed, and it need not be called for except in cases of necessity.

President Collins: I think it would be better to have a fund ready to use, and have it ready at any moment.

Mr. H. Rauchfuss: I think, too, that we should have it on hand. Would it not be advisable to tax each bee-keeper at so much per colony, so as to have the money ready?

Mr. Frank Rauchfuss: It should be a voluntary contribution and not a compulsory one.

Mr. Foster: I believe that Mr. H. Rauchfuss' suggestions are good; but, before the motion is submitted, we should determine what the assessment per colony should be. Is five cents per colony enough, or too much?

President Collins: How many colonies are owned by the association members?

Mr. Foster: Nearly 25,000. The association has about a hundred members.

President Collins: One cent per colony would be sufficient, and almost all would agree to a low assessment like that.

Mr. Jouno: I think that one cent per colony would be sufficient, too. We might have a flat rate, at so much per yard, as a small colony is just as liable to be interfered with as a large one.

Mr. Frank Rauchfuss: -It must be handled like an insurance deal. A man who lives where there is no house within a mile or two should pay a higher premium than otherwise. Every year make assessments, and a larger premium should take a lower rate.

President Collins: Most states have a special provision for that matter, but this state has not; but I feel warranted in saying that it would not be a violation of any law that exists, and you do not need a statute to establish it. Would it not be advisable to appoint a committee to draft rules and regulations?

Mr. Jouno: I move that we appoint a committee to draw up resolutions and report tomorrow.

Motion carried.

Committee appointed: Mr. Jouno, Mr. Cornelius, and Mr. Herman Rauchfuss.

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#### EVENING SESSION

DECEMBER 12, 1912, 7:30 P. M.

Solo by Miss Mildred Henthorne; age, five years.

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#### BEE-KEEPING IN COLORADO

WESLEY FOSTER, BOULDER, COLORADO

There are several phases of bee-keeping in Colorado which I think will be of interest to us to take up this evening. I might say, in the beginning, that the greater part of this information has been gathered in my work in the past year in inspection of bees over the state.

The problem among the bee-keepers this year in regard to the spraying of fruit trees was more serious than the trouble with foul brood. The loss may not have been greater, but it has aroused more feeling

among the bee-keepers. The sections of the state that were affected most seriously were the Canon City fruit district, and Delta and Mesa Counties. At Canon City they have been troubled the last two or three years with the leaf-roller, which is the larva of a moth that lives on the foliage of fruit trees. This pest carries over the winter in the form of bunches of eggs on the bark of fruit trees. These bunches are about one-quarter inch in diameter, and contain from a dozen to two hundred eggs. These eggs hatch out when warm weather comes, and the larvæ consume the leaves of the trees. This became so serious that it threatened the life of the trees; so last year different preparations were made to fight them. The State Agricultural College inspector and the Department of Agriculture in Washington advised spraying, and various substances were used, the principal one being arsenate of lead, such as is used for the codling-moth. The spray was recommended to be applied early and continued. They commenced spraying before the buds opened at all. They found they were killing some of the larvæ and eggs before they were hatched; so they continued spraying along through fruit-growing time. As a result, nine-tenths of the bees in that thick area of Canon City were killed outright. That stirred up considerable feeling on the part of the bee-keepers. Later the fruit-growers were not satisfied, because they were advised by certain men—among them the man at Washington—that the spray would hurt the blooms, and those who used the spray, with hardly an exception, had no fruit whatever; so that they are rather disgusted with what they considered the "expert advice," and the bee-keepers are rather "peeved" because they lost their bees, and the prospects of a crop, which were very good at that time.

On the western slope, in Mesa and Delta Counties, the fruit-growers are growing cover crops more than ever before. They are planting alfalfa, red clover, sweet clover, etc., as a cover crop; but when they begin spraying, the spray falls on the bloom, and the bees commence to die; so the bee-keepers think it was not worth while after all.

Last summer I visited several orchards around Grand Junction where bees were dying off in August and September. No honey was secured, and swarms were dying out soon after swarming. Mr. Green was requested by fruit-growers to place bees in certain orchards, and in a few months they were all dead from spraying.

In Delta County they had the same trouble in the fruit orchards. Even some bee men do not think it is the spraying that does it. They have read this in different bee journals, which say that spraying the trees has not hurt the bees, in certain instances. I read of one instance, where a man had sprayed trees which were in full bloom, without any injury whatever. He did not state any particulars. It is only reasonable to suppose that poisoning will work an injury to the bees only when it is applied to a great mass of bloom that the bees are working on at that time. The Canon City district is very closely set, and all the men were spraying at about the same time, and fruit bloom was practically the only source of nectar. I saw the bees, and most of them were dead, or hopping around in the last stages of suffering, and it was during that time that the fruit men were spraying the most; so that has brought up the question of legislation in regard to spraying.

I supposed, until recently, that we had a law on that in Colorado, but I learned that the orchardists, in getting the old law amended, had it supplanted by a new one, and the new one has no clause in it bearing on this question whatever; so we have no recourse at this time. It is up to us whether we are going to do anything in regard to it or not.

The fruit men in Delta County said to Mr. Ensley that they would be willing to sign a contract to cut their clover in their orchards before it bloomed, or before they sprayed, to save the bees; and it seems that that might be done, although there are some who will spray at the wrong time.

The fruit men all agree that the first spray should be applied after the petals have fallen, and just before the calyx closes; so the relation of the fruit-grower to the bee-keeper is one that should have the attention of our association. The influence of our association over the state is greater than would be imagined by judging by the attendance at these conventions. We have a great many members now who cannot get to our meetings, and I have answered from three to six letters a week, on various subjects. I have done part of this work on behalf of the state inspection work, because the questions asked were such as would come under the heading of that work; but we, through our state association, have been able to circulate the good of our association through several meetings that I have been successful in arranging over the state.

Last spring, at the meeting at Montrose, we did not have over six members of the association present; but we had a far larger attendance than at this meeting today. We had sixty at one, and from fifty to sixty at each of the others. We had a banquet the last evening, and about forty were present. I wish we might get interested enough here so we could arrange something as good.

Another thing that will help to get the bee-keepers together is local meetings. We cannot expect to get them all to this convention, but can call meetings during the season, and have picnics, and in that way get them together, and stir up interest, and do a great deal of good. If it does nothing else but arouse fellowship, it would be worth while.

We had a picnic at Boulder in September, where about twenty or twenty-five were present; and although they had no program, they had a good time, and every bee-keeper thoroughly enjoyed it. If we held those in all the counties of the state, they would be thoroughly enjoyed. We had a good meeting at Cortez. Mr. Frank Rauchfuss attended the meeting and gave a talk on grading honey, and discussed local matters; and the people said, if they could get him to come again, they would have a better attendance than ever.

It seems to me that the bee-keepers are a little behind the other agricultural interests. We are a branch of them, and the Department of Agriculture has a great fund of information derived from experiments that have been carried on for years. They have tried to get this information to the people through bulletins, but this has largely been a failure, because people will not read them. The ordinary expert does not seem to be able to prepare a bulletin that is as reasonable as a novel, and for that reason the tons of literature sent out have not been so profitable as would be desired.

The experimental work in bee culture that should be done has been done only to a limited degree. The other interests are having county experts, whose business it is to meet the farmer on the land, tell what they know, and thus carry it to the people, and they are finding that this is a success. One of the largest works that we can take up in bee-keeping is to get the experimental knowledge derived from experiments, and then get men to go out and distribute the information among the bee-keepers, and talk over their problems with them.

