

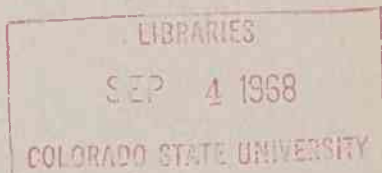
SCIENCE

THE STATE AGRICULTURAL COLLEGE
OF COLORADO

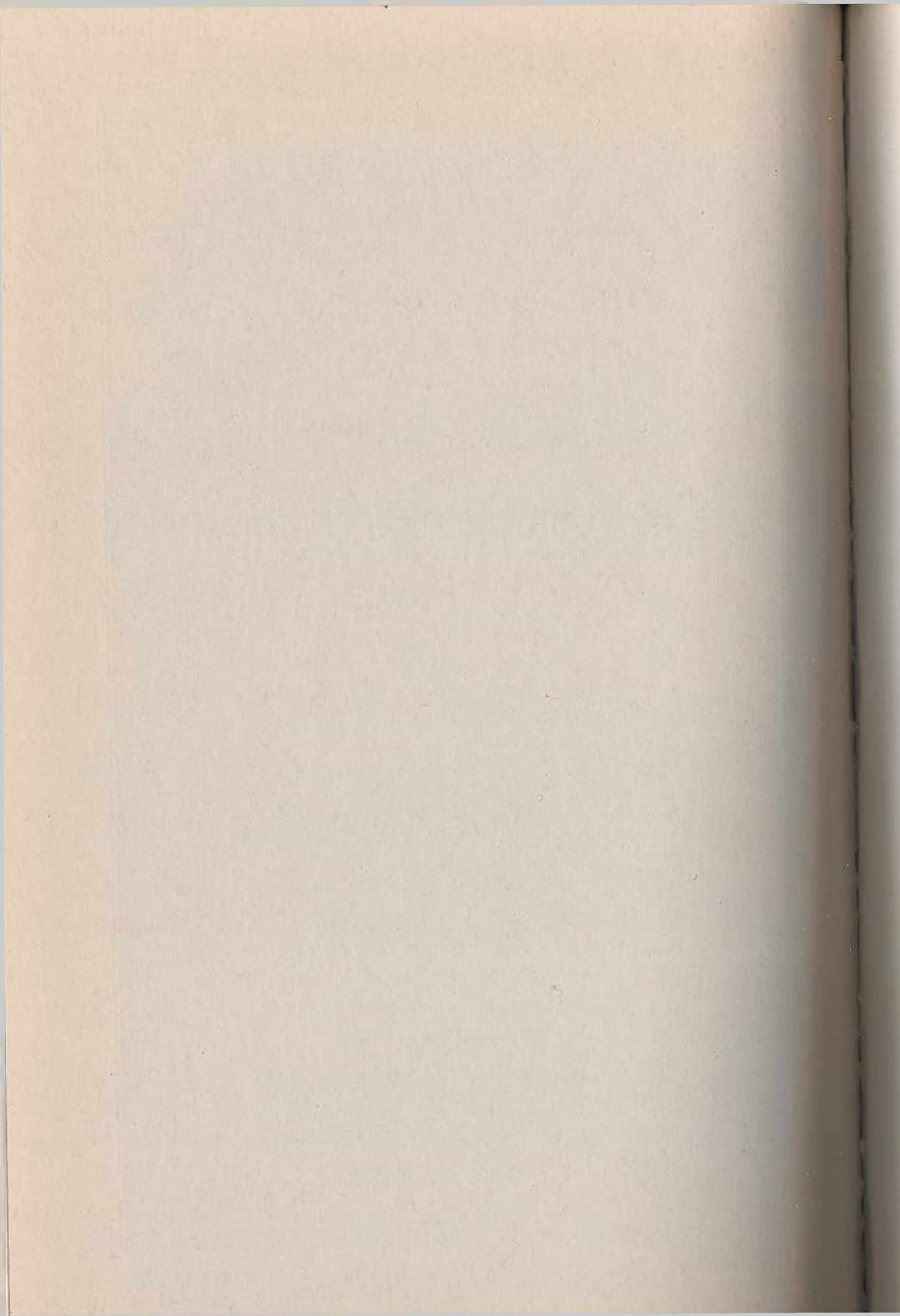
THE FORTY-SEVENTH
ANNUAL REPORT

— OF —

The Colorado Agricultural
Experiment Station



FOR THE FISCAL YEAR 1933-34



THE STATE AGRICULTURAL COLLEGE
OF COLORADO

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FOR THE FISCAL YEAR 1933-34

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FORT COLLINS, COLORADO

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FINANCIAL REPORT OF THE EXPERIMENT STATION

For the Year Ending June 30, 1934

DR.	Hatch Fund	Adams Fund	Purnell Fund	State Mill Levy Fund	Special Fund	Irrig. Cash Fund	Total Funds
Balance, July 1, 1933.....	\$14,545.60	\$10,840.17	\$104.64	\$ 25,490.41
From the Treasurer of the United States as per appropriations for the fiscal year ending June 30, 1934, under acts of Congress approved March 2, 1887 (Hatch Fund), March 16, 1906 (Adams Fund), and February 24, 1925 (Purnell Fund).....	\$15,000.00	\$15,000.00	\$60,000.00	.....	.....	.....	90,000.00
Other sources than the United States.....	79,662.76	28,427.43	.....	108,090.19
CR.	\$15,000.00	\$15,000.00	\$60,000.00	\$94,208.36	\$39,267.60	\$104.64	\$223,580.60
To Salaries.....	15,000.00	15,000.00	43,792.14	23,111.93	17,673.77	104.64	114,682.48
Labor	5,924.14	21,364.23	271.78	.....	27,560.15
Stationery and office supplies.....	520.16	1,316.87	112.31	.....	1,949.34
Scientific supplies, consumable.....	1,663.66	1,331.04	1,747.35	.....	4,792.05
Feeding stuffs.....	257.63	5,337.11	81.25	.....	5,675.99
Sundry supplies.....	215.88	2,589.09	1,407.33	.....	4,212.30
Fertilizers	82.50	7.00	202.47	.....	291.97
Communication service.....	191.72	1,288.92	58.87	.....	1,539.51
Travel expense.....	2,237.03	4,738.18	137.46	.....	7,112.67
Transportation of things.....	26.14	1,032.76	33.08	.....	1,091.98
Publications	1,027.07	3,007.03	.....	.....	4,034.10
Heat, light, water, power.....	23.80	4,433.15	150.74	.....	4,607.69
Furniture, furnishings and fixtures.....	513.44	826.84	340.23	.....	1,680.51
Library	33.36	468.19	0.50	.....	502.05
Scientific equipment.....	2,599.23	1,103.08	229.85	.....	3,932.16
Livestock	14.00	2,761.20	.....	.....	2,775.20
Tools, machinery and appliances.....	508.67	2,976.21	330.15	.....	3,815.03
Buildings and land.....	169.23	7,542.80	478.68	.....	8,190.71
Contingent expenses.....	200.20	874.57	11.16	.....	1,085.93
	\$15,000.00	\$15,000.00	\$60,000.00	\$86,160.20	\$23,266.98	\$104.64	\$199,531.82
Balance on hand June 30, 1934.....	8,048.16	16,000.62	.....	24,048.78
Grand Total.....	\$15,000.00	\$15,000.00	\$60,000.00	\$94,208.36	\$39,267.60	\$104.64	\$223,580.60

LETTER OF TRANSMITTAL

To His Excellency, Edwin C. Johnson, Governor of Colorado:

In accordance with the law of Congress establishing Agricultural Experiment Stations, I have the honor to transmit the Forty-seventh Annual Report of the Colorado Agricultural Experiment Station for the Federal and State fiscal years July 1, 1933, to and including June 30, 1934.

