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Thirtieth Annual Report

of the

State Board of Agriculture

and the

State Agricultural College

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FORT COLLINS, COLORADO

1908

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AGRICULTURAL EXPERIMENT STATION

FORT COLLINS, COLORADO

1908

DENVER, COLORADO
THE SMITH-BROOKS PRINTING CO., STATE PRINTERS
1909

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*.....,
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J. F. TUTTLE, JR., LL. B., A. M.,
(Harvard), College Lecturer. Residence, Denver, Colorado.

LETTER OF TRANSMITTAL.

To His Excellency,

THE GOVERNOR:

Sir—Herewith I transmit my annual report as Secretary of the State Board of Agriculture. It is respectfully commended to your attention and to the thoughtful consideration of the General Assembly.

A. M. HAWLEY,
Secretary of the State Board of Agriculture.

The State Agricultural College,
Fort Collins, Colorado, November 30, 1908.

REPORT OF THE PRESIDENT.

The State Board of Agriculture:

Gentlemen—I submit herewith reports from the heads of the various departments of the Colorado Agricultural College, for the year ending November 30th, to which I invite your careful attention.

My own report at this time will be very brief, since it is my purpose to present at the end of my term of office a report covering the ten years of our co-operation.

It gives me unusual pleasure to state that there is perfect harmony in the College. Never has there been such evidence of solidarity. Never has there been a time when every member of the College, from the lowest to the highest, has been in more perfect accord with not only the members of his own department, but with those of all other departments. I am convinced, too, that the quality of work has never been surpassed. It would seem that every man not only feels the importance of his position, but is giving to it the full measure of his powers.

The student body, being almost without exception high-school graduates, is showing a college spirit and application to work of the finest sort.

There is a compactness, an *esprit de corps,* a marching together, which is most commendable. There are as many seniors as last year; twenty-five more juniors, eleven more sophomores, and three more of freshman rank, there being 112 in this year's freshman class.

The short course which began its work in November last has an enrollment of 106. There will be others entering after the Christmas holidays.

The student organizations are well officered, loyal to the administration, and performing remarkably well their several functions.

The faculty, united, is in that most desirable attitude of awaiting your instructions, determined that the policy of the board shall be its policy.

The support of the local press and of local organizations is given the College without reserve. I am confident that there has never been a time in the history of this institution when everything has so conspired to a great forward movement as will surely come under the efficient leadership which your wisdom will provide. If I may be permitted, I desire to submit a few suggestions.

I think I need not counsel you not to depart one iota from the letter and the spirit of the law which established and maintains these land-grant colleges as "high seminaries of learning.

where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts."

As in other States, that battle has been fought in Colorado and won on the side of the law and sane, approved, scientific education.

I desire further to call your attention to the high schools of the State. While we have cultivated their friendship and sent to them yearly a representative of the College with good results, the time has come when some one should devote all or the greater part of his time to cementing these preparatory schools and the Agricultural College. Not alone by a thorough visitation and an exploitation by models, samples and stereopticon lectures the work of this College, but by helping to so reshape their courses of study as to give better opportunity, certainly greater incentive to select such a high school course as will lead to this institution. Here lies one of, if not the most important work of this board and your faculty during the next five years.

I wish to again call attention to the demand for a four-years' industrial preparatory school to be established here under your supervision for the benefit of those graduating from the eighth grade who may not have high school privileges at home, and for those who may prefer more practical preparatory work than is usually provided in high schools.

One-third or more of our correspondence is in relation to such a school. The present faculty is willing to add to its duties the labor of helping to establish here such an industrial preparatory school, knowing the demand for it and fully realizing the great service it would render the College itself.

By an alternation of recitations and laboratory work with that of the College, as now scheduled, the present buildings would be ample. A head master and three or four additional assistants would be sufficient help for the first two or three years.

The faculty has with great care prepared a course of study for your consideration which they believe would meet the demands of such a school. I herewith submit a copy.

This preparatory school would double the enrollment of students at once. A small fee of from $10.00 to $20.00 a year could be charged under the laws governing the College which would almost cover the additional expense. It is worthy your consideration in the program of your growing College. It would complete the triangle of Agricultural College education. A preparatory school for the graduates of the common schools, which would either lead to the College courses or be more or less complete in itself for those who desire both practical and cultural education of a limited nature; next, the winter short courses already so successfully established for those who, older, lack either

time or means, or both, for a more thorough training; and then the long courses as now established, leading to the degree of B. S. for those who desire technical and special preparation in agricultural, veterinary, horticultural or engineering lines. All these statements relate as truly to domestic science for young women.

I believe some co-operative work should be undertaken with the State Normal School looking to the preparation of teachers of elementary agriculture in the rural schools. A beginning might be had by offering a summer school course at the Agricultural College, using our buildings, equipment and teachers, under the joint supervision of the College and the State Normal School. Before agriculture may be introduced into the common schools there must be a preparation for instruction in agricultural branches.

You should appoint at this meeting a legislative committee, whose special concern shall be the securing of much larger appropriations for the College from the Legislature. Either the permanent income must be increased to two-fifths of a mill, or greatly increased special appropriations obtained.

The College has outgrown its revenues. The increase of its extension work, which in no wise meets the present and constantly growing demands—a work so helpful to both the State and the College; the need for more buildings and new equipment, the increasing rate of living—making it necessary to increase the salaries of some of your employes—the greater demand for experimental work along many lines, all make it imperative that the claims of the Agricultural College shall be presented to the incoming Legislature as they have never yet been presented. The people are ready to help, organizations are proffering their assistance; you can double your revenues if you become urgent.

The animal husbandry department is at present in charge of Professor Morton; the department of agronomy is in charge of Professor Knorr; that of farm mechanics and dairying is under Professor Bainer; the farm and stock not otherwise supervised as above indicated are in charge of Mr. O'Brien, and the government horse-breeding plant under Professor Williams, sent out by the Department of Agriculture, at Washington, all reporting directly to the President of the College.

I have a few minor recommendations to offer later in this session relative to the immediate needs of the College.

B. O. AYLESWORTH.

REPORT OF THE IRRIGATION ENGINEER AND METEOROLOGISTS.

To the Director:

The development of the State of Colorado has been largely bound up with irrigation. Our station is the best situated of any in the Union for irrigation investigations. Extensive plans were made in the beginning, but the funds available made it necessary to postpone most of the investigations then proposed. An essential qualification of those taken up was that the cost was to be small, for during several years the sum available could not much exceed $100. This led to some projects, not such as would have been taken from choice, but from the necessity of the situation. Fortunately, some of these, whose merit was cheapness, proved to be of much value. Some of the questions relating to water-supply, to seepage matters, to measurement, were taken up. These became important because of the serious questions involving the fundamental water ownership and rights of the whole State. It was based on some of the investigations of the station that the successful defense of the State of Colorado against the attack of the State of Kansas was successfully made, and the result has been immediately seen in the activity in irrigation development since the determination of this question by the Supreme Court.

There has been a large amount of data in various lines, the results of measurements, of continued observations and of records, and it is now of pressing need that these be reduced and prepared for publication. This needs to be done to prepare for taking up other work in contemplation. The restricted quarters, the lack of laboratory space, has prevented the consideration of much work of importance and the laboratory tests in connection with plants and the use of water. With the new building, which it is hoped will be available during the coming year, this restriction will be removed and the limitations largely removed.

The danger to the valuable records has been a source of constant anxiety for some years back, but, fortunately, we have not suffered. There is, however, the constant risk. The same conditions have restricted the room and the opportunity for doing work requiring room.

The work of the past year has been along the lines of the plans adopted, and is the continuation of plans in force for some time. Special progress has been made in the reduction of some classes of the observations that now have become of great value. These it is hoped to systematically reduce. Without more room it is hardly possible to consider more aid for that purpose.

Respectfully submitted,

L. G. CARPENTER.

ANIMAL HUSBANDRY.

To the Director:

Dear Sir—The experimental work in live stock, as planned for the summer of 1908, has been carried out. The ration experiment with swine upon pasture was carried on for nine weeks, and has now been closed. Five lots of pigs, fourteen in each lot, were fed as follows:

Lot 1—Rape pasture; 1 per cent. of live weight in corn.

Lot 2—Rape pasture; 2 per cent. of live weight in corn.

Lot 3—Dry lot; corn at pleasure.

Lot 4—Alfalfa pasture; 2 per cent. live weight in corn.

Lot 5—Alfalfa pasture; 1 per cent. of live weight in corn.

Respectfully submitted,

C. E. MORTON,
Animal Husbandman, Agricultural Section.

Fort Collins, Colorado, November 1, 1908.

AGRONOMY SECTION.

To the Director:

Dear Sir—I hereby respectfully submit to you the following report:

No. 1. To develop a hardy type for higher altitudes.

No. 2. To develop a drouth resistant type for non-irrigated lands of the West.

The preliminary work for these experiments has been conducted in the alfalfa breeding nursery for three years. As soon as desirable stocks (hardy and drouth resistant) have been established in the nursery they will be taken to those localities for which they are specially adapted. Next spring we hope to send alfalfa stock to Gunnison.

No. 3. To develop a forage type for the irrigated lands which shall yield a desirable quality and increase the quantity of forage now produced by our present type of alfalfa.

In our plant-breeding nursery we now have alfalfa stocks from nearly all sections of the globe. Here we are testing the individuality of each plant, constantly adding new stocks that seem desirable and eliminating the undesirable ones.