The East is getting more out of this than the western part of the United States. Mr. Demuth is spending most of his time in the East, studying their problems, showing them how to produce comb-honey. Why have not we someone out here? Because the western associations have not awakened to the fact that they can have it. That is a line of work we should take up, because this extension work is going to advance very rapidly in the next few years. We have found out that, by hiring practical men, we can make for better practice in our problems than in any other way, and I hope our association may be of some help in getting that started. It is easy to do, if we work together, and, if we know just what we want, it is easier to secure things than a great many of us would imagine. We can help the various bee-keepers in their problems very materially.

I have enjoyed the inspection work I have done more from the fact that I have been able to talk better bee-keeping methods to the people, and from seeing that they appreciate it, than from the inspection work itself. If you can get a man interested, you do not have to teach him about foul brood any more. He will be his own inspector. In Colorado, at the present time, there is an opening for young men who can raise queens, and go ahead with a great deal of the out apiary work. A great many bee-keepers need young men in their work. The Agricultural College has no means of teaching apiculture as it does horticulture, and we should look into that.

#### DISCUSSION

Mr. Henthorne: I think this subject of getting acquainted with the bee-keepers has been of interest to all of us—to know whether any good ever came of this foul-brood inspection, outside of the fact of inspecting bees and getting the keepers to clean up; and I personally agree with our secretary that if you can get a man interested in keeping bees, he will inspect his own. I believe the majority of bee-keepers and specialists do not need any inspector, because, if they are going to make a success, they will have to inspect their own bees. My experience has been that about all you can do is to go and visit them, and if you can get them interested and get their confidence, they will clean up their bees; and if not, they will not clean up anyway—not if you had four hundred inspectors.

Mr. Foster: There are three things that the ordinary farmer bee-keeper does when an inspector comes and finds foul brood in his bees. He either finds out how to treat them, and treats them, more or less successfully; or he says he will not do anything, and lets it go until the inspector comes next time and burns them up; or he hunts around after the first trip, and sells them before the inspector makes the second trip. I have found that the number who sell out, or let the bee inspector burn up the outfit, is somewhat greater than the number who stayed with it and treated the colonies. In any case, I think the situation has improved. It has been necessary to destroy but very few live colonies of diseased bees. We generally found some capable bee-keeper who was willing to transfer the bees for them, and burn up the old material; but, in the main, the inspection seems to have a tendency to drive the bee-keeping into the hands of the specialists, which, I think, is the best thing, unless we can improve the quality of the ordinary bee-keeper, which we have not done to any great extent.

Mr. Jouno: I should like to ask Mr. Foster if he does not think the farmer bee-keeper, on the average, has lost more money by undertaking to keep them than he ever made out of it?

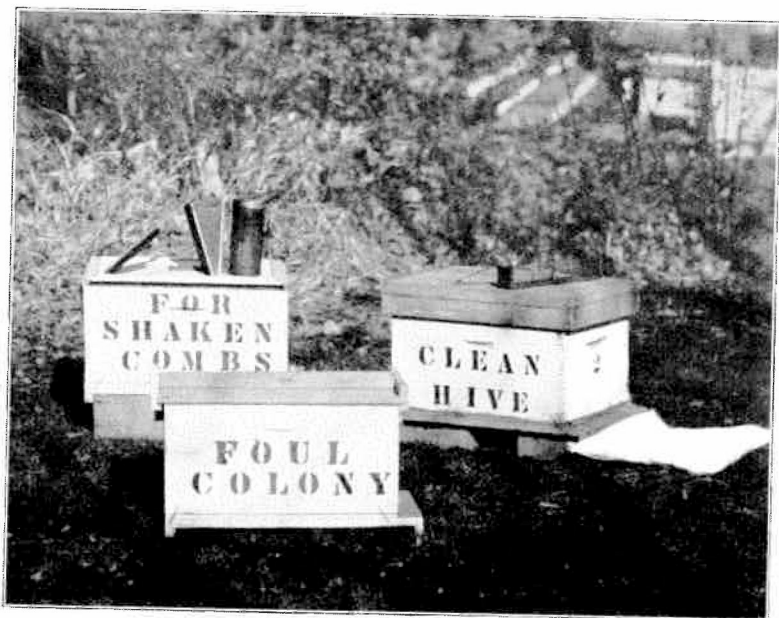
Mr. Foster: That is a pretty hard question to answer. The average farmer bee-keeper in Colorado has not put very much into it. A great many have put nothing into it. A swarm of bees came along, and they put them in a box. That did not call for an investment at all; they got honey, and were satisfied. But a great many others here in eastern Colorado, when a swarm comes along, go and get a hive. It is done more in Denver than in any other part of the state; seldom, if ever, in the western part. Bees do not represent to them any money investment, so that what little honey they get is clear gain to them. They probably lose more in time than in money. I do not think we can do anything to do away with the farmer bee-keeper, except to enforce the inspection law. We have quite a number of small farmer bee-keepers who are making a success of it. There are more who are not successful than otherwise, but some of the best bee men I have known have been men with five or ten hives. We have some with from three to five hundred hives who are keeping them in about as bad shape, as far as disease is concerned, as many of the smaller ones, although the tendency is very much toward specialization.



Apiary of R. E. Diggles, Clifton, Colorado.