E. P. SANDSTEN, Director.

Fort Collins, Colorado
July 1, 1934.

REPORT OF THE DIRECTOR OF THE EXPERIMENT STATION

To the President and State Board of Agriculture:

The work of the Experiment Station for the year has, on the whole, been satisfactory. While the continued decrease in State funds has seriously handicapped the program, we have been able to effect many economies and adjustments and the Station budget has been balanced, with a safe surplus maintained. If the State income for the Station should continue to decline, we shall be faced with two alternatives: Reducing salaries or a reduction in personnel, and work carried. We naturally made considerable expansion during the years of plenty, and it is unreasonable to expect that we can continue all the work that was then carried. It therefore appears to be the best policy to curtail some lines of investigation and concentrate on those that will result in the greatest immediate benefit to the state. Original research is safeguarded by Federal funds specially designated for research purposes. The reductions thus far have not seriously interfered with the efficiency or usefulness of the station.

The section heads have loyally cooperated with the Director in balancing their budgets. The most encouraging thing has been their willingness to cooperate on station projects on a wider scale than ever before, making it possible to attack the problems from many sides. This cooperation has been particularly noticeable between Horticulture, Pathology, Chemistry and Botany. This cooperative program has made it necessary to rewrite some of the station projects and redistribute funds for their support. Noticeable progress has been made in connection with the soil project carried by the Agronomy Section, and the results are fundamental for a better farming program in the state. The Chemistry Section is making a permanent contribution to the relation of mineral constituents of the soil to the occurrence of deficiency diseases among livestock, and the feeding value of various forage plants.

The Animal Investigations Section has this year started feeding experiments to determine the value of different mineral supplements in fattening livestock. The Pathology Section is cooperating with the Chemistry Section in a study of nutritional diseases. The Horticultural and Chemistry Sections are cooperating on the composition and quality of Colorado potatoes as related to soils, elevation and climate obtaining in the various potato-growing sections. Work is contemplated in connection with vitamin studies of Colorado vegetables as compared with vegetables grown in other producing states.

The Entomology Section is doing very active work on the control of the potato psyllid, and also the control of truck-crop insects by the use of pyrethrum insecticides. This work is of vital importance to the vegetable industry, since the former use of arsenical insecticides has been prohibited by federal law, and it has become neces-

sary to devise insecticides that are non-poisonous to human beings. This work has been outstanding and has saved the vegetable growers large sums of money.

Dr. Barmore, of the Home Economics Section, has been working on fundamental problems in connection with the physical and chemical behavior of materials used in baking, with special reference to our high altitude. The report from Dr. Barmore indicates that the preliminary or foundation work for future study of high-altitude cooking and baking has been completed. With this work done, Dr. Barmore is now in a position to take up some of the more immediate problems of high-altitude baking and cooking.

COLLEGE FARM AND SUBSTATIONS

The farm was taken over by the Experiment Station a year ago, by order of the State Board of Agriculture. The first part of the program was that of reorganizing the personnel and taking an inventory of the entire situation. The reorganization was quickly made, with Mr. W. P. Kintzley in charge as Assistant in the Experiment Station. The reduction in personnel temporarily made some hardships, as more than one-half of the workers were dismissed. The wage schedule was changed to make it uniform. The condition of the equipment was quite bad, and considerable overhauling and additions had to be made.

In taking over the work of the farm, a budget of \$6,000 was set aside for expense. The total receipts for the year were \$7,763, making a total expense budget of \$13,763. The charges against this fund amounted to \$12,037, leaving a balance above running expenses of \$1,726. The expenses for labor, \$9,458, and tools, \$1,154, were the largest items.

We believe this statement shows that a good beginning has been made in reducing expenses, and also in improvement of the farm. The morale of the men is very good and they are taking an interest in their work. Mr. Kintzley is especially to be commended for his energy and honesty. Without his help this showing could not have been made.

The last year's work at the Avon substation was, in many respects, unsatisfactory, and a change in the superintendency was made the first of this year. While the experimental work did not suffer, the demonstrational phase did, and the general crop production was not up to the standard of past years. The present man in charge, Ralph Manuel, promises well, not only in handling the work on the farm, but he is conducting the business in a very satisfactory manner and we look forward to a successful year.

The experimental work with potatoes under Professor Metzger is making continuous progress. We have several new varieties of potatoes that originated on the farm that give promise of becoming valuable to the state. These, in another year, will be tested in other

localities before they can be let out for general distribution. The improvement of older varieties by selection and tuber indexing to eliminate plants and diseases has been in progress for several years, and we are now distributing them to leading growers for testing in the important potato-growing sections of the state.

In addition to the horticultural projects, the farm is carrying on tests with alfalfa. These tests are on field scale, and as a result we have made a notable improvement in yields and in stand. It is a demonstration in better seed and one in which the farmers are intensely interested. Mention might be made of the work with garden peas, principally as a feed for cattle in the mountain sections; also the beneficial effect of peas in connection with the seeding down of alfalfa in crop rotation.

At Rocky Ford, the work is developing very rapidly under Mr. Fauber. The bindweed menace has been practically eliminated, the soil which was badly depleted of fertility has been fertilized, and crop production has greatly increased. Considerable leveling had to be done to permit more efficient irrigation and to prevent flooding, due to the level nature of the land. A small-fruit plantation which was started 2 years ago is doing well. The buildings have been repainted, the onion storage shed stuccoed, and the place in general has been cleaned up and now looks very attractive.

The principal lines of work have been in connection with onion production, storage and improvement of the seed stock, as well as a study of cultural practices. The storage problem we feel has been very well worked out and reported on in a bulletin. The breeding work with the Valencia onion, carried on mainly at Fort Collins, is also carried on at Rocky Ford, particularly in testing out the new varieties and in selection. Plots of alfalfa of various varieties are being tried out on the farm, which may indicate which varieties are the most hardy, most disease-resistant, and best adapted to the valley. Varieties of vegetables are being tried to furnish information to the growers.

The substation is serving as a trial ground and demonstration, as well as an experiment station in connection with the work done at Fort Collins. It gives an opportunity to test out new varieties in sections where they are to be grown.

The station at Austin has, in the past, been carried on in connection with the work of the State Horticulturist. Due to the curtailment of funds, the expenses of operating the station had to be carried by the Experiment Station. The cost of this operation will be approximately \$1,500. The manager's salary is paid out of the State Horticulturist's funds. It is possible this amount can be reduced if prices for fruits become normal, as the income from the station will be credited to the Experiment Station. The station is a testing ground for new fruit introductions, work with soil manage-

ment and cultural practices; also projects on the washing of fruit to remove the arsenial and lead residues. The station is used, too, as a demonstration in orchard practices and methods.