Considerable close-hand pollenation has been done; by this means some excellent stocks have been developed. We now have more than 6,000 individual plants in the nursery; about two hundred of these are the specially selected hand pollenated stocks.

CORN.

No. 1. To breed up an acclimated type of dent corn which shall possess more desirable physical characteristics and be hardy for altitudes from 4,000 to 6,000 feet.

This work has now been in progress for five years. Although this work is making good progress, it is a question in my mind if this would be of any advantage to the farmers of the irrigated sections. If this work could be continued on dry land, it would be of greater value to the farmers of Colorado.

BARLEY INVESTIGATION.

No. 1. To obtain a desirable drouth-resistant barley, without beards, for lands above the ditch.

For this work all possible beardless varieties that could be secured were planted in the spring of 1908. Several beardless varieties in the nursery were crossed with our best bearded varieties, in order to seure desirable types of beardless barleys.

No. 2. To obtain a good quality, high-yielding feed barley, without beards, for irrigated lands below 6,000 feet.

This work is along the same line as the above.

No. 3. A very early type for the higher altitudes.

A number of very early maturing stocks from the College were placed in several localities at an altitude of from 8,000 to 10,000 feet. This year these stocks proved fairly satisfactory.

No. 4. A more desirable malting type for irrigated lands.

Nothing has been done with this, and it may be advisable to drop this work.

MEADOW AND PASTURE GRASS INVESTIGATION.

Nothing has been done with this, except that a number of stocks have been planted in the plant-breeding nursery.

OAT INVESTIGATION.

No. 1. Development of a superior milling oat for the higher altitudes of the inter-mountain region of the West.

This was carried on in the regular plant-breeding work in centgener plots. This work will be continued in the nursery for several years.

No. 2. Do the various types of oat differ in drouth-resistant power, and can this be intensified in breeding by selection?

Nothing was done with the above.

STOCK ROOT INVESTIGATION.

To determine the best type of roots, under Colorado conditions, for economical feeding of beef, pork and mutton.

For the past two years a number of varieties of stock roots were planted, with the object of selecting varieties best adapted for Colorado conditions. In the fall of 1908 it was considered a good plan to cross some of our mangles with the sugar beet, in order to secure a better keeper than the common mangles.

Several very good stock carrots were saved from the 1907 crop (these were planted in my home garden, and seed was grown from these); that year over 75 per cent. of the carrots died from rot. It is hoped that this seed will prove rot resistant.

SUGAR BEET EXPERIMENT.

No. 1. To determine the effects of various fertilizers and manure upon purity and sugar contents of the beets; the residual effects of commercial fertilizer and manure upon the soil; crop rotation by continuous culture.

This was carried out as planned, and is now in its third year.

No. 2. Cultural methods, including tillage, seeding, harvesting and siloing.

This was carried out as planned. The results of this work are most gratifying.

No. 3. Determine the minimum amount of water that will grow a maximum crop of beets.

This was carried on as planned, with the exception that the water used was not measured; the plats were simply irrigated one, two, three, four and five times.

SPRING MILLING WHEAT.

To determine the cause of deterioration in spring milling wheats on the irrigated lands and in the higher altitudes. In connection with this project wheat was grown by the Experiment Station and three co-operators in three different sections of the State. One of the co-operators at Carbondale, altitude 6,100 feet; Alamosa, 7,546 feet, and Rocky Ford, 4,180 feet. This is the first year of the work. As soon as the milling apparatus and necessary equipment can be installed, the milling tests will be carried out, as outlined in the plan.

Respectfully submitted,

F. KNORR,
Acting Agronomist.

Fort Collins, Colorado, November 1, 1908.

FARM MACHINERY.

To the Director:

Dear Sir—I hereby respectfully submit the following brief report of experimental work in farm mechanics:

Last April these outlines of work were submitted to be carried out between then and June 30, 1909. The subjects of these outlines were as follows:

Cement posts for farm use.

Feed grinders, cutters and crushers.

Farm buildings and construction.

The first subject—"Cement Posts for Farm Use"—is just completed, as far as the experimental work is concerned. The data have been secured and are ready to be written and arranged in bulletin form. We desire to get this material in shape for publication by November 30, 1908. Neither of the other two subjects has been started.

We hope to carry out the second line of work—"Feed Grinders, Cutters and Crushers"—between now and June 30, 1909.

It seems necessary to omit the last line of work for the present time on account of the limited amount of help in the department and the large amount of instructional work to be given.

About $1,200 out of the $2,000 appropriated by the State for experimental work has been used during the past summer for erecting additional machinery space for the department machinery. This space is in the form of an addition to the old farm mechanics' building and covers a space 36x66 feet. It has ten-foot posts with floor above for light machinery.

Mr. H. B. Bonebright, assistant in farm mechanics, has spent about one-half of his time since last January working with the cement fence post experiment. I have also spent a great deal of my time during the past six months in the same line of work.

Respectfully submitted,

H. M. BAINER,
Professor of Farm Mechanics.

Fort Collins, Colo., November 1, 1908.

REPORT OF HORSE BREEDING INVESTIGATION.

To the Director:

I beg to submit to you a brief report of the horse breeding investigation as conducted in co-operation with the U. S. Department of Agriculture for the period beginning with my appointment as expert-in-charge, October 22, 1908, up to the present time.

STUD RECORD SUMMARY.

There are at present in the stud seventy-six (76) animals, consisting of the following:

1 stallion.
28 mares in service.
8 two-year-old fillies.
2 two-year-old colts.
4 two-year-old geldings.
7 yearling colts.
9 yearling fillies.
9 male foals.
8 filly foals.

76 total number in stud.

There have been no additions made to the stud during the time aforementioned, but the above summary includes the mares and foals purchased during the summer and their addition to the stud is of such importance as to deserve special mention at this time. The purchase was made by the original purchasing board composed of Mr. Geo. M. Rommel, Animal Husbandman of the Bureau of Animal Industry; Prof. W. L. Carlyle, Expert in Animal Husbandry, and Director C. F. Curtiss, of the Iowa Experiment Station. The mares purchased represent blood lines that are producing the best carriage horses in Kentucky. Three were sired by Wilson's King, and the fourth by Chester Dare, the grandsire of Ahma, second prize carriage brood mare at the 1907 Blue Grass Fair. This is the best blood that can be obtained in Kentucky at the present time and its introduction into the experiment should prove very valuable in the results attained.

The mares were all in foal when purchased, and all have foaled since purchasing. The mares, Barthania, McCord and Elvira Lindsey were bred back to Bourbon King, and the mares Golden Picture and Bethel Princess were bred to Golden King before being shipped to Colorado. Some of these mares will be eventually mated with Carmon, and the refinement and quality

which is characteristic of these blood lines should be of great value in the production of carriage horses of the proper type.

ELIMINATION OF UNDESIRABLE ANIMALS.

A number of animals in the stud at the present time have been recommended for disposal. There are fifteen animals in all to be culled and include the following:

Mares:

Brown mare—California.

Bay mare—Florida.

Chestnut mare—Minnesota.

Three-year-old fillies:

Brown filly—Idalia.

Bay filly—Monella.

Two-year-old filly:

Bay filly, out of Idaho.

Two-year-old geldings:

Brown gelding, out of California.

Brown gelding, out of Illinois.

Yearling fillies:

Chestnut filly, out of Minnesota.

Bay filly, out of Michigan Lady.

Yearling colts and geldings:

Bay gelding, out of Illinois.

Bay colt, out of Wisconsin Queen.

Foals:

Chestnut filly, out of Minnesota.

Bay colt, out of Florida.

Bay colt, out of Monella.

Of the above recommendations, one has already been disposed of; the yearling colt, out of Wisconsin Queen, having been destroyed in accordance with a board resolution passed during the last meeting.

The above recommendations were submitted to Dr. A. D. Melvin, chief of the bureau of animal industry, by the former board of survey composed of the members of the purchasing committee aforementioned.

The recommendations have been favorably acted upon by the department and the animals the property of the department ordered to be sold by the present board of survey composed of the writer as chairman, Prof. C. F. Curtiss and Mr. Geo. M. Rommel.

The animals the property of the department which were condemned and recommended to be sold are the mares California,

Florida and Minnesota, and the three-year-old fillies, Monella and Idalia.

The remaining condemned animals are the property of the experiment station and are subject to sale at its discretion. I trust some suggestion will be submitted as to the best manner of disposing of these animals. As it is quite essential that the identity of these animals with the experiment be lost, because of their inferior qualities, the manner of disposing of them deserves some deliberation. It has occurred to me that it would probably be advisable to place them in some good market, such as Omaha or Kansas City, and allow them to bring whatever the open market afforded. This would insure a total loss of identity, but on the other hand a slight sacrifice of proceeds of sale might occur. The matter, however, is left to your discretion, and I trust some recommendation will be made for their sale, as the horses should be disposed of at once.

IMPROVEMENT.

The improvements made have been only those of urgent character. Two sheds have been built approximating an expenditure of about $200.00. Water lines have been installed in three paddocks, the remaining paddocks having been previously equipped with water.

MAINTENANCE OF ANIMALS.

The majority of the brood mares are kept on pasture in the foothills with a daily allowance of upland hay. The mares with foals, stallions, young stock, and mares which do not thrive on pasture are kept at the barns for constant attention.

The young stock is maintained on a ration of oats, alfalfa and upland hay. They are very thrifty and are growing nicely.

CONCLUSION.

The development of the young stock indicates that progress is being made in attaining the proper type of carriage horse. With the condemned horses eliminated, and a continued process of judicious breeding practiced, the outcome of the experiment can be none other than successful.