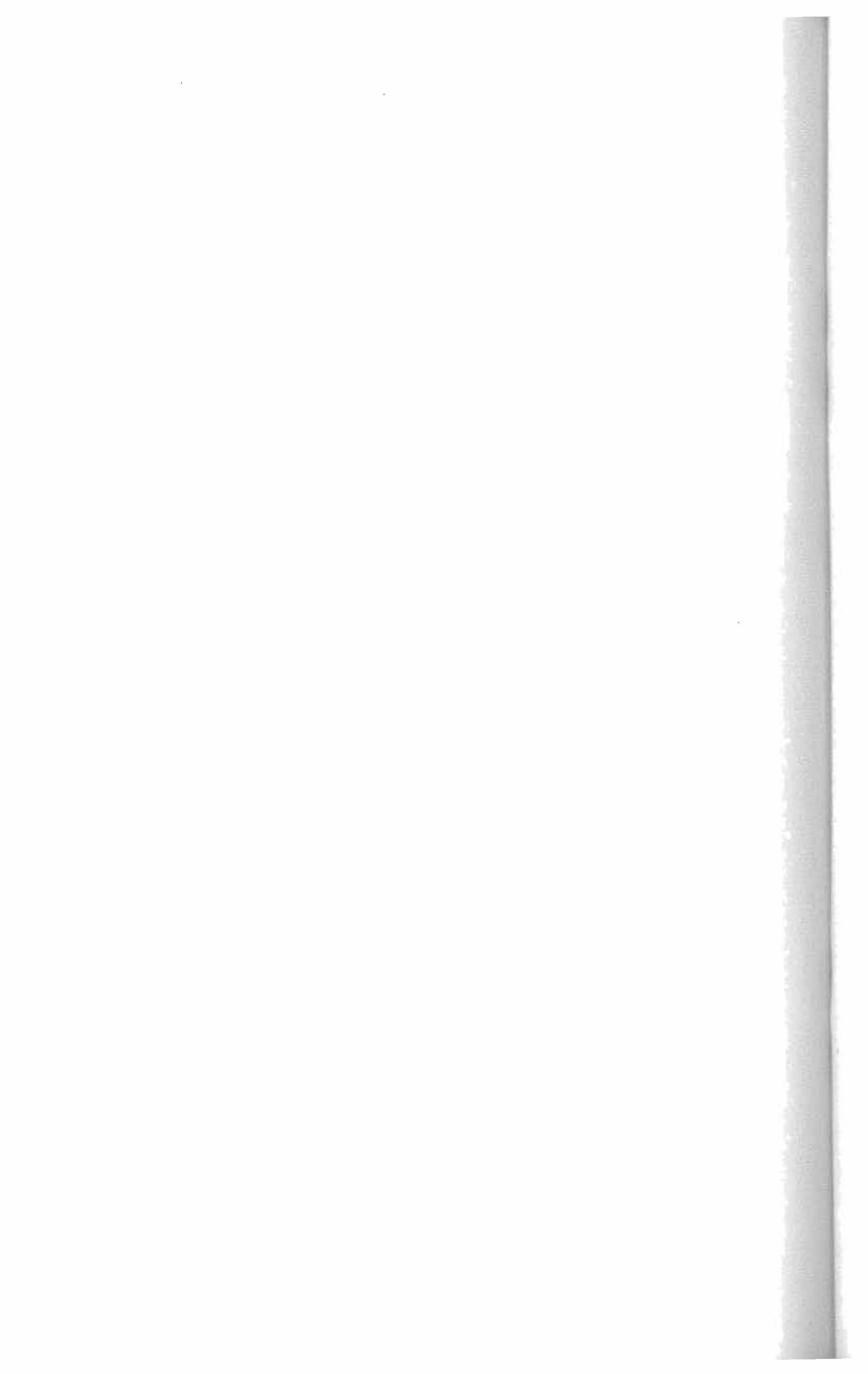
Note the Substantial Hive-Stands, That Help in Apiary Work and Keep Ants and Toads and Dampness Away from the Hives.

Photo by Wesley Foster, Boulder, Colo.



A Good Arrangement of Hives Preparatory to Treatment for "Foul Brood" by the Shaking Method.

Photo by Wesley Foster, Boulder, Colo.



Mr. Foster: In the last two years foul-brood inspection in the counties where I have been allowed to work with the county inspector, has been a success. Disease has been reduced in the counties where I have done the most work. The percentage in Montrose has been reduced from about 14 per cent to about 7 per cent, in one year; in Mesa County, in the last five years (and Mesa County spends more money than the whole state in bee inspection), from 14 to about 2 per cent, and they have over 14,000 colonies of bees. It has encouraged me to know that, where we have been able to do thorough work, we have been able to get the disease practically under control. However, the greater part of the state is still untouched.

Mr. Cornelius: I do not want to censure our brother too much, but does not the law state that when a visit is made the second time, he shall burn the hives?

Mr. Foster: No.

Mr. Cornelius: Then I am mistaken.

President Collins: Mr. F. Rauchfuss would like to make an announcement which is of general interest to the bee-keepers.

Mr. F. Rauchfuss: On the first of January the parcels post will be effective. We want to call the attention of all of the bee-keepers to this fact. They should then patronize Uncle Sam and quit the express companies. I think it stands us in hand to do so, even if the express companies should reduce their rates. It is a great help to us to have this privilege, and those of you who have never enjoyed it do not realize what you have missed. In a year or two you will wonder how you ever got along without it.

Mr. Henthorne: I think that this is the kind of topics we should discuss—something of general interest to bee-keepers.

Mr. Frank Rauchfuss: What, in your opinion, is the principal objection that has been raised to the new grading rules? No doubt you have received some during the season.

Mr. Henthorne: To be honest, I would say that I have not had anything definite put up to me in the way of criticism.

Mr. Frank Rauchfuss: I want to give you my experience. In my trips over the state, coming in contact with the bee-keepers, I have frequently met with this criticism, that the knowledge of the grading rules was not definite enough, especially in regard to color, and the cappings of the sections. In the majority of these cases I have been able to show these people that it was their fault, because they did not take time to study them. Some of them thought that the instructions were not part of the grading rules, and I had to tell them that they were just as much a part of the grading rules as the rules. Some of them expressed a doubt as to whether anyone would be able to grade intelligently by these rules, without having some instruction. Now, anyone here, who expresses such a view as that, can have the proof of the incorrectness of his position by coming down to our store. We have some five or six hundred cases of honey that have been graded by these bee-keepers for the first time. They had no instructions, except what have been printed, and still I will admit that the results surprised me. They were good enough so that the honey could be sold in the home market without regrading. I would not say that it would all pass for shipping trade, but it was sufficiently good for local trade.

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## MORNING SESSION

DECEMBER 13, 1912

President Collins called the meeting to order and announced that the first number on the program would be a piano solo by Mrs. Wesley Foster.



Mr. Foster asked for discussion of the new method of holding elections.

President Collins: My idea would have been to have started a little earlier, and to have had more nominations for the different offices, and to have had more members take an interest, and, when there was a tie, to send the two highest back for another vote.

Mr. Foster: I was in doubt as to the various phases of the referendum election. The way it should have been done was to have had a list of members sent out with the first nominating ballot, so we should have known who were members, and who were their choice for nominees.

Mr. H. Rauchfuss: We had the privilege, but did not know who were members.

Mr. Martin: I approve of the method of election, because it gives a man an unprejudiced idea, if he knows most of the members. There couldn't be a better way of placing this before the members, and I understand that it places it only before the paid-up members, who should be the ones to vote on this question.

President Collins: I believe that there should be a list of names and addresses sent out, so that we may not only know who they are, but have their addresses. Thus we may communicate with them and ascertain if they will serve if elected. However, the result has been that we have only seven more votes this year than the number present here in the room.

Mr. Foster: Is there any objection to this method of election; that is, if a list of members is sent out to all the members at the time of the nominating ballot?

Mr. H. Rauchfuss: I think there is one—that the secretary has it all in his own hands when the nominations come in. There should be more than one officer to go over the list of nominations and settle on the final ballot.

President Collins: Suppose you or I make the nomination, and he does not send it out; we should then raise the question.

Mr. H. Rauchfuss: Is this done in other elections—city, county, or state elections?

President Collins: Yes; it is left entirely with the clerk. The individual should follow up his nomination and see that it goes to the regular officer.

Mr. Foster: I should be in favor of turning it over to an election committee, if it could be gotten together, and it would take some work off the secretary's hands.

Mr. Martin: I believe the committee would be all right, but not so effective. It would be more complicated, and I do not believe it would bring any better results.

President Collins: There is just one thing unjust about it. We have found in all elections, where this has been worked, that the party sending out the names has the strong suggestion to all the members, in case he wants to continue the office. This would be so, no matter what officer it was left with, and by having an election committee you would obviate that tendency to maintain oneself in office. Just the personal knowledge of knowing a man gives him an advantage when you come to the election of officers.

Mr. Henthorne: Mr. President, I move that we lay this on the table and leave it until the first thing in the afternoon session.

Motion was carried.

Mr. Foster: The question of grading rules was discussed last night, and it was decided to continue the discussion today. Mr. Rauchfuss asked what fault, if any, was to be found with the rules as they now are.

Mr. Lester: I do not find any fault, except that there is no provision made for off-colored honey; it is all for white honey.