Mr. F. M. Green, deputy in charge, spends a considerable portion of his time in the field among the growers, helping them to solve their individual problems. The work is particularly important at this time, since the decline in fruit prices has been very discouraging to the growers and they need a great deal of help in encouraging them to continue their work. We look forward to better financial conditions among our fruit growers. Mr. Green also makes visits to the southwestern corner of the state where considerable fruit production is being carried on, as well as into the upper Arkansas Valley. A fruit growers' meeting is held at Austin every year; also meetings of growers in the Grand Valley and Canon City.

The situation on the Cheyenne Wells substation is very unsatisfactory. The home station has not felt justified in withdrawing funds from the support of long-time projects. No state appropriations have been made for work at Cheyenne Wells for several years past, and when they were made they were not paid. The last appropriation of \$4,000 in 1927 was unpaid. The farm is well located and has fairly good equipment in the way of buildings and silos. The dry seasons experienced in the state during the past 4 years have made it very difficult for the renters of the farm to make a living. This year we were obliged to get a new tenant, and from reports he seems to be doing well and is cleaning up the place and putting in crops, with a prospect of obtaining some return.

There is one thing that might be done, and that is to make the Cheyenne station a demonstration in tree planting for the Eastern Plains. We have had considerable correspondence with some of the federal departments in trying to obtain funds for work of this kind at Cheyenne Wells, but thus far we have been unsuccessful. To undertake work in tree planting would be rather expensive to begin with, and I doubt the advisability under our present financial conditions. In view of these facts I recommend that we let matters stand for another year, and after that time decide upon a definite policy.

AGRONOMY

CRITICAL PERIODS IN THE USE OF IRRIGATION WATER.—This project is primarily a study of the best time to use irrigation water. Two papers have been published and a technical bulletin is in the hands of the bulletin editor in the course of publication. This work reveals that where only one irrigation is given, the best time to irrigate is between jointing and heading. Where the crop is irrigated early and the land dried out by the growth of that crop, a residual effect is produced which carries over into the next season, reducing the crop. This residual effect persists with additional applications of water but can be measured with applications as small as 5 inches

and as high as 23 inches. The latest work suggests that this residual effect is due to the exhaustion of nitrogen compounds. The residual damage can be controlled by late summer, or early fall, irrigations and can be compensated for by nitrogen fertilization.

THE CONTROL OF EXCESSIVE SOIL NITRATES.—Technical bulletin No. 6 gives the results of over 10 years' study. These studies indicate that nitrates do not become present in damaging quantities in permeable soils. They may become present in damaging quantities in impermeable soils or on seepage soils, in which cases they are mixed with other salts in sufficient quantities to cause damage. These are salt spots rather than nitrate spots. The problem then becomes one of balanced farming, proper rotation and fertilization. Nitrates have been applied without the presence of other salts in very high amounts without causing serious damage to the crops. This phase is receiving major attention at present.

STUDIES IN THE CONTROL OF BACTERIAL WILT AND WINTER KILLING IN ALFALFA.—Bacterial wilt has made alfalfa stands short-lived because it kills, in a short number of years, most of our existing varieties. One strain of Turkestan is found to be resistant, but it lacks some desirable hay qualities, is not sufficiently high in yield, and is subject to some other diseases. The present attack on the problem is by means of plant breeding which gives promise of producing high-yielding resistant sorts.

GENETIC STUDIES AND LINKAGE RELATIONSHIPS IN BARLEY.—Linkage studies show that certain barley characters are inherited together, or linked. Thus it becomes difficult to produce certain barley characteristics in barley breeding because it necessitates handling a sufficient number to get the linkage to break up in cross-over inheritance. The work has thrown much new light on the fundamentals of barley breeding and out of the work we have created several new and very promising strains which are under test.

SOIL PLAQUE METHOD OF DETERMINING MINERAL SOIL DEFICIENCY.—The work reported in technical bulletin No. 2 has been continued. Studies are being made on the modified Daas method of determining soil fertility requirements. A water-soluble method is under investigation which gives promise for certain soil types. Electrolysis methods have been investigated thoroly and have shown less reliability than the Daas method and water-soluble methods. A report on the electrolysis studies is nearly ready to present for publication.

HIGH-ALTITUDE CROPS.—A major portion of the high-altitude crop work is carried at Fort Lewis. This work covers high-altitude grains and forage crops. Pea work is resulting in new varieties. A manuscript is written, ready to offer for publication.

PLAINS CROPS AND MANAGEMENT.—Methods of planting corn have been studied. These show that corn can be planted much ear-

lier than formerly was thought possible. Corn planted the first of May, even if frozen down, is apt to mature a crop earlier and better than corn planted May 20.

Prior to the appearance of footrot, *Helminthosporium sativum* the best date of planting wheat at Akron was about August 20. Experimental work has shown that where footrot is a problem planting with the soil a little cooler almost completely controls the disease. The best date at Akron in the light of these new findings is about September 15. Earlier plantings are likely to be destroyed by the footrot. Later plantings somewhat reduce yields.

Some new and superior grain sorghums which will mature in the season available in the Akron section are nearly ready to be put into the hands of the farmers.

ANIMAL INVESTIGATIONS

MINERAL SUPPLEMENTS TO BEET BY-PRODUCT RATIONS FOR CATTLE FATTENING.—Following are the results secured on this experiment:

1. Addition of lime to a standard beet by-product ration did not aid the fattening process.
2. Substituting oat straw plus lime for alfalfa in a beet by-product ration proved to be possible.
3. One pound of cottonseed cake was sufficient as a supplement to oat straw.
4. Cane fodder showed a slightly greater feed replacement value than alfalfa in a standard beet by-product ration.
5. One pound of cottonseed cake was the most economical amount of protein supplement with cane fodder.

WINTERING CALVES A.—Grinding fine to medium-stalked cane fodder is not a profitable practice.

WINTERING CALVES B.—One ton of cottonseed cake replaced 7,850 pounds of North Park hay in a wintering ration for calves.

RANGE MANAGEMENT.—Three different systems of management of the range are being practiced: Lot 1, continued grazing; Lot 2, deferred grazing, and Lot 3, deferred and rotated grazing. The experiment is in its final stage, which will be 3 years' grazing by steers.

MINERAL SUPPLEMENTS FOR LAMBS.—Results secured were as follows:

1. Cane fodder must be supplemented with cake to compare favorably with alfalfa hay.
2. The addition of minerals gave no definite results. Some showed positive results, others negative without any certain trend of calcium and phosphorus carriers.

3. A calcium-phosphorus ratio of 5:1 was apparently too wide, since it depressed gains.

4. Grinding medium to fine-stalked cane fodder was not profitable.

CONTROL OF CULTURES WITH A HOME-MADE STARTER BOX.—The technical control of butter cultures or starters by the construction of a home-made starter box can be successfully carried on by all types of dairies, creameries and market-milk plants at a very reasonable cost to the individual.

BOTANY

DISEASES OF TRUCK CROPS.—A wilt of peppers caused by *Phytophthora capsici* has been found in the state and the conditions governing infection have been studied. Sixty varieties of peppers and related plants have been tested in greenhouse and field for resistance to this wilt.

Field spraying for purple blotch of onions has resulted in a decrease of losses from 42 to 7 percent.

A crown rot of pyrethrum caused by *Phytophthora* sp. and also a seedbed damping off of the same plant caused by *Pythium* sp. have been controlled by changing cultural practices.

A wilt of Canada thistle caused by *Sclerotinia sclerotiorum* has been studied but has not proved active enough to be used for control of the weed.