Respectfully submitted,

J. O. WILLIAMS,
Expert in Charge.

Fort Collins, Colo., Dec. 8, 1908.

REPORT OF THE VETERINARIAN.

To the Director:

There are at the present time no animal diseases threatening the security of the live stock interests of the State. There are, however, a few diseases that are a constant menace to this industry, and while at the present time none of them has assumed the proportion of an epizootic, yet in the aggregate they claim an annual mortality that makes the raising of live stock as a business more or less hazardous.

These diseases are at all times to be reckoned with, not only because of a certain small loss, but because of the danger of their assuming wide-spread proportions and not only claiming the profits of the business, but a goodly proportion of the principal invested as well. The specific cause, prevention, and treatment are as yet little understood and are problems which can only be mastered by diligent scientific co-operation of field work and laboratory.

The most important diseases within the State, named casually in the order of their probable economic significance, are as follows: Tuberculosis, mostly in cattle and swine; necrotic stomatitis in hogs and calves, poisonous plants on the open range, black-leg and anthrax, strangles in young horses, hog cholera, mange of cattle in the western half of the State, scabies in sheep, contagious abortion, parasitic diseases, calf scours, swamp fever in horses, and glanders.

LOCO WEED INVESTIGATION.

This is the fourth season of our co-operative investigation of the loco weed problem in conjunction with the department of agriculture. This undertaking has been co-operative only to the extent that we have furnished the live stock. One thing seems to have been determined beyond what the western "cow man" already knew, and that is the specific nature of the poison, which, according to the report of the biochemic division of the bureau of animal industry, is barium. As an addition to science this discovery alone has unquestionably justified the investigation. The practical solution of the loco problem, however, does not rest with the discovery of the causative agent, but must be prophylactic or curative to have any economic value.

As no information has been furnished us regarding this season's work, I am unable to report anything definite. The efforts of the U. S. Department of Agriculture to bring to light

the long hidden mysteries of this perplexing problem in the interests of science and a great western industry are certainly worthy of commendation and warrant the generous appreciation and co-operation of the western stockman.

NECROTIC STOMATITIS.

During the winter months a year ago this disease reached the proportions of a veritable scourge among the swine in almost every section of the State.

The disease assumed a degree of virulency never before reported. Thousands of young pigs died and older ones in many cases succumbed. The specific organism (bacillus necrophorus), which, no doubt, is responsible for this condition, is also an invader in hog cholera outbreaks, and the post mortem as well as ante-morten lesions, in necrotic stomatitis, range all the way from those characteristic of this disease to those typical of hog cholera.

Necrotic stomatitis is commonly spoken of as sore mouth disease in pigs and calves. This name, however, is a misnomer, as the mouths are often not in the least affected.

In some cases we find ulceration of the walls of the stomach, with deep-seated necrotic areas, and tumefaction of the muscular coats. In most every case, deep sloughing sores may be found on the feet, tips of the ears, nose, or in some unusual place on the surface of the body.

Control of the disease seems not to be difficult when active measures properly directed are adopted. A thorough, systematic quarantine and disinfection have been recommended by letter, through the press, and by personally visiting the diseased herds.

The things especially recommended have been the removal of healthy animals to new quarters, the burning of all litter, disinfecting feed troughs, and dipping all the hogs once, and the little pigs every three days, in a solution of potassium permanganate, one ounce to one gallon of water.

HOG CHOLERA.

The conditions for raising hogs in Colorado approach the ideal. This fact is becoming appreciated, and, as a result, hog-raising has taken an impetus in the last two years, which augurs well for the future of this industry in Colorado. Hog cholera has not as yet caused much loss, and there are those who make the sweeping claim that hog cholera and other contagious diseases need not be feared because of the favorable climatic conditions in the arid West.

These claims, in the main, are not substantiated and the danger is that we become overzealous in this respect and relax our vigilance in necessary quarantine and sanitary measures. We have already lost enough hogs from cholera in the West

to effectually refute such ill-advised statements. The fearful loss from hog cholera in this country actuated the U. S. Department of Agriculture to undertake a thorough investigation, with the hope of securing a remedy or, better still, a means of protecting hogs against this disease.

After several years of diligent research, an effective means of immunizing hogs against cholera has undoubtedly been secured. That this product, known as Dorset's hog cholera serum, will protect hogs against the disease cannot be doubted. The objections to it are two-fold, viz., the expense in its manufacture, and the danger of distributing the virus among careless veterinarians and uninformed farmers.

The Kansas experiment station has undertaken to produce a protective serum by passing the cholera virus through the horse. The claim is made that this method will successfully protect the hog against hog cholera, and at the same time avoid the objectionable features of the Dorset method.

While it is practically certain that we now have a sure method of preventing the spread of hog cholera, the fact remains that farmers are themselves largely responsible for the spread of the disease, and the education of the farmer as to the nature of the micro-organism which causes disease is, after all, the principal safeguard.

In accordance with your instructions, arrangements are now being made to start in the work of making the Dorset hog cholera serum. It is doubtful if the serum can be made and administered in remote sections of the State for less than forty cents a dose. We shall undertake the work in a limited way and enlarge upon the work if circumstances warrant us in so doing.

Respectfully submitted.

GEO. H. GLOVER,
Veterinarian.

Rocky Ford, Colorado, October 23, 1908.

L. G. Carpenter, Director:

The efforts of the field agent at Rocky Ford, during the past season, have been largely confined to the alfalfa seed breeding investigations, attempting to develop a better type of hay and seed yielding alfalfa; also endeavoring to determine the conditions and cultural methods necessary for the highest yields of alfalfa hay, and a more uniform production of the seed crop.

The results of these efforts may be briefly summarized, in the following observations and results, from the plats of different varieties and individual selections, all under the same conditions. Marked contrasts of practical value were revealed, in hardiness, in early spring development, frost resistance in spring, and in the tendency to lodge, with wind and rain. The character of the stems, and profusion of the leaves desirable for hay, and the tendency to good yields of seed, were variations of still more interest and value. Some of the plats would easily have produced double the yield of hay; of others, and of the sixty-four plats, comparatively few produced any seed, yet several were almost phenomenal in this respect; as high as four and one-half pounds from one hundred and seventy-five plants, that grew on one plat of two square rods; some individual plants produced as high as two ounces of seed. The plats of relative high merit were selected, and all the seed that was possible from them saved to continue the work in this line. About thirty-five pounds of seed was secured, ranging in amounts from one-half to four and one-half pounds from a plat.

Considerable effort was devoted to the study and determination of the principles that underlie the setting of alfalfa seed. The indications point to two factors: Weather conditions, and hereditary tendency. The latter may be controlled by seed selection, it is evident almost beyond doubt.

The experiments with the cantaloupe for disease resistance have been more of secondary consideration, as the results of our investigation in this line have been so manifestly successful that it is now clearly the work of the practical seed breeder rather than the experimenter.

It is gratifying to report that the practical merits of the "Rust-resistant" strain of cantaloupes developed by the Station is receiving recognition from growers; not only in the vicinity of Rocky Ford, but from the whole United States inquiries and reports are coming in. This strain is being extensively planted, and except for the one objection, its late maturity, it would soon become the exclusive strain. But as the earlier maturing cantaloupes capture the highest prices, and net the grower the

greatest returns, the early strains will still be grown to a large extent, even though they are expected to go down with disease. It is an unfortunate condition, for the diseased melons demoralize the markets with poor and uncertain quality, thus injuring the returns for the later cantaloupes of even first quality.

Disease resistance and early maturity, is a combination much needed. To get this result, the rust-resistant strain has been hybridized with the earliest strain, using the cross both ways. The final results of such an effort may require several years to accomplish, yet the indications promise decided results, as one of the selections from a hybrid of the second generation matured early, and was strongly resistant to the melon blight. The seed of this selection will be submitted to a field test this coming summer. One of the plants that was used in the crosses this season matured ripe cantaloupes in thirty-five days after the flowers were pollenated, which is nearly a week earlier than the average early strains. Several other hybrids were made this season, with a variety from Smyrna, and one or two other varieties that we have secured from the United States Department. The specific objects of these crosses were to improve the quality of cantaloupes, and to trace the laws of heredity in the melon. These hybrids, and a comparative test of some material secured in previous work in this line, constitute the extent of the cantaloupe investigations the past year.

The sugar beet investigation has been rather inert, for several reasons. The spirited controversy between the factory management and the farmers, and the unfavorable season, due to the shortage of rains and irrigation water, has discouraged any effective co-operative work. Outside of some general field observations, little has been attempted in this line. The sugar beet industry in the Arkansas valley has been severely injured this season by unfavorable climatic conditions, and the prevalence of the "curly top" trouble, root aphis, and several of the fungus diseases of the beet. Our investigation in developing a beet resistant to the curly top resulted last year in a failure of the seed to germinate, thus terminating at present the efforts in this line.

On several occasions during the summer assistance was rendered the Farmers' Institute corps under Prof. H. M. Cottrell. Addresses were made at Rocky Ford, Hotchkiss, Bristol, Hartman, Granada, Amity, Holly, Cortez and Mancos. An address on breeding cantaloupes was prepared and read before the American Breeders' Association, at Washington, D. C., January 26, 1908. Also, another article was prepared for the Denver Chamber of Commerce, on the subject of the cantaloupe industry.

The above is submitted as the general report of the field agent at Rocky Ford.

Respectfully submitted,

PHILO K. BLINN.

Cheyenne Wells, Colorado.