Mr. Frank Rauchfuss: I dislike to take the floor on this subject, but Mr. Lester evidently does not remember the rules. You will find there that all colors, except dark, are taken care of. But, on the subject of color, dark honey is not specifically mentioned in the grading rules or instructions, and it should not be, because we do not propose to send anything out of the state that is a discredit to the bee-keepers of the state. Therefore, the dark honey should be taken care of in the grading instructions, and should be mentioned in the class not entitled to shipping grades. Another point I wish to bring out is this, that the instructions regarding fancy honey are not perfectly understood. The fancy is described as "honey, comb, and cappings must be white," and many seem to think that if the honey itself is off color, it is all right if the cappings are all white.

Mr. Herman Rauchfuss: If I interpret the grading rules correctly, the result would be that we shall have very little fancy honey, unless it is in very favorable locations and under favorable conditions. Concerning the dark honey, who is producing dark honey that really is honey? There is very little—some on the western slope and some near the foothills. It would not be advisable to put such honey in a car of white honey and spoil the whole thing. If you put dark honey in with No. 1, it looks bad, but by itself it does not. That is one mistake we make—we put almost white in the same case with amber honey, which by itself would look very good, but mixed with the white spoils the looks of both.

There ought to be no old sections used whatever. I have seen some that looked as if they had been lying out in the yards—almost black; and such a section should never go on the market. Even the best kind of honey looks bad in a section like this. The loss you sustain is more than the cost of a new section would amount to.

President Collins: I wish to ask this question: If there is very little, or no, fancy honey, do you think that the rules are too strict to bar the bulk of the best honey on the market from fancy?

Mr. H. Rauchfuss: No. I do not. If you are not producing fancy honey, you cannot put up fancy honey. You have to be in a honey location to produce good honey. If you want to produce fancy honey, you have to go out on the prairie, where there are no trees, and where there is alfalfa. If we are not in a position to produce fancy, we should produce No. 1, No. 2, or choice.

President Collins: Then you have no objections to the rules as they stand?

Mr. H. Rauchfuss: None at all.

Mr. Henthorne: I would say this: I think that all that is necessary for us to do is to learn to grade according to present rules. At the time we changed them before, we had about the same trouble that we are having this year. We had to learn to grade according to rules, and I believe the only complaint we have at present is that we have not learned to grade according to rules, and I do not believe we could change the rules and profit much. I am like Mr. Rauchfuss about the fancy grade; there are people in Colorado who can produce fancy, and it is their duty to produce it, and for us to produce No. 1.

Frank Rauchfuss: I understand these grading rules are to be of sufficient scope to apply to all western localities. We have members here who have bees in other states, and it would be inconvenient for them to apply our rules in their own state. Is it not a fact that we have members in more than one state?

Mr. Foster: To a certain extent, yes.

Mr. Frank Rauchfuss: Then our grading rules should fit as many as possible, and not be confined to one section. The favorable comment made in the bee journals seems to indicate that we are on the right

track; so let us try them another year, and then change, if any serious fault is found.

Mr. Foster: The only fault I find, in talking it over, is the claim that these rules are hard to grade by. That is quite a proposition to those who have been grading under the old rules. I believe a new bee-keeper, without the old rules in mind, could grade better than the older bee-keeper, with the old rules. You all know Harry Crawford, who is as careful a grader as we have, and he told me that it was a hard proposition for him; he could not tell what was partly off color and what was not, to his own satisfaction. So the interpretation seems to be the main trouble.

Another thing: A large per cent of the honey, in going east to the buyers, is regraded by the buyer to suit his own ideas. Is it possible for us to grade according to these rules, so the buyer cannot grade up? Why cannot we have the grade stamped on the box, so that regrading cannot be done between the buyer and retailer. It is done by the apple-growers; they stamp the name of the grade on the outside of the box. It seems to me that the bee-keepers are paying for the extra grading that the buyer does. If we could fix it so this could not be done, we might get more for our honey.

Mr. Herman Rauchfuss: That will be easy for us to do, but you will find a great many objections. They might do it with apples, but they will not handle honey unless it is profitable. Is there much profit in it? It has been very hard to sell honey, and if you put an obstacle like this in its way, you cannot move it at all. They will not buy it by our names and addresses. Where do you find a house with the cost mark on the goods? This amounts to the same thing.

President Collins: As I stated yesterday, I was in Indianapolis last spring, and saw culled honey on the market for sale as Colorado honey. I saw good honey, that probably would run as choice No. 1, on sale as California honey, and I believe that it came from the same place as the other. That man was giving us a black name every day.

Mr. Frank Rauchfuss: We did not ship any honey to Indianapolis last year.

President Collins: I do not know where they got it; they may have gotten it from other places. They were selling honey in the month of May, and the question is whether it was Colorado honey or not. No matter whether it came from our association or not, there ought to be some way of finding out. We are fencing on this question. It is a question of opinion as to grading rules, as to what they mean, and we are not meeting the question squarely. If there is regrading that grades on the market higher after it goes there, do we properly interpret the rules? I believe Mr. Frank Rauchfuss admits that we had a question as to what should go in No. 1 or No. 2, as regards amber. Are we to understand that our rules are more strict than those in other parts of the United States?

Mr. Herman Rauchfuss: Can Colorado honey be sold as such, if it is not, under the Pure Food Law?

President Collins: That law does not apply as to place, but as to quality.

Mr. Herman Rauchfuss: Where did he get that culled honey?

President Collins: He told me that it was from Colorado. I am simply presenting the case as it came to me; I did not question it. He might have been violating the law; I do not know. I am not saying that these rules are too stringently interpreted; I am repeating what has been said by many. They feel it, on account of the fact that they have found that the grades are considered higher when they go back east than they are here.

Mr. Frank Rauchfuss: Why are not these people here, if they are interested?

Mr. Polhemus: I find, by traveling through Kansas, that Colorado honey is considered right up to grade—just what it is represented to be; and it brings a higher price than almost any other honey; and I don't think that the rules are too strict.

Mr. Frank Rauchfuss: There is one thing a producer always takes a pride in, and that is quality, and the attractiveness in which the honey is put up. Any bee-keeper who is simple enough to think that honey sells on eating quality does not know anything about it. Honey sells principally on appearance. It does not make any difference how well flavored, if it does not look good, it will not bring the price. You take a case of amber honey, no matter how good it is, and people will not buy it. So we should have our grading rules established to such a point that we will strive to get the finest-looking article on the market.

Mr. Frank Rauchfuss: This market quotation business is an important one to consider. The other day I received a letter from a western-slope bee-keeper, who says: "Why are your market quotations in the bee journals always lower than those of others?" You send some honey to some of these men who are making these quotations, and see what you are getting. Our market quotations are just what they are; anyone can come down and buy at just the prices we are quoting, and if other people see fit to misrepresent them, we should not be found among them, should we? The market quotations have a great influence on the people who have honey to sell; they look them up, and see large ones from one place and smaller in another, and ship their honey to the first one.

The price Mr. Foster just spoke of—nineteen cents in Chicago, in February—does not seem extravagant to me. If you knew how much loss there is in granulation from a carload, you would come to the conclusion that there was not so large a profit. He puts it into his warehouse perhaps in October, and he has some left in April or May, and some of it perhaps has paid as much as \$3 a case, and some sells for \$1 or \$1.25 a case, and is glad to get rid of it at that.