A sclerotinia on Chinese elms was found in the spring causing considerable damage to seedling trees, attacking the roots and bases of stems. Sanitation has apparently resulted in control.

Mosaic of peaches has been found in the Palisade district and eradication of diseased trees is in progress.

WEED CONTROL.—Extensive experiments on chemical treatments and tests of cultivation methods have been continued. Custom spraying was done in Otero County. Bulletin 403, Colorado Weeds, was published.

RANGE IMPROVEMENT.—Reseeding experiments have been carried on in Logan, Moffat and Larimer counties. Intensive ecological studies have been continued on sagebrush areas; also on mountain hay meadows in North Park. An accurate plane-table survey map of the grazing areas in North Park was completed, together with accompanying ecological data. Chemical analyses were made of over 500 grass samples from mountain hay meadows.

The grass nursery of native and exotic range grasses, many of which were obtained thru the courtesy of the United States Department of Agriculture, has been enlarged and increase plots of the more promising grasses have been planted.

THE SEED LABORATORY

SAMPLES TESTED.—

Farmers and Dealers.....	1,050
Seed Registration Service.....	150
Range Ecology.....	195
Longevity Investigations.....	260
Pyrethrum Investigations.....	5
	<hr/>
Total samples received.....	1,660

TOTAL TESTS MADE.—

Purity.....	875
Germination.....	3,040
Identification.....	10
Examination.....	20
	<hr/>
Total tests made.....	3,945

SURVEY OF ALFALFA SEED QUALITY.—During the alfalfa-planting period the laboratory was continually called upon to advise as to which grade of alfalfa seed was the best to buy. In order to have sound advice, samples were collected of all grades of alfalfa seed in Fort Collins. From these it was determined that the use of the highest grade of the variety desired was always advisable. The slightly higher cost per pound of pure live seed in the best grade could be compensated for by sowing from one-half to one pound less per acre. The best quality contains so few weeds as to be negligible; while all other qualities contain weeds in quantity and of varieties such as to be a real menace to the farm.

SORGHUM-SUDAN HYBRIDS.—For the past 3 years the laboratory has been working on the detection of these hybrids in sudan grass seed because it has been demonstrated in Australia that these hybrids are poisonous when pastured.

Selections of individual seeds have been made to be planted for the field day at Akron.

Examinations have been made of seeds of 300 individual self-pollinated plants received from G. W. Deming. Mr. Deming will plant the seeds and again bag the heads. He will make these seeds available for further study by the laboratory.

MILLET.—It has been demonstrated by growing individual, selected seeds in the greenhouse that Siberian millets on the market in Colorado are mixtures of more than one variety. The plants have ripened and the seeds are being examined with a view to finding characteristics by which the percentage of mixture may be determined.

IDENTIFICATION OF SWEET-CLOVER SEEDS.—Mixtures of white-blossom and yellow-blossom varieties of sweet clover are very com-

mon on the market. Examination of seeds from individual plants of each species appears to offer the only solution.

As a beginning, seeds from 40 plants of *Melilotus alba* were collected and examined.

CHEMISTRY

On September 5, 1933, J. W. Tobiska, associate in chemistry, took charge as acting head of section.

The study of vitamin values (A B & G) of the several varieties (Common, Grimm, Turkestan and Cossack) of alfalfa grown in this section was directed to the following objectives:

To find the effect of (1) different methods of field curing, (2) rapid artificial drying, (3) use of ultra violet light, (4) green crushing before drying and (5) the effect of time and manner of storage upon the quality or vitamin values of Colorado alfalfa hay.

These studies were not completed until late in November, 1933, and while the experiment was not exhaustive, insofar as the studies were carried out they seemed to indicate that A vitamin was the only one affected to a marked degree by the method of curing, and that all three vitamins (A B & G) were more affected by the method of curing, than by any difference attributable to the particular variety of alfalfa grown here.

Owing to a long-standing need for cooperative work on various research projects between the Chemistry Section and other sections of the Experiment Station, steps were taken to line up several projects which seemed the most needed. The titles of the projects approved by the Director as well as the progress reports upon the same are recorded below:

I.—“The Effect of Starch and Mineral Content on Quality of Colorado Potatoes,” cooperative with Horticulture.

Partial chemical analyses of 22 samples (crop of 1933) of selected strains of Colorado potatoes, from several localities, were made. The mineral analyses of ashes from these samples are in progress and will be completed during the summer. The scope of the project cannot be briefly summarized but results thus far attained are encouraging and hold forth some promise. Fluctuations in starch content from about 11.5 to 19.5 percent have been observed.

II.—“A Study of the Mineral Content of Some Colorado Forages and Soils in Their Relation to Certain Nutritional Deficiency Diseases of Livestock,” cooperative with Pathology-Bacteriology.

This study was actively started at the middle of May (1934) with the sampling of forage grasses, soils and blood from herds under observation in Northwestern Colorado.

III.—“Nutritional Characteristics of Mountain Meadow Hay Plants of Colorado,” cooperative with Botany.

The chemical analyses of 11 individual species and 3 mixed hays from the 1933 crop of North Park region (harvested about

Aug. 21, 1933) are now completed. The investigation of the A B & G vitamin values of these samples is past the peak but cannot be completed before the end of July, 1934. This work should be carried thru another season.

IV.—Cooperative with Animal Investigations.

The Animal Investigations Section had arranged for a series of feedlot, stock-fattening experiments in the fall of 1933. There had been no joint planning of the procedure with the Chemistry Section, but late in the fall when stock-feeding operations began, the need for chemical cooperation became evident and we were advised from the Director's office to carry the chemical control work on fodders used, as well as some blood analyses incident to the sheep-feeding experiments.

The Chemistry Section took care of this work as it was presented, and the final blood tests of four lots of 20 sheep each have been completed.

In addition to the above operations, the section has been called upon to do a considerable amount of chemical service work for individual farmers and citizens of the state. The major portion of this has had to do with stock and domestic water supply.

ECONOMICS AND SOCIOLOGY

TYPE-OF-FARMING STUDY.—This investigation was undertaken at the beginning of the fiscal year 1933-34 in cooperation with the Bureau of Agricultural Economics in the U. S. Department of Agriculture. The chief purposes in developing this project were (1) to acquire a more comprehensive understanding of the agriculture of the state as a whole; (2) to locate and delimit the different types of farming areas within the state; (3) to determine the general character of the farming carried on in each area; and (4) to identify and evaluate the relative importance of the various forces and conditions which have been and are now shaping the types of farming in various parts of the state. Seventeen major types of farming areas in Colorado have been identified and described.

AN ECONOMIC STUDY OF FARM ORGANIZATION AND MANAGEMENT IN THE GREELEY AREA.—Two phases of work have been emphasized in this study. The first relates to factors affecting the variation in costs and returns of winter fattening of lambs in Northern Colorado. Some of the more important factors influencing this enterprise are (1) purchase cost of lambs; (2) weight of lambs at the beginning of the feeding period; (3) variations in feedlot costs; and (4) sale prices. The second phase involves an analysis of the entire farm business and it provides comparative figures relating to farm returns from year to year. A summary of the incomes on 16 farms for the year 1933 compared to records for 1932 shows general improvement. This betterment in farm business conditions is the result of several

causes. Better prices were received for potatoes, cabbage, corn, barley and sugar beets and better yields were obtained from practically all of these crops. Furthermore, the feeding enterprise in this general area has proved to be more profitable than in the previous year.