To the Director:

I desire to submit the following report on the above farm, situated in Cheyenne county, Colorado:

The year just passed has been an exceptionally dry one, less than ten (10) inches of rain having fallen during the entire year, and this season about three and one-half (3½) inches up till the first of August. During the month of August about two and one-half (2½) inches, and on the 18th of October about five (5) inches, making a total for the year of about eleven (11) inches.

The spring being so unusually dry, planting and seeding was all done quite late. The 6th of May there was seven (7) acres of ground sown to macaroni wheat; on the 8th of May there was five (5) acres sown to side oats, which did but little good, and on the 19th and 20th of June was ruined by hot winds. Weeds were in evidence on this ground, notably the Russian thistle, and this, with what little wheat and oats remained, were cut for cattle feed, making about a ton of feed to the acre.

On the 13th day of May there was eight (8) acres planted to corn, but, owing to the dry weather, did but little good, and on two different times was materially damaged and ruined by hail; was planted over to cane on the 20th of June, and was left stand to pasture in the field. On the 3d of June there was ten (10) acres planted to cane, which yielded about a ton of feed to the acre. On the 10th of June there were eight (8) acres sown to hersey grass, which germinated very slowly, and which came up very uneven and made a very small crop, and was well mixed with Russian thistles.

Garden of a general character, as well as potatoes, were put out, but proved an absolute failure.

THE ORCHARD DIVISION.

Trees have done no good at all; no fruit on account of the late freezing in the spring, and the trees have made no noticeable growth. The two dry years of the past have drawn all the moisture from the ground, and has so remained until the big rain of the 19th of October.

Many trees show the effect of dead limbs in parts of the tree. The orchard proper was deeply cultivated the early part of October, in anticipation of some moisture, so that the rain that did come was thoroughly saved, and therefore the orchard goes into the winter in as fair condition as can be expected after the prolonged drought.

There have been sown fifteen (15) acres of fall wheat (turkey red). This wheat was sown during the past month. Also, five (5) acres of rye have been put in.

Dated this 9th day of November, A. D. 1908, at Cheyenne Wells, Cheyenne county, Colorado, and respectfully submitted.

Yours truly,

J. B. ROBERTSON.

REPORT OF DIVISION OF AGRONOMY.

To the State Board of Agriculture:

Gentlemen—I hereby submit to you the following report:

CLASS WORK, COLLEGE COURSE.

Last spring, at the close of the college year, the curriculum for the agricultural students was revised. By this change much work has been added to our teaching, but the department of agronomy feels that by this change the course is strengthened, and better fits the student for his chosen work.

The students that were graduated from the agronomy and live stock work last spring have returned to the farm, feeling that, with the knowledge gained here, the farm affords the most remunerative work. It is hoped that, with the new course of study, which covers a wider range, a larger number of young men will be educated to take up farming from a scientific standpoint.

The work in soils is not so extensive as it is where a special department of soils is established. Up to the present time we have been able to teach only the rudiments of "soils." This portion of the work should be strengthened.

The classes in field crops will receive more work this year than in the past. In order to make this more thorough, we should have a small greenhouse. Such a structure need not be more than 10 x 15 feet. The study of the growth of grain, etc., in connection with their classroom lectures, is very essential. The students are not here during the growing season of the grain and grasses, so some substitute should be provided.

COLLEGE REPORT FOR 1908.

The farm management class of senior students has been developed into extremely practical work. Through the kindness of the Denver & Rio Grande Railway Company transportation was given to the seniors, so they were enabled to visit several of the most successful farmers along their route and study methods of farming. Thus, by combining the practical with the theoretical, they appreciate more keenly the value of their education, and they also realize the tremendous field of work that lies before them.

PRACTICAL COURSES.

The practical course work has increased very rapidly. Teaching the short-course students is more difficult than the reg-

ular college students, since in most of the agronomy work text books can not be used. The texts on field and forage crops are not suited for our work, going too much into detail, for which our time is too limited; besides this, most of the material does not apply to our crops under our varying conditions. Likewise, the texts on farm management are not adapted to our State. Nearly all of this is lecture work and discussions, in which the students take great interest.

FARMERS' INSTITUTES.

Whenever possible, and when not conflicting with the regular college work, the writer assists, so far as he is able, in the institute work. This year he has attended thirteen institutes, besides acting as judge of grain exhibits at a number of fairs throughout the State.

Respectfully submitted,

F. KNORR,
Acting Agronomist.

Fort Collins, Colorado, November 24, 1908.

ANNUAL REPORT DIVISION OF ANIMAL HUSBANDRY.

To the State Board of Agriculture:

Gentlemen—I respectfully submit the following report:

EQUIPMENT.

The live stock teaching work has been strengthened by the purchase of Hampshire ewes, and could be made still stronger by the addition of some long-wool sheep.

There is not dairy stock enough available for class work and either Jerseys or Guernseys should be purchased, as recommended in a previous report.

CLASS WORK.

The teaching work was carried very satisfactorily this year; but the new long course, and the practical course present a schedule of teaching which fills practically the entire day, from November until the middle of March. Not over half of the time of the head of the division should be given to teaching, as the correspondence and overseeing of College stock requires about one-fourth of the time, and experimental work one-fourth.

If some farmers' institute work is to be done by this division during the summer, assistance is needed for the entire year, otherwise only during the winter months.

Respectfully submitted,

G. E. MORTON,
Head of Division.

Fort Collins, Colo., November 1, 1908.

ANNUAL REPORT OF DEPARTMENT OF BOOKKEEPING AND FARM ACCOUNTS.

The State Board of Agriculture:

Gentlemen—I herewith submit the annual report of the Department of Bookkeeping and Farm Accounts.

BOOKKEEPING.

At your biennial meeting held in April, 1907, you authorized a one-year bookkeeping course. Since that time very little has been done in the way of advertising this course. Owing to this fact the attendance has been small.

The small attendance is due, largely, to lack of advertising the work and the tuition fee attached thereto. I am strongly in favor of abolishing the tuition and allowing students to register for this work the same as in other courses offered, i. e., free from tuition; also to recognize the course in the way of advertising.

The work for this course, as I have outlined, is the same as the subjects taught in the junior year of the old commercial department and requires high school preparation.

Should you see fit to act favorably regarding my request, I am satisfied you will see a large increase in attendance, besides meeting the approval of many.

FARM ACCOUNTS.

The students in the practical course in agriculture will enter the class of farm accounts early in November, at the opening of the short-course term. Last year I had two divisions in this class and this year, from the present outlook, the attendance will be much larger.

The instruction given is to show the application of the fundamental principles of accounting to the every-day routine of general farming. The system used is simple and practical, one that will meet the requirements of the farmer, dairyman, fruit grower or stockman.

HOUSEHOLD ACCOUNTS.

During the first term of the practical course in domestic science the students take up the subject of household accounts. They are taught how to keep accounts in the home, accuracy in taking care of the receipts and disbursements, and in balancing and proving their work. The use and care of checks, receipts, drafts and notes, etc., are taken up and discussed with good results.

Respectfully submitted,

CHAS. G. DWYRE, JR.

Fort Collins, Colo., October 29, 1908.

REPORT OF DEPARTMENT OF CHEMISTRY AND GEOLOGY.

November 10, 1908.

To the State Board of Agriculture:

Gentlemen—I have the honor to present the following statements pertaining to the Department of Chemistry and Geology:

The instructional work has followed the requirements of the courses as given in the catalogue from year to year. There have been changes in the work, necessitated by changes in the other departments. These changes have, in my opinion, been of doubtful advisability.

I would be very glad to extend the course in chemistry, but I believe it to be inexpedient under the circumstances. The complaint of the students now is that they have not the necessary time to do more. We have endeavored to maintain a fair standard of work in the department, and we believe with reasonable success. The work in general chemistry continues through one year; two terms are devoted to the study of general inorganic chemistry and one term to the organic chemistry. The laboratory work is devoted largely to qualitative work and to such special lines as are required by the other departments.

Geology is studied for one term. We have an excellent suite of rock samples and a good collection of fossils for the illustration of these subjects. Our collection of minerals is limited, and while our samples have some merit as individual specimens, we need a collection of the common minerals which are met with in common rocks.

The short-course work in the department lasts about five weeks, daily recitations. We can only hope that the results of this work are more satisfactory to the students and others than to ourselves. It may be that the time is well spent in doing this class of work, but general chemistry has in the years that we have had this work seemed too specific and difficult for the student to whom it has been presented.

The interior of the building under my charge has been painted since my last biennial report, and its appearance greatly improved. So far as I know, the building is in good repair.

Respectfully submitted,

WM. P. HEADDEN,
Professor of Chemistry and Geology.

REPORT OF DEPARTMENT OF CONSTITUTIONAL HISTORY AND IRRIGATION LAW.

The State Board of Agriculture:

Gentlemen—The work of this department since the date of the last semi-annual report requires but brief mention.

The summer vacation was spent in attending the various teachers' normal institutes in the different districts of the State, representing the interests of the college, and making from one to three addresses before each institute. The work required an approximate travel of 5,000 miles within the State.

During the fall term classes have been conducted in agricultural economics and in international law, in the regular courses, and in government and irrigation law in the practical five months' course.

During the winter term there will be classes in advanced history, in political economy, in irrigation law, and in the law of contracts, all in the regular four-year courses.

For the zeal and attention and conduct of the students in all classes I have only words of compliment.

With my acknowledgments to the president of the college, and to each member of the faculty for their constant courtesy, I am, Very respectfully,

W. R. THOMAS,
Professor of Constitutional History and Irrigation Law.

Fort Collins, Colo., November 15, 1908.