Mr. Pease: If amber honey is capped white, how are you going to know it?

Mr. Herman Rauchfuss: You can usually tell by holding it up to the light.

Mr. Pease: Then the color does not refer to the capping, but to the honey itself. If the honey is gathered from alfalfa or sweet clover, will it be white or amber?

Mr. Herman Rauchfuss: It will be white honey, unless these might be in bloom and others too, and some bees work on one flower and others somewhere else. You will find the different kinds of honey in the same section. Some even seem to keep it separate. Guess we shall either have to keep up to them or educate our bees better.

President Collins: This question of deception on the market is away from the question, but I should like to say what others think of us. One or two eastern buyers have said to me: "What is the matter with you fellows in Colorado, that you insist on selling potatoes by the pound, and run off your honey by the case instead of by the pound? You are a lot of cheats, representing it to run as so many pounds, when it does not."

Mr. Herman Rauchfuss: I guess that is why they quote honey by the pound. They buy it by the pound and sell it by the section. Do we want to fall in that trap too, and sell our honey by the pound instead of by the section? We guarantee them to weigh so much, don't we?

Mr. Foster: Honey that is sold by a large number of the bee-keepers in Colorado is not sold by the pound; it is sold by the case. I do not know how buyers in Chicago buy.

Mr. Herman Rauchfuss: It is quoted by the pound; do they not buy it that way?

Mr. Frank Rauchfuss: The buyers buy to the best advantage. If it is to their advantage to buy by the pound, they will buy it that way; and if they can get heavy weight by the case, they will do that. You should not take such statements made to you so seriously; there is very little that you should consider. We all know their tactics; a buyer goes into a town where there is no association, and picks out one or two of the most prominent bee men and says: "You are well posted;" pats him on the back, and says: "I want you to help me make up a car;" and he makes it all right, and the man plays the "Judas," and sells the other fellow, and he says: "I bought this honey for so much;" and the deal is made at the lower price. This is not applying only to Colorado, but everywhere. I have found these conditions in California. If I go to South Dakota, I cannot do it; the only way I could get it there would be from a bee man at the price of the ordinary markets. Where you have no organization, they get you. In any line of trade this is true.

President Collins: If honey has been graded higher after purchasing, should we do something?

Mr. Herman Rauchfuss: Have we any proof of that?

President Collins: I have heard it several times, and would ask: Is it true of certain parties?

Mr. Foster: Mr. Tyrrell told me that, in talking with buyers at Detroit, Cleveland, and Cincinnati, he judged that it was almost the universal practice to regrade. The A. I. Root Company told me that they had to regrade all the honey they bought and that they have a room just for that purpose.

Mr. Herman Rauchfuss: As I understand it, they have a man who wants to buy a car of honey. We grade our honey according to those rules. We go down to Sterling, and see Mr. Cornelius. We are ready to load our car, and tell what we want, and say: "Have you got that?" "Well, I have only No. 1." We have to grade our honey according to what we have. They can divide it up into fifty different grades, if they want to, but we cannot. If we did, we never could sell a car of honey. There is always a controversy before you can make a deal. If you had six different grades, you could not sell it at all.

Mr. Foster: Several years ago we had only two grades. Now we have four. Mr. Rauchfuss says we do not need so many grades. Perhaps it would be better to go back to the old grades, No. 1 and No. 2. I believe that under the old rules we should get more for our honey. If we cannot grade it so the buyers will not regrade it in the East, we had better keep to the two grades. The men who have sold in two grades have secured more for their honey this year; but whether the price will be permanent or not is a question. I know many have put in No. 2 honey that was half unsealed on one side; it was very pretty honey for quality. I know some Arkansas Valley bee-keepers who got only praise for No. 2 honey, where half the sections were unsealed.

President Collins: How was the weight?

Mr. Foster: The weight was good.

Mr. Cornelius: In regard to what Mr. Foster has said, I cannot agree with him. From my own experience with the two-grade rules, I had from 100 to 250 cases of cullled honey. Now I have, with about the same amount of honey, about fourteen cases of culls. The No. 2 takes in a grade lower honey than the No. 2 old grade, and is lighter weight; so, if it is all sealed, it will go in No. 2 now.

Mr. Foster: I am not going to advocate, before this meeting, a return to the old two grading rules; but it seems to me that we ought to try to arrive at some decision by which we could grade, by giving

the buyers a chance. I do not think we should have to pay for the re-packing.

Mr. Herman Rauchfuss: Do not sell those people any honey.

Mr. Foster: We cannot sell it to anybody else.

Mr. Herman Rauchfuss: Then, what are you going to do about it?

Mr. Foster: As bee-keeping co-operation extends, the ultimate aim will be for the producers' associations to sell directly to the retailer; but we are not prepared to do that yet.

Mr. Herman Rauchfuss: I believe Mr. Foster is coming right down to it. Where have we co-operation among the bee-keepers? Why don't the people in California and Wisconsin co-operate? They are about twenty years behind Colorado people. They have tried it in other places and have not made a success of it. When we all co-operate, we can do something.

President Collins: I used to be a producer in Wisconsin myself. They have not honey in sufficient quantities, or bee-keeping closely allied enough in those localities, to do much without our help. We should do something to bring about co-operation—nationally, not locally. They are so situated that they cannot get up a meeting like this, to save themselves. It is out of the question, unless we, who are associated so we can co-operate, will help them to come in. Shall we do it through the national, or not

Mr. Herman Rauchfuss: What is the matter with California, Utah, Idaho, and Nevada? Don't they produce large quantities of honey? Nevada produces a fine quality, which compares favorably with ours. They produce it in car lots—not many cars a year, but sufficient.

Mr. Frank Rauchfuss: In ordinary seasons there are produced from twelve to fifteen carloads in Nevada. Nevada is very well adapted to co-operate. The same with California. The comb-honey business is practically in one county.

President Collins: I have never been west of Grand Junction, but I know about conditions in Wisconsin.

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## AFTERNOON SESSION

DECEMBER 13, 1912

President Collins in the chair.

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## MANAGEMENT OF OUR APIARIES

D. C. POLHEMUS, LAMAR, COLORADO

We unpack our bees the latter part of April and feed those that need feeding; and from that time on make weekly visits to the yards to build up the colonies. When the strongest of them have from eight to ten combs of brood, we begin to equalize, giving the weaker ones from the stronger ones, uniting them with stronger colonies. Then we put on the extracting supers, raising half of the brood up into the supers. Then we put an excluder between, but the queen has access to both parts of the hive. When we get four or five combs of honey, we commence to take out and extract.

In doing this, we use a wheelbarrow, with a deep super on to put the combs in, making about four supers full to a wheelbarrow load, and wheel out to the motor wagon and load them on, and haul into the home place to extract, hauling in about twice a day. They are located all the

way from three to eighteen miles from home. We make two trips a day from home with the wagon. One man does all the extracting at home, using a frame extractor, with an electric motor to run the extractor. It is the cheapest and least bother of anything we have tried. We run it for fifteen cents a day, and it is always ready. In fact, we let our extractor run all day. The long running cleans out the combs well with honey.

In regard to requeening, our plan is to dequeen a few of our best colonies, using our queen with a nucleus, and building it up; then taking the cells from these queenless ones when they get ripe, and starting another nucleus. Our experience in rearing queen cells is not very satisfactory. We get too many small cells, and not enough large ones.