A STUDY OF COSTS AND METHODS OF PRODUCING CATTLE AND SHEEP ON THE RANGE IN COLORADO.—This investigation is based upon ranch organization records covering some 20 operating units which are located in the North Park area and it embraces a 3-year period thru which falling prices made it extremely difficult to meet current operating expenses. The records in question provide a picture showing the shifting methods and practices that have been adopted from time to time in order to adjust costs to declining revenues. It was found that a uniform size of herd adapted to available feed and pasture gave better returns during years of falling prices than the too prevalent policy of building up herds while prices were on the down grade. The cheapest calves were those resulting from an increase in the calf crop. Records for 1932 indicate that the net income from cattle probably reached the lowest point in a period of 26 years.

RURAL SOCIAL AGENCIES IN COLORADO: CLASSIFICATION AND EVALUATION.—This study embraces an inventory of the agencies and organizations of a social character which have been developed in the open country and in towns and cities that are essentially agricultural. It deals directly with the educational, recreational, religious, health and other social phases of these agencies.

A STUDY OF TAXATION IN COLORADO.—Three problems have received consideration during the year. In the first place attention was directed to a revision and completion of the study relating to county consolidation in Colorado. In the second place the manuscript dealing with County Government in Colorado was revised and certain references relating to recent legislation affecting county functions were added. In the third case a thoroughgoing analysis of delinquencies in the payment of taxes in certain selected counties in this state has been made. All three phases have contributed rather extensively to our knowledge of taxation with special reference to the agricultural industry.

AN ECONOMIC STUDY OF LAND UTILIZATION IN NORTHWESTERN COLORADO.—The records secured in 1933 in this area for the 1932 crop year show the continued financial difficulties which confront farmers in this general region. The chief causes for this unfavorable condition may be found in adverse price conditions, high transportation costs and a virtual collapse of the banking institutions of the region.

A STUDY OF THE MAJOR TYPES OF COOPERATIVE ORGANIZATION IN COLORADO.—During the early part of the year a ratio analy-

sis of the business of 24 farmers' elevators was returned to each cooperating unit. The management of 17 business units have cooperated in this study for 3 years in succession and practically all of these men have furnished information in regard to their business enterprises for a fourth year. On the whole the outlook for the future of many of these organizations is not very encouraging. Due to an almost complete crop failure in much of the territory, which in many cases makes the third consecutive year, the volume of grain handled has steadily declined. Considering the handicaps under which these managers have been compelled to operate, most of them have made a very good showing.

CIVIL ENGINEERING

During July and until August 10, 1933, the work in this section was in charge of Mr. D. A. Wigle, who left the college August 15, 1933. His time was spent in closing up his work and arranging his data in convenient form for his successor, Mr. E. A. Lawver.

During August and September most of Mr. Lawver's time was spent in continuing the tests on evaporation of road oils in aggregates begun by Mr. Wigle, and in checking and analyzing the data obtained by him. This resulted in a decision to make new cylinders of aggregates and oil for further tests of evaporation to extend over a period of many months. Accordingly, during the remainder of the year, 182 cylinders were made using varying proportions of different oils and aggregates.

These cylinders were placed out of doors in the test lot soon after being formed, and tests have been made regularly on the various groups since then. The tests have been chiefly for oil and water content, altho some have been made for compressive strength. In all, approximately 300 tests have been completed.

During November, December and the first half of January a number of cylinders were compressed, using aggregates with varying percentages of *water* mixed with oil. These cylinders were tested for compressive strength to determine what effect, if any, water might have upon the stability of the mixture. The results showed that water was an important factor and indicated that a further study should be made. However, due to classes in the laboratory since January, only about half time could be given to this study.

For the year commencing July 1, 1934, it is proposed that the studies of evaporation of road oil from aggregates be continued. It is also suggested that further and complete tests be made to determine the effect of water in aggregate at the time of mixing with the oil, and a bulletin written. In order to secure more accurate and complete results upon this subject, it is recommended that an experimental roadway be constructed during the coming summer on the college campus. One of the unimportant driveways with a moderate

amount of traffic should be selected. Laboratory tests should be made in conjunction with this road in order that the results may be more conclusive. Two years or more may be required to complete the project, but at least some conclusions can be obtained in a much shorter time.

MECHANICAL ENGINEERING

The Mechanical Engineering Section of the Experiment Station has had one project during the year: Sugar Beet Machinery.

Experimental work on mechanical blocking of sugar beets has been concluded and in August, 1933, U. S. Department of Agriculture Leaflet No. 97 was published, "Cross-Blocking Sugar Beets by Machine."

Detailed studies of labor and power costs on a 10-acre beet plot were made.

Fertilizer placement trials are now in their third and possibly concluding year. These trials are to determine the best agronomic and most mechanically feasible way of placing fertilizer with reference to the location of the beet seed.

Both experimentally new and commercial planters are being tested for their relative abilities.

New tillage tools are being designed and tested.

Mechanical harvesters are approaching nearer commercial acceptability. Tests indicate that still more development work is necessary.

ENTOMOLOGY

ONION THRIPS.—Onion thrips were especially bad in a number of sections of the state during the year. Many fields in the western part of the state especially, had the yield very materially reduced. Two series of experimental spray tests were carried in the Arkansas Valley. In this work, attention was given to the more promising sprays of the year before, and in addition some combinations of pyrethrum and rotenone. The data do not show conclusively that spraying has given enough results to justify the expense. The most promising results were secured with nicotine-sulphate in combination with summer oils.

PLANT-LOUSE INVESTIGATIONS.—Part III of Aphidae of Colorado appeared in the June issue of Annals of the Entomological Society of America. It consists of over 100 pages with 124 illustrations, the drawings for which have all been made as a part of the work. The three parts of this paper now total over 300 pages, and probably it is the most complete work ever published on this difficult group of insects.

RELATION OF SYRPHIDS TO PLANT LICE.—Six species of syrphids were carried thru their life cycle with plant lice as their food. All of the species of lice fed upon were determined by Miss M. A. Palmer.

This project was planned to correlate with that of the plant-louse investigations, so as to give more complete information on the value of the syrphid fly larvae as predators upon the injurious species of plant lice.

POTATO PSYLLIDS.—The losses from the potato psyllid and the psyllid yellows that come from their feeding, were not as great as during 1932. However, the total crop reduction undoubtedly amounted to several million bushels. Probably the greatest percentage of loss occurred in the Mesa County early potato-producing sections, where only a little over 25 percent of a crop was dug. The loss was quite heavy in the early producing section of Weld County, but hardly comparable to the year before, when most of the early potatoes were not dug. Losses were rather heavy in Teller County, and many fields in Alamosa, Costilla, La Plata and Weld Counties showed a marked decrease. A survey of the state showed that the only section where at least noticeable losses had not occurred was in Routt and Moffat Counties. There we were unable to find the insect. Considerable injury also resulted in many plantings of tomatoes. Early infestations in the Arkansas Valley undoubtedly reduced the yield of canning tomatoes materially. Some fields in Larimer County did not produce over 50 percent of a crop.