REPORT OF DEPARTMENT OF DOMESTIC SCIENCE.

To the State Board of Agriculture:

Gentlemen—I have the honor and privilege of presenting my annual report concerning the work, condition and needs of the Domestic Science Department. It gives me great pleasure to report that the work has been very gratifying in the past year. The continued approval of the students and the public is reasonable assurance that Domestic Science work is being recognized and is regarded as helpful. In presenting these matters to your consideration, it must be said that our work is comparatively new work, and, therefore, real needs exist if there is to be progress in the future.

Our greatest need is a new building. During the past summer this building was thoroughly cleaned. The bath tubs were removed and the bathroom changed into a fitting room. In the basement the walls were repaired, and now with new paper, paint and good walls, the building is clean and attractive.

The heating system is very unsatisfactory, and on cold days last winter it was impossible to heat this building. When working in my office, I had to wear a heavy winter coat and felt the cold very severely. My stenographer and everyone else who was in the office with me always complained of the cold room. The basement is never warm until noon, and, as we have classes there from 7:30 on, it is very hard on the students and the teachers.

During the summer Professor Lory changed the lights. They are now adjustable, and very satisfactory.

The laundry is found to be too small to do good work. I wish that something might be done. We are using the small kitchen to help us out and the wet clothing has to be carried through the long hall, making confusion and a great deal of extra work. If a large room could be secured in some other building, and our old equipment used, the expense would not be great. The present laundry could be used as a cold storage room, as we have no place in which to keep our refrigerator and supplies.

Last June eleven girls were graduated in the two-year Normal Course; three in the General Science Course, and four girls were graduated in the Short Course. This year the attendance is only about one-half of what I expected, but I be-

lieve it is due to the publicity given to our college this last summer. The following students are now enrolled for this year:

Freshman	10
Sophomore	3
Special	7
First Year Short Course	17
Second Year Short Course	8
General Students	5
Graduate Students	1

The Normal Course was taken out last year, and also the Sub-Freshman class, which accounts for part of the loss in attendance. On account of change of courses two years ago, there are no Juniors or Seniors this year.

The one-week Short Course work in Domestic Science is growing rapidly. Last year there were three Short Courses held in various parts of the State and this winter there will be ten. In my opinion, this is the very best way of helping rural districts and small towns. It is practically taking the college work to these women who are unable to leave home and who are anxious and eager to learn the most modern methods of housekeeping. About eighty women registered for the Short Course held in Fort Collins last January. Requests are coming in every day asking for the date of the next one. Circular letters are to be sent out and we hope to have a splendid program for the week's work. Great interest seems to be taken in Domestic Science all over the State. At the Farmers' Institute work during the summer it was a real pleasure to address the gatherings of men and women as they seemed to think our work was not foolish, but of real practical help. Miss Brush and Miss Boswell assisted in the Farmers' Institute work this summer. Miss Margaret Ross and Miss Edna Pughe, two of last year's Normal graduates, have been secured to assist us in the Short Course work this winter.

Miss Crawford resigned last spring to accept a position in the University of Wyoming as instructor in Domestic Science. Miss Inga Allison, of Lake Erie College, was appointed to take her place. She is very capable and will be a great help to this Department. As far as I know, everyone in this Department is working in the greatest harmony, and each teacher is doing her best to uplift the work and to keep up a high standard.

I wish to ask for fifty dollars per year for my department, to be used at my discretion and to be placed at my disposal by January 1. This money will be spent carefully and an account of every cent rendered at the end of the year. It could be called an emergency fund. This would include the purchasing of extra groceries, sewing materials, and utensils, sometimes for extra

work such as having a woman come in for a day to launder the curtains and fine linen or to do housecleaning before school opens after a vacation.

Many requests for help have come from the club women of the State. About twenty outlines for club study have been sent in answer to these requests. I have been trying to get the club women interested, as I feel that it will be through them that we can get the work put into our public schools. I have been trying to work in this vicinity and have succeeded in inducing the Woman's Club of Windsor, and the Woman's Club of Fort Collins to give one-third of the year to Domestic Science. In other cases a few days will be given during the year. Last year I gave talks on Housekeeping at Colorado Springs, Denver, Windsor, Loveland, Fountain, Greeley, Pueblo and Fort Collins. During the year a physician and a trained nurse gave several lectures to our students. Mrs. Sarah Platt Decker, of Denver, gave a splendid talk to the students in April.

The National Federation of Woman's Clubs has done this College the honor of appointing me a member of the Domestic Science Committee, and the State Federation has made me chairman of the Domestic Science Department. At the meeting of the Federated Clubs in Colorado Springs, several people from other States asked about the Short Course work in Colorado. One woman who was there from Cincinnati, Ohio, invited me to give a week's Short Course in that State, but it was not possible for me to do so. I feel that the Short Course work is very important and very helpful.

Mrs. Guldlin, of Fort Wayne, Indiana, who is chairman of the Domestic Science Department of the National Committee writes me that she will put our work before all the women in the United States in the next two years, as she thinks the Short Course program of this State better than any other. I mention this because I think our State Board should know what we are trying to do. There is much to be done and it will take years to do it.

Last January at the State Teachers' Association meeting in Denver a Domestic Science Section was formed and we hope through this means to get the teachers of the State interested in the work. The officers have given us two mornings at the meeting in December, and if these meetings are successful we will soon have the work in many places in the State. In this way through the teachers of Domestic Science we will come in touch with high-school pupils and thus increase our enrollment.

The Foresters who took the Short Course last year asked for some special lessons in camp cookery and the request was granted. Last winter four lessons in camp cookery were given to a class of twenty-five of the College boys.

A donation of a fine gasoline mangle has been made to the Department by the American Ironing Machine Company. Pro-

fessor Lory has installed a fine electric stove. In this way we are able to teach the girls how to manage institutional or hospital work. I am glad the library is to be open evenings during the Short Course, and wish that it might be open the whole year, as the evening is the only time when students and teachers can get much benefit from the books.

The Science Association meeting was held here in the spring. Our students gave a luncheon to the visiting students and teachers, which was very much appreciated.

The Domestic Science Department got out a Domestic Science Special "News Notes" in April. This has been widely circulated and hundreds of requests have been received in this office for a copy of it.

The Theodosia Ammon's Memorial set of books were received in March and placed in the library. The books are used daily and will be a beautiful memorial for many years to come.

The physical culture classes are progressing nicely and it is to be hoped that some provision may be made whereby baths may be put into the gymnasium dressing room.

A dormitory is desirable.

During the year an outline of thirty lessons in Domestic Science for rural teachers was prepared and printed. Copies are sent free to any teacher in this State and on payment of a fee of twenty-five cents to teachers of other States.

I regret exceedingly that on account of a Short Course week at Del Norte and two lectures at the Corn Exposition in Omaha during the second week in December it will not be possible for me to entertain the State Board of Agriculture at luncheon until the spring meeting.

The things asked for in this report are most conservative, based upon real needs, and I commend them to you for your favorable consideration.

Respectfully submitted,

MARY F. RAUSCH.

REPORT OF DEPARTMENT OF CIVIL AND IRRIGATING ENGINEERING.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit my report as Professor of Civil and Irrigation Engineering for the current year.

The crying need of the Department at present, as it has been for some years past, is for a suitable building. For many years we have outgrown the present building, and the pressure for room has been so great that it has been necessary to dismantle some of our apparatus, and to adjust ourselves to the quarters, such as they were. This has meant a curtailment of the work we have felt was desirable to do for the students, and has prevented us from doing many other things which we believed were desirable and would be of benefit both to them and to the State. The need for this has been recognized by the Board.

The Legislature of 1903 made an appropriation of $40,000 through the efforts of the Senator from this district, Hon. W. A. Drake. After the bill was passed the contract was let and excavation made and some of the foundations put in when it was determined by the State Auditor that the revenues of the State were such that the appropriation could not be paid. In consequence the work had to be suspended, and thus it has remained for nearly five years. In the meantime there have been some revenues collected by the State Treasurer which were credited to the revenues of 1903-4, with the result that about a year ago this fund was credited with about $15,000 which was available for carrying on the work. This amount was too small to complete the building as planned, and it was a question how it could best be used in connection with the original plans. To change the plans so as to make a building that could be completed within this sum would not materially relieve the Department, and it was considered by all means best to retain our original plans and to build as much of the proposed building as possible. The amount was not sufficient to inclose the proposed building, but through the aid of additional funds set aside by the State Board of Agriculture, a contract was let which would enable the building to be inclosed, omitting some external parts which could afterwards be added, and omitting all interior finish.

This building as planned is 60x120 feet in extreme dimensions, consisting of two ends of the full width of 60 feet, and connected with an inner portion of 40 feet in width. It provides an assembly room large enough to seat 200 persons on the sec-

ond floor, with several class rooms that will seat as many as 50; a large room adapted for exhibits of irrigation and engineering apparatus, with office rooms for the Department, also an hydraulic laboratory fitted with an hydraulic tank, in which to carry on laboratory experiments; drafting rooms, and general facilities for instruction, together with additional rooms for use in connection with the Experiment Station.

During the existence of the Department a large amount of very valuable data has been collected, and it has been always a cause of apprehension that fire might destroy the records that have thus accumulated, and which would be impossible to replace. Their value is more than of ordinary scientific interest. They have already proved of great value, for instance, in the attack on the irrigation of the State by our neighboring State of Kansas, when the accumulated knowledge and records of this character had a great deal to do with the success in protecting the interests of the State.