When we get all the honey into the house, we load it on trucks—fourteen supers on each truck—that run on a track into the warming room. The heat is then turned on, and the next morning it is just right to extract. A warm day is considered the best time to extract honey, just as it comes from the hive. But my way is just as good on a cool day as on the warmest day.

Mr. Henthorne: About what temperature?

Mr. Polhemus: I think about 110 degrees. It requires very little heat to keep them warm enough. I keep the combs perfectly warm in a room four by ten feet.

These trucks hold two supers, side by side. The trucks are three feet wide, and the room about four feet wide, leaving space all around for the air to circulate.

A Member: You don't extract in the room?

Mr. Polhemus: No. Five truck loads go in the room, and each truck holds fourteen supers—between three and four thousand pounds of honey.

A Member: How is it warmed?

Mr. Polhemus: It is warmed by a gasoline burner. It is run all the time, and we do not consider it dangerous with the tank outside. If there is more than one burner, when one goes out and then leaks, there might be danger. It is the only means we have of heating the combs. We tried electricity, but it is too expensive.

Mr. Pease: You take the combs from both the lower and upper stories?

Mr. Polhemus: Seldom from the lower, just from the upper. Before fall we often put combs in the room and raise honey. The object is always to leave honey enough in the hive to winter them.

President Collins: By removing the surplus honey from the two stories, do you not frequently have swarms of bees that do not have enough left for the lower story?

Mr. Polhemus: Yes; if they are not heavy enough, we arrange it so the lower story will have enough honey left for winter.

A Member: Does the queen ever forsake the lower story and go to the upper?

Mr. Polhemus: Almost invariably; but you will usually find her in the lower story before fall.

A Member: Do you have anything to circulate the heat, or anything over it?

Mr. Polhemus: It is placed in the center of the room, with a double sheet of galvanized iron—about thirty-two inches by four or five feet long—to diffuse the heat.

Mr. Pease: How do you pack your bees for winter?

Mr. Polhemus: The hives are placed in groups—eight hives in a group. In the winter we take these hives and pull them back up to each other; then we throw straw on top and cover them with dirt, leaving an opening in the top of the hive for entrance.

Photo by Wesley Foster, Boulder, Colo.

A Serviceable Metal Mouse-Proof Honey-House, Built by R. W. Ensley, Read, Delta County.







A Member: Is the second story always taken off?

Mr. Polhemus: Nearly always. If one has to be left on, we leave it on, and pack around one.

A Member: Does not the moisture gather and mildew on the frames inside the hives?

Mr. Polhemus: No; we have no trouble that way at all. With our method, as soon as the season is over we are through extracting. We begin to take off, say, about July, and take off every day, and when the season is over we are through.

President Collins: Do you calculate to go through the swarms often enough to govern the question of swarming?

Mr. Polhemus: Yes; we go through each week, removing what surplus honey there is, and note whether there is any tendency to swarm.

A Member: How many men does it take to a yard?

Mr. Polhemus: Three men to run fifteen yards. One man makes two yards every day.

A Member: How does he conduct examination for queen cells?

Mr. Polhemus: It is a short process. He goes to two yards every day, but he does not have to examine each yard all through every day—just examines the top part; and if there are any cells in there, he will see them on the lower half of the upper combs.

A Member: Isn't there danger of there being queen cells below?

Mr. Polhemus: Very little; almost always in the lower part of the top part.

A Member: Do you go below to get honey?

Mr. Polhemus: No.

A Member: If the queen is in the top, and using that mostly, how can you have three or four combs of honey in the top? Doesn't she fill it with brood, so you don't have room?

Mr. Polhemus: Sometimes we put on extra supers. Sometimes a hive will have three supers on. We use both eight- and ten-frame. We prefer ten-frame for extracting honey.

President Collins: Would not the shifting of the hive, when the queen occupies the upper story close, putting the lower story up and the upper story down, eliminate using the third story?

Mr. Polhemus: We do not put on the third story unless necessary. The queen does not entirely desert the under one; she will go back and forth. As long as there is honey in those upper combs, she will not try to lay there; she goes below to lay.

President Collins: If I have a swarm of bees with a queen that has filled two stories so they are full of bees, and I shift the outside combs below, or those that have not bees in them, and put them above, should I get just as much? Would the queen go right on with her work below under those conditions?

Mr. Polhemus: I do not think so. We tried it, and did not get so good results.

President Collins: In regard to putting the foundation in with other combs: Unless your foundation is put in with some brood, at some stage, at the time of putting in between the two combs, you are bound to have an outrageous set of combs. I had a man go to work and spread some of mine in good shape.

Mr. Herman Rauefuss: If you put your foundation in at the wrong time of the year, you will ruin your colonies. You put it right in the center of the brood-nest—say, the middle of July—and they will fill it with honey. You have to cut your brood-nest entirely in two, and it is a very poor way of doing. You can do it in the spring of the year, but

do not do it after the honey flow has commenced. They will fill it solid with honey.

Mr. Walcher: I experienced that this summer, to my sorrow.

Mr. Lester: I have used the excluder, and never had better combs; no brood in there at all.

President Collins: Did you put a sheet of foundation into the super under those conditions, with empty combs on each side?

Mr. Lester: Yes, sir. When extracting, I took the frames out and extracted them, and put the empty combs back on the hives, and sometimes put a sheet under every other one. I put nine frames, instead of ten, in order to have more honey.

Mr. Jouno: I think he took the combs out and extracted them, so they did not stay there a great while.

Mr. Polhemus: I never have had any trouble with the foundations giving us any bad combs.

## RENDERING OF WAX

### DISCUSSION

Mr. Lyons: In the rendering of wax I use steam. The first thing I do is to take out all of the combs and throw them into a pile on the ground. I use eight horsepower; it is less trouble to keep up steam with a large boiler, and I do the work myself. The combs are shoveled right into a half-barrel of water, and with the steam pipe running into it I regulate the steam (the press, a German hatch press, is right by the side of the barrel). As fast as it melts, I dip the wax and comb in hot water in my press, and this runs down into a pit under the press. It first drops into the separator. The wax is separated out of the hot water into a barrel, all enclosed, the steam pipe running in to keep it warm; and in this way it is kept warm for twenty-four hours. The wax melts as fast as I can make it. After the vessels below are filled, I bring the wax up and put it into another barrel to clarify it. This I remelt, dump into another tub, and then draw off into another separator. This time it is caked into half-gallon cakes, and it is set back in the pit, where it keeps hot for twelve or twenty-four hours. When it cools slowly that way, it rises to the top. I use the water right over again, so it does not take so much steam to keep my wax hot. My average is about a pressful in five minutes. I have taken the refuse from all makes of presses, and paid a cent a pound for it, and put it through mine, and then made good profit.

Mr. H. Rauchfuss: Will you take any refuse and pay a cent a pound for it?

Mr. Lyons: Not from every source, but from the average bee-keeper.

Mr. H. Rauchfuss: Can you get the wax all out of the press in five minutes?

Mr. Lyons: No; I press it twice.

A Member: Do you have heat under the press?

Mr. Lyons: No; just the hot water.

A Member: Do you handle it in a sack or something?

Mr. Lyons: It is put in a sack and the sack folded over. You want a certain grade of sacking to give the best results—not too coarse or too fine. The best thing I have found so far is the best-grade sugar sacks.