Control tests thru the use of sprays were carried in five counties of the state, so selected as to represent the more important potato-growing areas, as well as the localities where the insect had been the most injurious. A total of 114 plots were used, which involved approximately 210 acres. In addition to this, approximately 300 acres were sprayed by growers directly in cooperation with the Entomology Section of the Experiment Station, and with our equipment. Of the large number of materials tested, only one, the lime and sulfur, showed control.

The results of these 114 spray tests show quite conclusively that the potato psyllid can be controlled by timely and thoro spraying with lime and sulfur. The strength of the solution is: Standard liquid lime-sulfur, 1 gallon to 40-50 gallons of water, with two applications. These should be made early when the insect is first noticed. If spraying is delayed until the potato vines are well infested, the damage is already done. Timely and thoro application of the spray mixture is necessary to obtain results.

GENERAL INSECT INVESTIGATIONS.—There are always a number of emergencies that develop each season that make this an important project. The greatest attention this season was given to the problem that was presented by a definite tolerance being placed on both lead and arsenic, upon certain vegetable crops, especially cauliflower and cabbage. This regulation meant that the standard arsenical insecticides that have been used for years in controlling such insects as the cabbage looper, imported cabbage worm and the diamond-

backed moth, had to be discarded or used in a very limited way. Attention was given to trying out certain vegetable compounds, especially pyrethrum and rotenone. Some very satisfactory results were secured at costs that are not prohibitive. Two applications of these materials gave a practical control at a cost ranging from \$3.50 to \$7 per acre. Practically no cauliflower was condemned on the market this year, whereas a number of cars were condemned the year before and much of the crop was never harvested on account of the threat of condemnation. The result of this work has been published in Extension Circular 79-A.

HOME ECONOMICS

THE BAKING OF FLOUR MIXTURES AT HIGH ALTITUDES.—The investigations in this section have been carried on by Dr. Mark A. Barmore, associate in research, with Lafayette Butler as laboratory assistant.

A summary of the work on the section's project is given below:

The study of "The Influence of Physical and Chemical Factors on Egg-white Foams" has been completed and written up for publication. A somewhat detailed account of this work appeared in an earlier report.

The next phase undertaken was that of the application of the findings of the above investigation, and a study of the effects of altitude on the production of angel food cake. The main factors investigated were the following:

1. The effect of the content of potassium acid tartrate on cake volume, tenderness and color, cell size and invert-sugar content.
2. The effect of foam volume on resulting cake characteristics.
3. The effect of oven temperature on the length of the baking period, on cake volume and tenderness, and on the amount of evaporation.
4. The difference in the volume, tenderness and cell size of cakes baked from thick white, as compared with cakes baked from thin egg white.
5. The effect of flour and sugar content on the cake characteristics, such as volume, compressibility, tensile strength (tenderness) and cell size.
6. Effects of altitude on the cake volume, tenderness, and compressibility, the amount of expansion during baking, the rate of change of internal cake temperature and the maximum internal cake temperature, and the amount and rate of evaporation.
7. The effects of the temperature of coagulation of egg white, in the presence and absence of acid, on its physical properties, and the effect of sucrose and acid content on the temperature at which the coagulation begins.

The most important findings were obtained from items 5 and 6, from which it was possible to derive an equation, based on the ten-

sile strength of the cakes, that expressed all possible recipes for any desired altitude up to 15,000 feet. The major value of this method is not in the result it yields to the study of angel cakes, but in its demonstration of the fact that there is a method of calculating the correct combinations of ingredients for one kind of cake that should be equally applicable to the other more complex types.

HORTICULTURE

POTATO VARIETY TESTING AND IMPROVEMENT BY SELECTION.—

The importance of the potato selection work is being more generally recognized by growers and shippers thruout the state. During the past year there has been a very marked increase in the demand for disease-free potato seed stocks. This has been emphasized by the increased number of inquiries for foundation seed stocks from the station. Two thousand pounds of seed of the Katahdin variety were released to growers to secure further information on its range of adaptability in the mountain districts. Over 4,000 pounds of seed of the dark-red Peachblow variety grown at the Mountain Substation will be planted in the San Luis Valley. Satisfactory progress has been made in increasing and maintaining this new type comparatively free from disease. One thousand pounds of the Rural New Yorker No. 2 seed will be released to growers on the western slope for seed increase. The improvement project is used as a basis for the maintenance and improvement of potato seed for release to growers interested in certifying their potato seed.

The work of testing new strains and varieties of the United States Department of Agriculture, as well as those introduced by other stations and by this station, is being continued. So far, there have been no new varieties introduced that are satisfactory for general production. Several of the new ones have possibilities in restricted mountain districts, but have not been tested sufficiently to recommend a general replacement of any of the standard varieties.

ONION BREEDING AND STORAGE.—Marked progress has been made in the development of pure lines of the Sweet Spanish variety of onions by inbreeding. The work originally started with inbreeding on 100 individual lines. These have been reduced to the 25 outstanding types. Several of the inbreds show considerable resistance to purple blotch and neck rot under conditions of infection.

Onion curing experiments are being continued at the Rocky Ford Substation. Delayed topping of onions after pulling continues to show promise as a method of lowering storage rot losses.

Tests on disinfecting onion storage houses by thoroly cleaning and chemically treating the interior before placing the bulbs in storage show that it is a practice that will reduce storage rot losses. More work is necessary on disinfection and fumigation materials and methods after the onions are placed in storage houses.

HEAD LETTUCE.—There are 53 different head-lettuce selections and crosses developed by the department under test for tipburn resistance. While many of these strains show high resistance to tipburn, further selection is needed to improve the solidity of the head. There has been some difficulty encountered at Fort Collins in producing sufficient quantities of seed for larger plantings in order to make it possible to have more individuals from which to select.

The regular strain trial plantings of new introductions of the New York variety are being continued this year and are important phases of the work. These tests are needed to make more definite recommendations on strains suitable for commercial plantings in the state.

RASPBERRY INVESTIGATIONS.—The progress on this project was delayed last year by winter killing of the canes in 1932, so very little information was secured on the effect of different pruning methods on yields. A new planting on comparing hedge and hill-row methods of production was started this year.

STRAWBERRY INVESTIGATIONS.—This work includes the testing of new varieties and studies on better cropping practices with particular reference to the heavy-soil types. There are now about 30 strawberry varieties under test, which include all of the recent introductions by the different experiment stations and the United States Department of Agriculture.

GENERAL VEGETABLE CROP INVESTIGATIONS.—Miscellaneous testing of vegetable varieties is carried under this project, which includes the testing of new introductions from experiment stations, commercial sources and individual growers. This work is of fundamental importance to the vegetable industry of the state, and also valuable from the experiment station viewpoint in that foreign plant introductions are tested and observations made on their disease resistance and insect tolerance. The work is carried at all three substations.

ORCHARD MANAGEMENT.—The study of methods of cultivating, irrigating and orchard-soil management at the Austin orchard is being continued, since such work is of vital importance to the fruit industry. It has been found that deep cultivation of an orchard should not be carried on during the growing season, especially with old, closely planted trees. Chiseling or subsoiling 16 to 20 inches deep confined to the middle of the space between tree rows in late winter or early spring has proved a great aid in breaking plow pan and loosening up tight soils. It is also valuable in securing a better distribution of irrigation water under ground.

The consistent and methodical use of cover crops should be the basis of handling soils in the orchard. The use of commercial fertilizers has not been carried far enough as yet to warrant recommendations on their use.