The new building is of white brick and will be an ornament to the grounds, and one which we can look to with great satisfaction.

The need of the Department is to finish this building so that we may occupy it at the earliest possible date. By finishing this it will relieve the building which we now occupy so that it may in turn be used to relieve some of the pressing needs of other departments which have outgrown their present quarters.

The present plans of the building were made when a central heating plant was in contemplation, so that there is no provision for its heating. It was thought that a structure, temporary or permanent, as the case may be, could be built back of the building, at a cost less than would be required to change the plans of the present structure and to include a chimney. The appropriation ought to be enough to complete the building and to equip it. The equipment calls for the furniture for the offices, lecture rooms, cases in the museums, hydraulic tank and standpipes, and various other hydraulic and engineering laboratory apparatus, so that the total amount required for this would be $40,000 to $50,000; the smaller sum would not be sufficient to completely do so.

In some previous reports I have called attention to the line of usefulness for the Department and College by instruction in roads. This would be a natural supplement to the work that is being done. There is considerable need, and some organized desire for instruction of this character. A systematic course of study in roads is worthy of consideration. An instructor could be provided at an initial cost of from $1,200 to $1,500 per annum, with some equipment, meaning a total annual cost at present of from $2,000 to $3,000. Such an instructor is needed in the College and in the Institute work, and should be provided for in the near future if it is not considered timely at present.

The general work of the Department has proceeded with a fair degree of satisfaction. The principal difficulties have been those connected with small quarters and the necessity of adapting the work to the current situation.

The Field Camp, which has become an important feature of our work, and a very important element in the instruction of the students in engineering, was this year taken to Pike's peak. Through the courtesy of the mayor and council of the city of Colorado Springs we were permitted to use their building at Seven Lakes as the headquarters of our camp. It is at an elevation of 10,900 feet. With this as a center, surveys were made of existing reservoirs and proposed reservoirs in that vicinity. Besides that there were extensive engineering works within a moderate distance. The reservoirs of the city of Colorado Springs; reservoirs of the Pike's Peak Power Company; the power house at Skagway; the mines at Cripple Creek and Victor; the cog road up Pike's peak, and numerous other important structures within a moderate distance. The camp was pronounced one of the most successful we have ever had, at least in that respect. The cost was also less than the camps of the past few years, principally because of less teaming being necessary, and also because of a systematic effort to keep down some of the expense of the commissary.

Students have shown a commendable interest in nearly all of their work. The record of the graduates has been very good and gives increased satisfaction in their success. The Department has felt first that it was important to turn out men who were good citizens and who would be an element in their communities. In addition, it has endeavored to turn out men of such skill that they would be sure of support, and to give them such an outlook upon methods of engineering that with opportunity they would be on the road to acquire skill and ability. The record of many of the graduates was given in the last printed report. It did not include all. The list could be extended with names and with the creditable work of others. The graduates have made their mark in irrigation and hydraulic work in many enterprises which relate to the development of the West.

Respectfully submitted,

L. G. CARPENTER,
Professor Civil and Irrigation Engineering.

L. G. Carpenter,

Professor Civil and Irrigation Engineering.

Dear Sir—I submit herewith the following report of my work in your Department for the year ending December 1, 1908:

During the months of December, January and February I traveled over the State and visited all the high schools, and many of the lower grades, inspecting the work done in the different schools, addressing the student body at each place upon the merits of the Agricultural College, work done here, and the advantages one secures by coming here. This trip is what we call the high school trip, and is the one that has been taken by Prof. J. W. Lawrence heretofore.

Returning to Fort Collins about March 4, I had charge of the following classes during the spring term:

Senior class in hydraulics. There were nine students in this class and all did good work.

Sophomore class in agricultural hydraulics. There were fifteen students in this class and the work done was acceptable.

Sophomore class in irrigation engineering. This class was made up of seventeen students, and was fair. The class seems to be weak in many ways, and their work with me in irrigation engineering shows a number of failures and conditions.

The sophomore class in drawing met in the afternoon and they covered practically the same ground that has been covered by all classes in this course.

I also had charge of the junior class in drawing for one-half of the term.

During the summer months I spent the time as a member of one of the institute squads, and together with Dr. Glover, Prof. Cottrell, Dr. Newsome, and others, we held Farmers' Institutes for about eight weeks.

The first two weeks of this term were spent in Field Camp at Seven Lakes, about twelve miles west of Colorado Springs. The work consisted of the survey of a reservoir storing the waters of Beaver creek, the seniors having charge of the dam site survey and also the topography of the reservoir. The high water line contour was run by the juniors and sophomores. Surveys were also run for reservoirs No. 7 and No. 8, lying further up in the mountains. We also took occasion to visit the different points of interest in this region, going over the entire Cripple Creek district and also inspecting the engineering works already completed in the Seven Lakes district.

The classes taught during this term are as follows:

Junior class in hydraulics. There are twenty-eight students in this class, and the work as a whole has been poorly done.

Senior class in meteorology. The thirteen students in this class have done acceptable work in every way.

Twelve students in the photography class have also done good work.

At the present time I am giving to the second year short-course students lectures on the principles of irrigation. This class has twenty-six students in it, and all seem to be greatly interested in their work.

The afternoons have been spent with the junior class in hydraulic laboratory. We spent the first part of the term rating meters at the College lake, after repairing the damage done to the station last winter by the ice. At present we are at work rating the streams in this vicinity, and will continue on this line of work throughout the remainder of the term.

Respectfully submitted,

E. B. HOUSE,
Associate Professor of Irrigation Engineering.

REPORT OF DEPARTMENT OF ENGLISH.

To the State Board of Agriculture.

Gentlemen—In the main, the work in the Department of English is being carried out as outlined in the catalog. In addition to the regular work we have two students taking subfreshmen English, and one student, a junior, taking special work in grammar.

At present we have the following classes:

		No of Students.
(1)	Class in Sub-Freshman English	2
(1)	Class in Special English	1
(3)	Classes in Freshman English	87
(1)	Class in Sophomore English	15
(1)	Class in Senior Logic	13
(1)	Classes in Parliamentary Practice and Citizenship	19
(3)	Classes in Practical Course English	46
	Total (11) Classes	193

Miss Carscadden, a graduate of the University of Nebraska and a teacher of experience, is first assistant in the department. Mr. Iddings, of the Agricultural Department, has kindly consented to take the work in Parliamentary Procedure and Citizenship, and Miss Baker, a graduate of the University of Colorado, is helping correct themes.

The Practical Course students in English have been divided into three divisions based upon their present efficiency in English, and not upon grades from other schools attended. A student will be promoted from one class to the next higher as soon as he is worthy of advancement. "It is up to the student."

We are pleased to note that the library is now open in the evening. Heretofore, the students in our department have complained that they have had no time to do work in the library.

The most efficient work in the department would necessitate additional help.

Respectfully submitted,

B. F. COEN,
Professor of English.

November 14, 1908.

REPORT OF THE DEPARTMENT OF FARMERS' INSTITUTES AND COLLEGE EXTENSION WORK.

To the State Board of Agriculture.

Gentlemen—The Farmers' Institute and College Extension Work for the year ending November 15, 1908, has been as follows:

	Attendance.
128 Farmers' Institutes	20,285
7 Special Meetings	600
28 Train Institutes (1,583 miles)	5,005
12 Farmers' Short Courses	1,401
3 Domestic Science Short Courses	1,034
Total	28,325

The total number of sessions at all institutes was 240, and the total attendance at all sessions was 33,605. Forty speakers connected with the College and thirty-three from outside took part in the work. The expense for the year was $7,886.33.

In March, 1908, the Denver & Rio Grande Railroad furnished free to the College a Potato Institute train of four cars and ran the train over 1,583 miles of their track. The baggage car contained all the implements and equipment needed for growing potatoes in Colorado. Three passenger coaches were used for seating audiences to hear lectures on potato growing. The College sent seven lecturers on this train. It stopped at 23 towns, and 28 meetings were held attended by 5,005 people. The result was a large increase in the acreage planted to potatoes in the territory covered by the train. F. A. Wadleigh, Assistant General Passenger Agent of the road, accompanied the train and aided very much in extending its usefulness.

In June, 1908, F. S. White, Agricultural Commissioner of the Rock Island-Frisco Railroad, invited the College to hold Farmers' Institutes along the Rock Island Railroad in Colorado, working in connection with him. Institutes were held in eleven towns, the lectures being given in halls. Following the lectures, the audience visited the exhibition car of the Rock Island-Frisco System.

All the railroads except the Burlington and the Missouri Pacific have given our lecturers free transportation to attend Farm-

ers' Institutes and this aid has enabled us to double the number of meetings we have been able to hold with our appropriation.

In 1907, Prof. Wendell Paddock held at Delta a week's Short Course in Fruit Growing, the first Short Course held in the State outside the College. It was so thoroughly appreciated and such a marked success that it was decided to have the Farmers' Institute force spend the winters in holding Short Courses, adapting each course to the special needs of the locality in which it is held.

From January to March, 1908, there were held at places outside the College twelve Farmers' Short Courses with a total enrollment of 2,435. Each Farmers' Short Course was held for six days and each Domestic Science Short Course for five days.

To secure a Farmers' Short Course 100 subscribers were required, each paying a fee of two dollars, and fifty subscribers at one dollar were required for a Domestic Science Short Course. These fees paid about half the expense to the College.

The Short Course is the most thoroughly appreciated and the most valuable extension work done by the College. It permits the giving of extended information on subjects of special importance to those who attend.