Mr. Matthewson, of New York: My method is similar to that of Mr. Lyons. I am still using steam. I have large boiler—fifty or sixty gallons. I have my press beside the mill. The sack is right. I prefer a coarser

sack to a sugar sack, because it holds better. I melt my slum gum the same as he does. I melt it in hot water—the hotter the better. In making my wax, press it two or three times, then two or three times again; then draw the water out and throw back in the kettle; then dip it out. After I have made these cakes of wax, clean out the kettle and remelt it. Take sulphuric acid, turn it into the kettle, and turn slowly, and it will precipitate every bit of dirt you have in the wax. You can use too much acid, but you can easily tell when you have added too much. Melting the combs in the water, the water will soak into the combs and penetrate them, and when in steam, it will penetrate the combs. I have tried both, and like the water better. I do not use the same kind of press. I use a lard press, and can get a ton of pressure on it.

Mr. Herman Rauchfuss: I have one weighing twenty tons, and I do not think it is heavy enough.

Mr. Matthewson: Use more water then.

Mr. Jouno: Doesn't the sulphuric acid burn?

Mr. Matthewson: No.

Mr. Lester: I used acid, too. The steam I used to heat the water, and the steam is the method of heating the water.

Mr. Herman Rauchfuss: You have to soak the old combs well at first, before you apply heat. Put in barrels with a great deal of water in them. If you soak broken-up combs very fine, you will not need to use acid.

Mr. Lyons: It is not necessary to break them up where you use steam heat.

Mr. Herman Rauchfuss: You will have to break them up so the water can get to them. I have a hydraulic press, and I broke one of them trying to press it. The only trouble we have is to get sacks heavy enough to stand the pressure.

Mr. Lyons: I have made more money from wax than from bees the last few years.

President Collins: The last two years I have gotten better results, with the least outlay, in wax outfit than any of you. I had an old boiler, a tub, a gunny sack, and fork handle. I took out between three and four hundred pounds; shipped all but twenty-five or thirty pounds of slum gum to Mr. Rauchfuss. The receipts were not large enough to pay me to own an expensive outfit. I soaked the wax as Mr. Rauchfuss says; kept barrels soaking every night for four or five days, and ran about a hundred pounds a day. I dipped it from there into the hot-water boiler, and from there through the gunny sack through boiling water, but putting through about two quarts of water at a time. And the slum gum that you got from the western slope was run through in that manner. You sent me a fair receipt from it, but it was not enough to pay me to own an outfit. It would pay me better if I shipped it to someone who has an outfit.

Mr. Herman Rauchfuss: If you have slum gum in a sack, and let it get wet, it will take but a few days until nearly all the wax is gone. It seems to evaporate. In that way thousands of pounds of wax have gone to waste every year. If we get it at the right time, before it commences to mold, we could get the proper amount of wax out of it.

President Collins: The last quantity that I shipped to Mr. Rauchfuss before this was from Boulder. It consisted largely of combs from foul brood and old combs, and I had run them through boiling water so as not to cause infection; and I got scarcely anything out of it. These last were spread out twenty-four hours, and dried before shipping, and there could not have been much loss, as there was no chance for molding.

Mr. Henthorne: My outfit is practically a home-made affair. All I might say is that I used to use stove boilers, but bought a feed cooker with stove underneath. It will hold about fifty gallons, has a lid on, and I use that for cooking the slum gum. I have a press which I made myself;

I use an ordinary large-size wrench screw, and it does the work fairly well. Get a fifty- or sixty-gallon feed cooker it is the finest thing I have ever tried, outside of the steam proposition. You can get initial heat, it will hold a great deal of wax, and you can keep enough melted to keep you going as fast as you can work it. I have tried saving slum gum, and it always gets moldy before I can get it shipped.

Mr. Lyons: Do not use too much in your press at once. Get a small cake. I broke the screw (I have an inch screw now); broke the plate underneath, and have practically rebuilt it, so I could use a jack screw on it; but I found that too slow. By making the cakes of slum gum smaller, and putting them through twice, there is very little left.

Mr. Cornelius: While we have prospects of getting a small amount of money from our county (Logan) for deputy inspector, as I understand it, the appointment can be made through our inspector here. In case we get only a small appropriation, is there any possible chance of getting any help from up this way?

Mr. Foster: The work the past year has been distributed in those counties where the county would either appropriate money for a local inspector, or, in case the county would not appropriate money, several bee-keepers would work with me and give their time without pay. A few counties have done a small amount of work in order to keep down disease, and have kept conditions in a fair shape; but it seems to me that it is pretty hard to get enough money from the state to take care of all the inspection.

I understand that New York has deputy inspectors, under the department of agriculture, and that each inspector has charge of fifteen counties. The trouble with the county inspectors in our state is that they are all bee-keepers who have their own bees to take care of, and they cannot take time to do the work when it should be done. In New York they have four men who put in all their time. The local county inspector also knows everyone, and some of the bee-keepers get the idea that he is trying to condemn their bees and buy them up. I think if we had a legislative committee appointed to go into this and take the matter up with Professor Gillette, he would like to confer with them as to some phases of the law. I should like to see a committee appointed representative of the whole state, and correspondence can be carried on with them to get their ideas.

Mr. Cornelius: In case we are successful in getting a deputy inspector down there, is it possible to deputize him without paying, or pay ourselves to go over the county line? There are some apiaries on the county line that are undoubtedly diseased. Could we get an inspector to inspect those bees over the line, through appointment?

Mr. Foster: Yes; I could do it myself, or I could deputize some man down there to do it. Your county could not be expected to pay for that. In case we had a sufficient appropriation, we could pay that out of the funds, and would be glad to do it.

Mr. Cornelius: I think that in a short time we will call on you.