FRUIT VARIETY TESTING.—Many new fruit varieties are coming into bearing each year, and more information is being secured concerning their value.

PYRETHRUM INVESTIGATIONS.—A publication has been released on the results of the investigations to date, and commercial plantings, 1 acre in size, were made this spring for tests in different growing districts. The technical phases of this problem made good headway, and this year we shall be able to secure definite information on some of the more important inheritance phases. Pyrethrin content tests will be made on pedigreed lines to determine whether high-yielding ability is carried down to the progeny, and can be maintained by selection methods. Test plantings are made with the idea of securing more information on the range of adaptability, but it is too early yet to make any predictions as to the commercial possibilities of the crop. There are many problems which must be worked out before any commercial recommendations can be made.

POTATO SEED CERTIFICATION

During the past year, seed certification work has been largely concentrated in the San Luis Valley, and about 75 percent of our total certified seed acreage was in that section this past year. The acreage in other parts of the state has remained the same, but an effort is being made to increase the acreage in the Greeley district.

The average yield of potatoes from certified seed last year was 260 bushels, as compared to an average yield of 156.3 for the entire state. There were over 500,000 bushels of potato seed certified last season, 90 percent of which has been sold to potato growers in this state. Most of this acreage was of Brown Beauty and Peachblow varieties, and there is now more of a demand for Bliss Triumphs and Irish Cobblers for seed. On the average, the growers received 50 cents more per bushel for certified seed than the price for markets. However, the real object of this work is not so much to increase incomes of potato-seed growers, but to improve the quality and yield of the Colorado potato crop as a whole.

Present indications point to an unusually large acreage of certified seed for the present season. Most of this will be in the San Luis Valley, with an increased acreage in Weld County in the Greeley district. If the present indications follow thru, it will mean that there will be some 3,000 acres of potato seed to certify this season, and it may require a little additional help on inspection during the season.

Due to the unusually mild winter, left-over potatoes in the field are sprouting and volunteer plants are presenting a serious "weed" problem. This is merely mentioned because this condition, tied up with the increased insect population, will mean more trouble with inspections and with the spread of virus diseases.

It has taken some 7 years of persistent work in the San Luis Valley finally to convince growers of the value of disease-free seed. They are now convinced of the relationship of disease and running-out of potatoes, and are taking an active part in increasing their supplies of better seed.

The next problem is to develop a local seed source for the Northern Colorado-Greeley district so that growers will be able to buy seed grown in the state. This year a series of meetings have been held in Weld County with the object of increasing the acreage of seed potatoes in the outlying areas of the district so that they can supply the commercial growers with seed for their commercial plantings. It will require several years to completely put over a certified-seed program in Weld County.

IRRIGATION INVESTIGATIONS

MEASUREMENT OF WATER.—A series of tests were made for the Twin Falls irrigation project on their orifice type headgate for the purpose of determining the accuracy of the headgate and of deriving, if possible, a more accurate rating table for the device. It was concluded from the study that there were too many variable and uncertain factors for the headgate to be accurate under all conditions, but in spite of these factors the device was fairly satisfactory for measuring irrigation deliveries because of its simplicity and flexibility.

The demand for information concerning the installation and operation of Parshall measuring flumes continued thru the year. Personal assistance was given, where feasible, to irrigation companies and other organizations contemplating the construction of these flumes. The results obtained have been gratifying as nearly all the large irrigation canals in the state are now equipped with these flumes.

A large number of tests were made during the year at the Bellevue Laboratory on different types of vortex-tube sand traps under different conditions. A progress report on the work has been prepared. From the tests, it was concluded that the types of tubes tested were most efficient when operating at less than the critical depth, and that, with a series of tubes, it would be possible to remove under favorable conditions more than 90 percent of the bed load from the canal. There are still many unknown factors concerning the operation of this device and the experimental work will have to be continued in order to remove these uncertainties.

Several experimental traps of the vortex type were constructed on irrigation canals during the past year. Model studies were made for two sand-trap installations, and one trap was constructed according to a design based on the model study. The operation of this trap will be investigated as soon as the canal in which it is located begins

to carry sand. Some experimental work was done at Bellvue on a grating type of sand trap which seemed to be very effective in removing sand and silt from canals where the velocity is low. These tests were made in a glass-sided flume.

Because of the economic importance of sand and silt removal from all canals, and specifically because of the importance of the problem in connection with the All-American Canal, an allotment of funds was made for the Public Works Administration thru the Bureau of Agricultural Engineering for building a laboratory and carrying on experiments on sand and silt removal. Because of interest in the work, the Bureau of Reclamation has also set aside funds for cooperating in the study. This laboratory is being built in the Imperial Valley and for 5 months R. L. Parshall, in charge of the Irrigation Investigations in Colorado, was in California supervising the construction of the laboratory.

The laboratory is now complete and a set of vortex-tubes has been installed which are being tested at present. The percentage of sand and silt in the water before and after passing over the sand traps will be the basis of studying the effectiveness of the different traps. Special sampling equipment has been designed and installed for the work. A preliminary study of the different types of traps will be completed by the end of the fiscal year.

METEOROLOGY.—R. E. Trimble, meteorologist of the station, continued the observations on evaporation, soil temperatures and weather which have been carried on for some time. These data are used extensively by other departments of the Experiment Station and also by outside agencies. The observations pertaining to the weather are published by the United States Weather Bureau. Information is also furnished to the Weather Bureau concerning crop conditions in this area.

PUMPING FOR IRRIGATION AND DRAINAGE.—The work on this project which is being carried on by W. E. Code, has been seriously curtailed during the past fiscal year because of the shortage of funds. The water-level records, however, have been kept up and some pump testing has been done to maintain the interest of the farmers in efficient pumping plants. Mr. Code prepared a manuscript for a bulletin on irrigation wells in Colorado and also drafted a bill for the control of artesian wells. Recently, equipment was installed at the hydraulic laboratory for making model-well tests. The purpose of these tests is to study the effect of different types of well screens, diameters of wells and sizes of gravel on the discharge from wells. Work on this project will be continued thru the summer.

PUBLICATIONS AND PAPERS.—There were no publications from the Irrigation Investigations during the fiscal year but papers were presented by members of the section at meetings of the American

Society of Mechanical Engineers at New York and of the Society of Agricultural Engineers at Berkeley, California.

PATHOLOGY AND BACTERIOLOGY

SHEEP LOSSES IN THE FEEDLOTS.—SOREMOUTH.—The summary of work on this project which showed that soremouth was due to a filterable virus, was published in the February number of the Journal of the American Veterinary Medical Association. The check on lambs vaccinated on the range in Texas showed that they did not develop soremouth as compared with unvaccinated lambs from Texas and some other states. Tabulations were made on 22,000 vaccinated lambs which showed a percentage of soremouth infection of only eight-hundredths as against 18,000 unvaccinated lambs from the same state which showed 20 percent infection. Fifty-seven thousand Colorado, Wyoming and New Mexico unvaccinated lambs showed 10 percent infection.

It would appear from this year's experience that vaccination of lambs on the range is not only a practicable procedure, but one which should be demanded by our feeders, since it is not feasible to vaccinate the lambs after they come into the feedlots. In some years the losses from the complications of soremouth are considerable.