A readjustment is necessary in the Farmers' Institute and Extension Work of the College. The members of the Experiment Station and College forces feel that in justice to their other work they must reduce very materially the time spent in Institute and Short Courses. At the same time to meet the needs of the farmers of the State more than double the number of Farmers' Institutes should be held with at least seventy-five Short Courses each year, and new lines of work are urgently needed.

In the past two years many thousand farmers have come to the State. Most of them are unacquainted with the conditions and methods that secure the best results in Colorado. They need help from the College. If they succeed, they bring thousands of other settlers to the State. Their failure means a permanent injury. For the benefit of the State, the College should hold a Farmers' Institute in every settlement where new settlers are numerous.

There were held during the year all the Institutes which the funds would permit and that with the free help of the faculty. With the instructors of the College finding it necessary to do less Institute work, more outside help will have to be employed.

Our appropriation was exhausted early in September and there have been many requests for Farmers' Institutes that had to be rejected on account of lack of funds, and a good part of the State has not been sufficiently covered. In the three northwestern counties of the State no Institutes were held because there was no money. These three counties have an area one-half

greater than Massachusetts, and when properly farmed will become one of the most productive sections of the State. In those sections of the State where Institutes were held there were not funds to hold a sufficient number, e. g., there are 70 stations on the lines of the Union Pacific Railroad in Colorado and many settlements off the railroad where Farmers' Institutes are needed. We were able to hold Institutes at but 12 places in all this territory.

Besides the additional work needed in Farmers' Institutes and Short Courses, the Farmers' Institute Department should take up two lines of work that have proven very efficient in promoting Agriculture in other States—Correspondence Courses in Agriculture and Boys' and Girls' Clubs.

There are thousands of new settlers on Colorado farms who need information throughout the season on problems that come to them in the new conditions under which they are working. Such problems as preparation of the soil and varieties to plant at different altitudes, when and how to apply water, methods of culture, how to feed Colorado crops, and prevention of insect depredations and plant diseases. Besides specific information they need to be taught the principles underlying farm methods peculiar to Colorado. A Correspondence Course fills this need and can be adapted to the special wants of each farmer.

There are more than 60,000 boys and girls over 14 years old of school age in Colorado. The Farmers' Institute Department should organize these boys in school districts and township clubs to grow grains, potatoes, sugar beets, melons and field peas, to feed Colorado crops and to study methods and markets. Each year a Boys' Institute should be held in a township at which the products grown by themselves compete. The prize-winning products of each township should compete at a County Institute and the winners in each county should enter a State Contest. Similar work should be conducted in cooking and sewing with the girls.

The Boys' and Girls' Clubs would not only enthuse the members in developing the agriculture of the State and give them valuable training, but it would have a strong influence in the same direction on their parents.

The expenses for the work of this Department last year were $7,886. With less help from the Faculty there will be needed the equivalent of the time of two thoroughly trained men all the year. This will cost at least $3,600, or a total of $11,486. If $25,000 is appropriated for the coming two years, it will furnish only $1,000 a year to extend the old work and to start the new work needed. Double the amount could be expended with profit to the State.

Respectfully submitted,

H. M. COTTRELL.

FARMERS' INSTITUTE AND COLLEGE EXTENSION WORK

For Year Ending November 15, 1908.

	College Staff	Farmers' Institutes	Special Meetings	Train Institutes	Short Courses	Total
1	Dr. R. W. Corwin	..	..	..	1	1
2	Hon. E. H. Grubb	3	..	28	4	35
3	President Aylesworth	..	..	..	9	9
4	F. C. Alford	13	..	..	..	13
5	H. M. Bainer	17	..	..	..	17
6	E. R. Bennett	32	1	28	8	69
7	P. K. Blinn	7	..	..	1	8
8	H. B. Bonebright	3	..	..	..	3
9	Rebecca Boswell	7	..	..	..	7
10	Emma Breining	..	..	..	3	3
11	Mary J. Brush	5	..	..	..	5
12	L. G. Carpenter	1	1	..	5	7
13	W. L. Carlyle	5	1	..	2	8
14	H. M. Cottrell	57	1	28	10	96
15	Elizabeth Cutler	..	..	..	1	1
16	Marguerite Frink	5	..	..	..	5
17	R. W. Gay	..	..	..	1	1
18	C. P. Gillette	10	..	..	10	20
19	G. H. Glover	8	..	..	4	12
20	W. P. Headden	1	1	..	6	8
21	E. B. House	21	..	..	2	23
22	E. J. Iddings	7	..	..	..	7
23	S. A. Johnson	15	..	..	..	15
24	H. E. Kingman	3	..	..	..	3
25	Fritz Knorr	13	..	..	..	13
26	B. O. Longyear	1	..	..	..	1
27	C. A. Lory	5	..	..	..	5
28	G. E. Morton	20	..	..	4	24
29	I. E. Newsom	11	..	..	..	11
30	W. H. Olin	6	1	..	..	7
31	W. Paddock	14	1	..	7	22

32	L. F. Paull	8	..	..	1	9
33	R. B. Parshall	8	..	..	..	8
34	Mary F. Rausch	8	..	..	5	13
35	W. R. Thomas	..	..	..	1	1
36	J. F. Tuttle	..	..	..	3	3
37	Geo. P. Weldon	2	..	..	..	2
38	Echo Ward	..	..	..	2	2
39	O. B. Whipple	14	..	..	5	19
40	Hon. F. E. Brooks	1	..	..	..	1

FARMERS' INSTITUTE AND COLLEGE EXTENSION WORK.

For Year Ending November 15, 1908.

	Outside Speakers	Farmers' Institutes	Train Meetings	Short Courses	Total
1	E. M. Ammons	1	..	4	5
2	B. G. D. Bishopp	9	..	..	9
3	E. R. Bliss	..	28	5	33
4	Prof. W. G. Chambers	1	..	..	1
5	J. H. Crowley	2	..	..	2
6	Sam Doll	..	28	..	28
7	J. W. Downey	8	..	2	10
8	H. L. Edgerton	..	26	..	26
9	C. L. Fitch	2	..	1	3
10	E. J. Foreman	1	..	2	3
11	Robert Gause, Jr.	..	..	1	1
12	F. Gaylord	..	..	1	1
13	J. A. Girardett	1	..	..	1
14	Chas. Green	..	..	1	1
15	O. C. Gregg	2	..	6	8
16	Gov. E. R. Harper	..	..	8	8
17	J. H. Johnstone	1	..	..	1
18	Anna Kihme	..	..	3	3
19	G. W. Martin	..	..	1	1
20	H. W. Moore	1	..	1	2
21	C. F. Mason	7	..	..	7
22	E. Matthews	..	..	3	3
23	H. F. Palmer	..	..	1	1
24	J. E. Payne	1	..	..	1
25	A. R. Pierce	3	..	..	3
26	C. H. Rhodes	7	..	..	7
27	I. Rothchild	1	..	..	1
28	E. Sherman	..	21	..	21
29	A. T. Steinel	1	..	..	1
30	E. Smith	..	..	2	2
31	W. G. M. Stone	..	..	8	8
32	W. H. Vassar	2	.	.	2
33	F. S. White	11	..	..	11

DEPARTMENT OF FARM MECHANICS AND DAIRYING.

To the State Board of Agriculture.

Gentlemen—I hereby respectfully submit the following third annual report of the Department of Farm Mechanics and Dairying:

Early in January Mr. H. B. Bonebright was secured as Assistant in Farm Mechanics and Dairying to fill the vacancy made by the resignation of Mr. W. G. Hummel.

During the past year eight classes have been taught in lecture room work, and eight classes in laboratory work. This includes work given in both the four-year course and the Practical Short Course. During the present term we are giving instruction to four classes in lecture work and three classes in laboratory work.

Twenty Farmers' Institutes have been attended during the year by members of the Department.

At one time last winter it became necessary to give instruction work to fifty-five Short Course students at one time. Under these conditions it became necessary for us to divide the class into two sections, and to give the instruction in two different places at the same time. Our class room is entirely too small to handle as large a class as this at once.

Very little additional machinery has been secured during the past year on account of not having room in which to store it. During the past summer an addition 36x66 has been erected to the south end of the Farm Mechanics' Building, and we are now very well equipped with storage room. Our present Farm Mechanics' Inventory shows a valuation of $11,275.00, and the Dairy Inventory shows $1,150.00.

Considerable correspondence has been carried on during the year on both Farm Mechanics and Dairy subjects. Some experimental work has also been carried on by the Department.

Respectfully submitted,

H. M. BAINER,
Professor of Farm Mechanics.

Fort Collins, Colo., November 1, 1908.

REPORT OF DEPARTMENT OF HISTORY AND LITERATURE.

To the State Board of Agriculture.

Gentlemen—I have the pleasure to submit herewith the annual reports of (1) the Department of Literature and History, and (2) of the Dean of Women.

The regular scheduled class work, which includes five courses offered in history, and five in literature, has been conducted during the past year, and in addition to this, a course of lectures in American History has been given for the girls of the second year in the five months' practical course.

The industrial history of the United States has been introduced as an appropriate addition to the Agricultural and General Science Courses, this branch being taught for the first time this year.

At the beginning of the fall term the dormitory, which has been the only home for college girls under college control, was abandoned, and I was asked by the President to secure homes for the girls in private families, and to provide plans for the same college supervision for all. By the assistance of Miss Carscadden, who is able to relieve me of a part of my class work, I have been able to devote the necessary time to this work of the supervision of the interests of the college girls. The following general regulations have been found desirable, and have been adopted with the full co-operation of the lady teachers and student girls:

(1) No women students are assigned rooms in houses where any rooms are rented to men students.