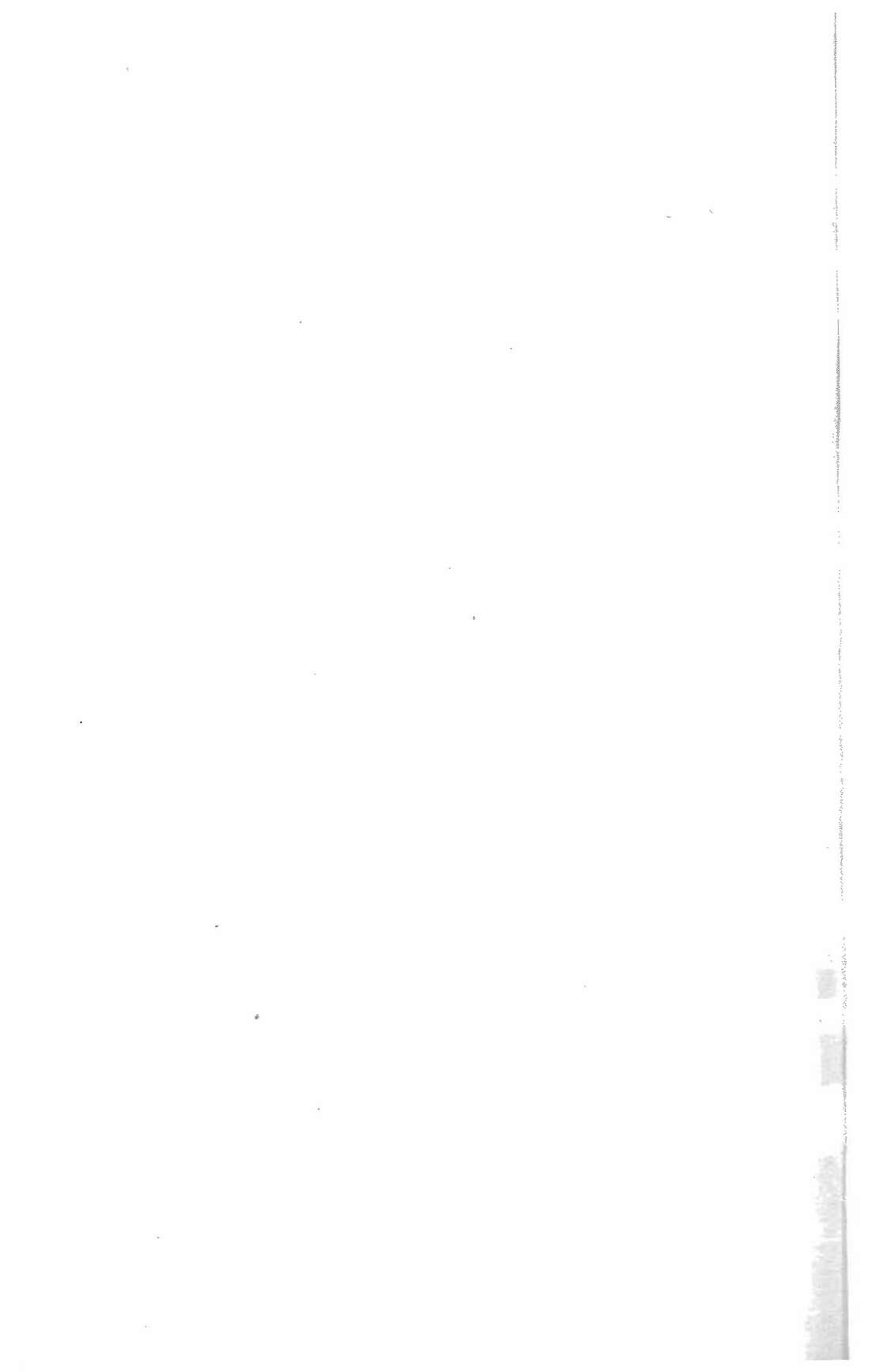
Mr. Rauchfuss: If Mr. Foster appoints a deputy, without pay, he can examine in any part of the state. Of course, if he is paid by a certain county, he is expected to work only in that county.

President Collins: On the western slope, when I first went there a year ago, they said they did not have any foul brood. The man I was working with brought some honey home later, and I found three cells of foul brood. The county bee inspector came and looked them over, and said there was none. Later we found sixty swarms, and Mr. Foster appointed me a deputy, without pay, and I did the work and burned them up. In order that I should not have any trouble in regard to the matter, after getting my commission from Mr. Foster, I asked that Mr. Gillette countersign it, and return it, so that there would be no question as to

whether or not he had authority to appoint a sub-appointee. In a case like that I would suggest that you have it countersigned.

Mr. Lester: Over in Delta County there are four or five deputy inspectors who have done some work without pay. There are bees right across the line in Montrose County which have not been inspected, and I know there is disease among them, but I could not go over there and inspect them without money.

Mr. Foster: Mr. Lester's commission was made out to inspect bees in Delta County, so that, in case he went over to Montrose County, they would say their own inspector could do the work for nothing. If there are any there now which have not been inspected this year, I should like to know it, and I will see that they are looked at as soon as it can be done.



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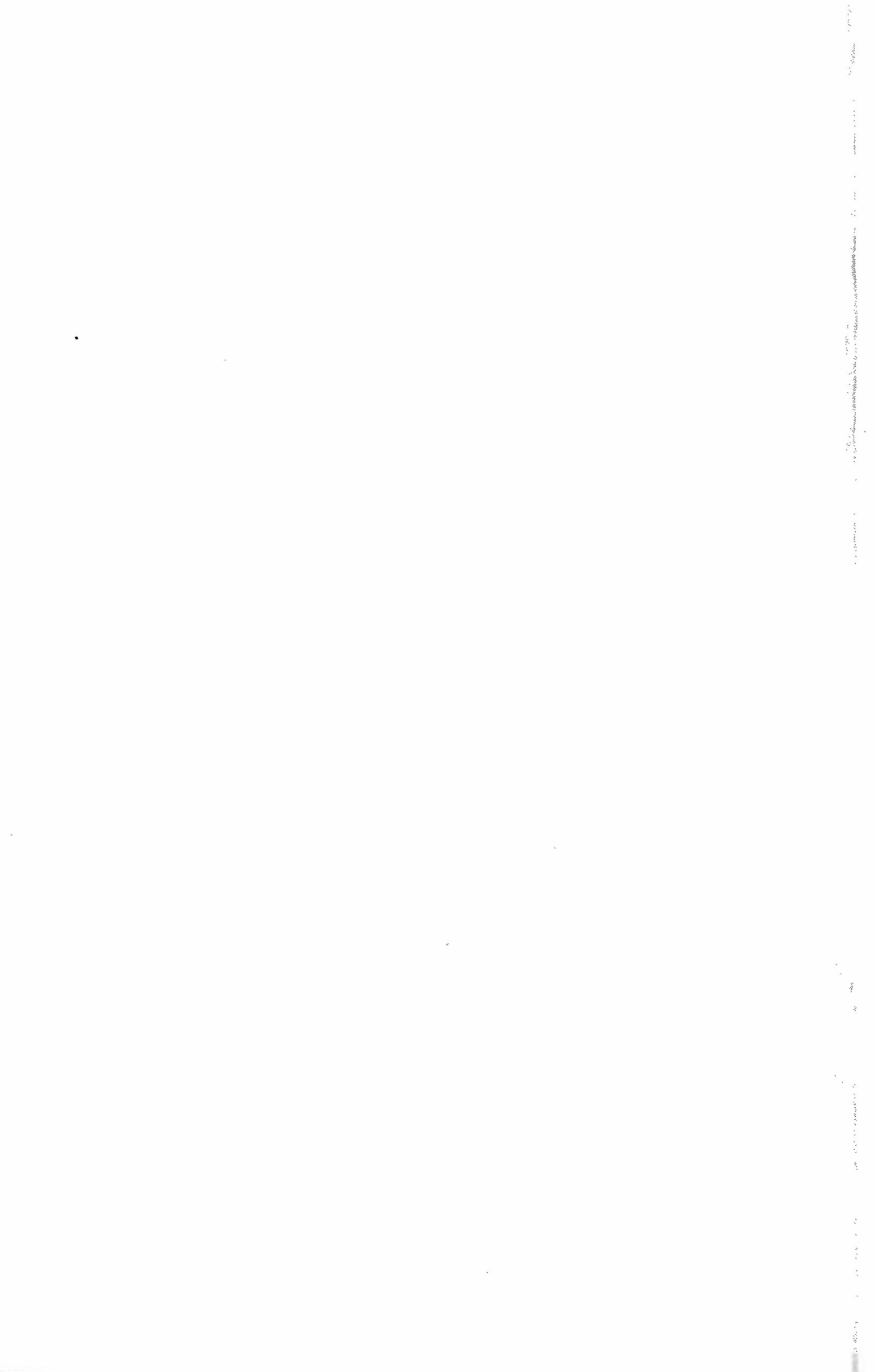
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