COCCIDIOSIS.—A summary of the 1933 experience with this disease showed six outbreaks comprising 10,061 lambs with 10 percent morbidity and 3.2 percent mortality. While the percentage of mortality was not as high as during the previous year, it was higher than in any other of the 5-year series except the last. This shows that the disease is still one to be reckoned as serious to the feeders.

An experiment to determine the longevity of the coccidia has been carried on in the laboratory for several months but is not yet finished. The indications are, however, that the organisms do not live very long when subject to drying, but when kept moist and at a low temperature, they live at least for several months. The maximum time has not yet been determined as the experiment is still in progress. The practical import of this is to determine how long pens may be infected after sheep have been taken out.

DEATH LOSSES ON HEAVY GRAIN FEED.—During the past 2 years special attention has been given to determining the toxicity of intestinal filtrates from lambs dead of overeating. This work was suggested because of findings with similar diseases in the British Isles and in Australia. During the season of 1932-33, out of 25 intestinal contents filtered, 9 proved toxic for guinea pigs and 6 for sheep. During the past season, out of the same number of filtered contents, only 5 were toxic for guinea pigs and 4 for sheep. The probability is that all contents that are toxic for guinea pigs are also poisonous

to sheep but the difference arises in the fact that in some cases there was insufficient material for the injection of sheep.

If one may be permitted a conclusion from such meagre data, it would be that while some of these intestinal contents are poisonous, it is not a constant finding, and it has not been shown that the toxin is actually absorbed into the circulation. This work will, of course, have to be continued over a period of years.

CONTAGIOUS ABORTION.—While the routine testing of all blood samples sent is being continued, special attention has been given to range herds during the past year. The idea is to apply our knowledge of blood testing and segregation to range animals in the hope that a satisfactory system may be worked out for control in these animals similar to that which already prevails in dairy cattle. Necessarily testing of range herds will have to be at longer intervals, possibly once or twice a year. Bleeding of two herds under observation in Middle Park is now being done by Dr. Cross but the results are not yet available.

SWINE ERYSIPELAS.—The disease was not transmitted by contact from affected to healthy swine when the two were kept together over a period of several months.

Several new outbreaks were observed but no very definite findings have been discovered. The seriousness of the disease in the state, however, continues.

PHOSPHORUS DEFICIENCY.—This project, which has just been approved during the past year, is to be in cooperation with the Chemistry Section. Dr. Cross and Professor Tobiska have been in Moffatt County making the preliminary observations and bleeding a considerable number of cattle for determining phosphorus content. Soil and forage samples are also to be taken. These observations will be made monthly during the summer. In this work there is excellent cooperation from the extension veterinarian and from the county agent at Craig. There appears to be a very deficient area in the western part of that county and only time will tell what the facts actually are.

ENCEPHALOMYELITIS.—That disease made very serious inroads on the horse population of this state again last fall. It reached its height in September, faded out in October and was completely gone in November. As during the previous year, a complete survey of the situation was made, largely by the questionnaire method, reports being received from the veterinarians of the state. One thousand five hundred and ninety-two cases were reported in 1933 as against 849 in 1932. The disease, which was very prevalent in the San Luis Valley during 1932 practically died out in that area in 1933, there being only 19 cases reported in the latter year. There were many more cases in both the Arkansas Valley and the Platte Valley districts than in the previous year, the Platte Valley leading with 1,270

cases. Since the mortality in the whole outbreak was approximately 31 percent, it is apparent that this is a most serious problem in Colorado horses.

During November an inspection trip was made thru the infected districts, with Drs. Karl F. Meyer and C. M. Haring, who have made much progress in the study of the disease in California. It was they who showed the disease to be due to a filterable virus, and they were the ones also who have produced a serum for its treatment. They are attempting to make a survey of the situation in the various states of the union where the disease has been prevalent. In Utah the mortality ran better than 90 percent. The disease also appeared in New Jersey but investigators report that the virus is different from the virus seen in the west.

ANAPLASMOSIS.—From time to time reports have been made on a disease seen in Routt and Moffat Counties which some have believed to be anaplasmosis. Dr. Stout found two cases of this disease near Craig in February and obtained samples of blood from both of them. This blood was injected into two cows in the experimental pens. One of these died 41 days after the injection, showing typical symptoms and lesions of anaplasmosis; the other is still alive. Smears from the cow that died were recently shown to Dr. G. Dickman who is probably the leading authority on anaplasmosis in this country and has done much work on the disease for the United States Bureau of Animal Industry in Louisiana. He pronounced the disease unquestionably anaplasmosis. This opens up a new field for investigation as the malady is now being reported from other areas in the state.

NATURE OF ORGANIC MATTER TRANSFORMATIONS in the soil with special reference to the microbiological decomposition of cellulose and hemicelluloses. Continued purification of enrichment cultures of cellulose decomposing bacteria has been carried out. Pure cultures of bacteria capable of decomposing cellulose as well as definite associations of these with other soil organisms are being obtained. When a sufficient number of these are obtained, the nature of their action upon cellulose will be studied. A collection of those plant materials making up an important part of the organic matter returned to the soil is being made. These materials will be used in studying the general nature of organic-matter decomposition under Colorado soil conditions as well as of their cellulose and hemicellulose constituents.

THE AZOTOBACTER TEST FOR SOIL FERTILITY.—A major portion of Dr. Reuszer's time has been spent on this project. It has been found that the spontaneous appearance of azotobacter on soil plaques is affected by time of year that the soil sample is taken, kind and amount of carbohydrate used and amount of phosphate used. The

results of an attempted determination as to whether nitrogen fixation in the soil plaques could be utilized as a measure of soil fertility were found to be vitiated by the presence of rather large amounts of ammonia in the laboratory air. This condition has been improved and the experiments are being repeated.

PUBLICATIONS

BULLETINS OF THE STATION

- The Home Vegetable Garden (reprint), by A. M. Binkley. No. 357.
 Baking Quick Breads and Cakes at High Altitudes (revised), by Marjorie Peterson. No. 366.
 Pyrethrum Investigations in Colorado, by C. B. Gnadinger, L. E. Evans and C. S. Corl. No. 401.
 Collar Rot of Tomatoes, by W. A. Kreutzer and L. W. Durrell. No. 402.
 Colorado Weeds, by Bruce J. Thornton. No. 403.
 Wheat Production in Colorado, by D. W. Robertson, Alvin Kezer, J. F. Brandon, J. J. Curtis, Dwight Koonce and Wayne W. Austin. No. 404.
 Planning for Lamb Feeding, by H. R. Lascelles. No. 405.
 County Consolidation in Colorado, by S. R. Heckart and G. S. Klemmedson. No. 406.
 Celery Production in Colorado, by A. M. Binkley. No. 407.
 Flower Gardens for Colorado, by George A. Beach. No. 408.
 Feedlot Diseases of Lambs, by I. E. Newsom and Floyd Cross. No. 409.

TECHNICAL BULLETINS

- Nitric Nitrogen in the Soils of the Arkansas Valley, by Robert Gardner, Alvin Kezer and J. C. Ward. No. 6.
 Grasshopper-bait Tests in Colorado, by F. T. Cowan. No. 7.
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ANNUAL REPORT

Forty-sixth Annual Report for 1933.

The publications for the year aggregated 568 pages, with 47,000 copies.

JOURNAL PAPERS

- Proventriculitis in Chickens due to Flukes, by I. E. Newsom and E. N. Stout. *Veterinary Medicine*, V. 28, p. 462, November, 1933.
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