(2) Gentlemen company is allowed only in the parlors, and never in private rooms.

(3) Company is allowed in student boarding houses only on Friday, Saturday or Sunday evenings, not on the evenings of regular school days, and not later than ten o'clock, excepting by special arrangement.

(4) Chaperones are required for all parties given by students.

(5) In general the young women are encouraged to exercise their own good judgment with regard to matters of conduct, and to be considerate of the rights of others in the homes where they are received.

Many of the best homes in Fort Collins have been opened to students under this plan, and most of the girls board and room at the same place. I have, by frequent visits in these homes, received very satisfactory reports regarding the home life of our student girls. We have at present as fine a class of young women as has ever been enrolled at C. A. C. One hundred and three is the total enrollment to date in all departments.

The Lecture Course, conducted for the last five years in the interest of the social needs of our young women, has been arranged for this year, as usual, to consist of five members. In addition to these five special entertainments an hour or so for social intercourse has been secured, by the co-operation of other departments, on the first Thursday afternoon of each month. The lady teachers, and often the wives of faculty members, join with the girls in these gatherings.

It is believed that wholesome College spirit, and devotion to C. A. C. ideals and interests will be fostered by these plans.

Permit me now to call attention to some of the needs of student girls:

(1) More adequate representation of their interests in our faculty councils.

When I entered the faculty there were fourteen members, two of them women, or about fourteen per cent. of the entire number. Since that time, by the action of your honorable body, the faculty has been increased by fifteen additional members, all of them men, making a total of twenty-nine who were listed in the last catalogue, so that the proportion is now but two women members in a faculty of twenty-nine. During a part of the year, the demands of the extension work leave me the only representative in the faculty councils of the particularly feminine interests of the College. I earnestly request that Miss Kettle, who has been for the last four years the head in fact of the Department of Modern Languages, be recognized as a member of the faculty, and so be given an opportunity to join in our deliberations upon matters of College policy.

(2) Better accommodations in connection with gymnasium work.

We require of every girl three hours per week in the gymnasium, but provide no decent facilities for the dressing room. The water and sewer pipes are already in the room used for this purpose, and at a trifling expenditure several wash bowls and appropriate partitions to provide privacy in the dressing room could be secured. Shower baths would also be desirable, but provision for water in some form is imperative. Our lessons in personal hygiene are contradicted in practice every day. I most earnestly urge the attention of the Board to this matter.

I would also ask you to confirm by your action my appointment by the President as Preceptress of Women, and to increase

my salary by an amount in proportion to the additional responsibility which I have been asked to assume. I have served the College for eight years, and during that time have had the pleasure of rejoicing with some twenty of the others of the faculty who have been encouraged by an increase in salary. Only five of the twenty-nine members of the faculty, besides our President and Secretary, have had a longer term of service than mine, and I feel that upon assuming the additional duties which I have been urged to accept this fall, my salary should certainly be increased to $1,800.

During the past few years I have been making a study of the conditions for women in the agricultural colleges of our country, and the opportunities they offer for women students. You may be glad to know that the work I have done along this line has been accepted by my Alma Mater at Ames as a thesis, and that the degree of Master of Philosophy was conferred upon me at the commencement last June.

I am always glad to acknowledge as a direct benefit to my Department any extension of library facilities. The recent provision for evening opening is a great accommodation to my students, and I trust that the plan may be continued.

Respectfully submitted,

VIRGINIA H. CORBETT.

Fort Collins, Colo., November 15, 1908.

REPORT OF THE DEPARTMENT OF HORTICULTURE AND BOTANY.

To the State Board of Agriculture:

Gentlemen—I have the honor to present the report of the Department of Horticulture and Botany for the past year.

The instruction in the Department has been given according to schedule and the interest on the part of both students and instructors has been good. Your attention was called to the fact in a former report that a change in the course of study was desired. This change has been accomplished, much to the benefit of all concerned, as we are now able to give more specialized work along the lines which the student may elect.

The Department never was in so flourishing a condition as at present. More students have enrolled for the course than ever before, and there is little that we need in the way of equipment, outside of greenhouses, that can be provided.

Mention was made in the last published report of preparations which were making for a fruit growers' short course at Delta. This course proved to be a great success, and the movement has taken a hold on the people, under Professor Cottrell's direction, so that now more calls are received for these courses than can possibly be met. We have been glad to give our time to help get the College extension work well started, but the time is now at hand when other arrangements must be made. Indeed, the demands on our time, both summer and winter, have been so great that experiment station work has been neglected. Possibly this result is inevitable, as the executive work and correspondence of the Department are assuming large proportions.

Respectfully submitted,

W. PADDOCK.

THE LIBRARY.

Fort Collins, Colorado.

To the State Board of Agriculture:

Gentlemen—The following report, concerning the College Library, is respectfully submitted:

The report is arranged under five heads: Functions, Equipment, Maintenance, Miscellaneous and Statistics. A general statement and description may be found in the annual catalogue and in previous reports.

FUNCTIONS.

The Library of this College is a general service office and not like a department. The service is to all departments and all the College.

This College is a technical institution, offering courses in the various phases of the subjects grouped about the soil and its products, a limited scope of engineering, domestic science, industrial sociology and the current, local student interests. We require a scientific library of reference and research, and our policy is plainly an intensive collection of books in direct response to our College environment. Our specialties (arranged alphabetically) are agriculture, domestic science, engineering, horticulture, industrial sociology and statistics, and public health and welfare. Subjects such as botany, entomology, history, language, literature, veterinary medicine, etc., are included or are contributory.

In addition, we have to assume, in part, the functions of a public library, because there is no large public library near us. The current student interests, including literary and debating societies, require books and service, and there is actually no limit to the student and public demand made upon a comparatively large library situated as this is.

Both for the sake of prestige and service, this Library must be notable as an intensive collection rather than a mass of nothing in particular, resembling hundreds of other inconsequent collections. This should be a scientific Library of reference and research within our specialties, and this report is devoted to an emphasis of that point of view.

We are one of four or five libraries in Colorado that rank higher than the others in size, equipment and service. We can hold that rank only by performing our intensive functions with whatever of maintenance we may have. We are just approaching

a knowledge of our functions, and this particular statement is put forth now because we stand upon the threshold of our library activities and at the beginning of library history in Colorado. Our progress and success depend upon careful plan and policy of an intensive collection liberally supported.

In the nation this Library is one of several similar libraries, many of which are perfunctory and of little service through failure to appreciate the importance of definite functions. On the other hand, there are those that understand this matter so well that they have skimmed the cream of our specialties (and other specialties) while we were idle or without means. This is true in the literature of irrigation, the history of agriculture, and in every department under the heads given in the alphabetical list at the beginning of this topic. This is going on all the time and grows more intensive and permanent as institutions increase their efficiency and responsibilities demanded in modern life. It is surprising to discover the real extent of this rivalry in collecting special material in our own lines.

In brief, our functions are plain enough, and a detailed statement is superfluous. It remains with us to provide for a collection in response to the present demands and to project the efficiency of this Library into the future of the College, so wonderful in its educational promise. We should take immediate measures to collect the history and practice of irrigation and agriculture in Colorado, and elsewhere. We shall have to go to market for nearly everything, and the sooner the cheaper.

EQUIPMENT.

Our book collection, in some part, has been in storage for seven years, because we have insufficient shelving, inadequate floor space or some similar want to hinder service and retard growth. Library progress must sit and wait for long periods while equipment crawls up to our station point. We have tons of material unavailable, and our reading room space is so cramped that something should be done for student accommodation. Our equipment is far behind our service. The inventory of the Library shows a value of $40,000; it is desirable to have such a collection in a fire-proof building.

DOCUMENTS.

We have a very valuable collection of documents of the United States. It is probably second to none in the Rocky Mountain region, and, as a collection, it is unusual in the West. We have spent a great deal of time on it and one portion alone (U. S. Dept. of Agriculture and the State stations) is worth $2,000. Our designation as a document depository is but three years old in effect.

Our serial set of congressional documents in sheep binding lacks only 300 pieces (out of 5,200) of a complete set, and we

have practically completed several "departmental" sets, notably, the Smithsonian Institution and U. S. Geological Survey. The fortunate conditions which have enabled us to make these collections are not likely to recur and the value of such material increases as the book market is cleared of documents.

We should make immediate plans for similar collections of the documents of separate States and foreign countries before it is too late. We should have official documents of engineering and public works of cities, States and nations; official documents on public health and vital statistics; on labor and the laboring classes; the reports of boards of agriculture; reports of special commissions covering many subjects from rural life to manufactures, from temperance and charities to technical education, as they touch our lines. A reference library cannot exist without official documents and research is impossible without them.

In the case of irrigation literature, a list of ditch and water companies should be made for purpose of correspondence. We should collect official information that is not now in print and probably never will be until some library collects the material for the research worker. All this document work should be pushed to a comprehensive stage so that check listing may be begun at once.

Our collection of documents is worth $10,000 at a low estimate and it has cost us very little. We are about to begin the difficult and expensive part of that work.

SCIENTIFIC TRANSACTIONS AND PERIODICALS.

We have a few good sets or parts of sets, especially in agricultural chemistry and botany, but we are without many important titles. We cannot take rank as a scientific library until we have given this class of literature more attention in English, French, German and Italian serials and periodicals.

Subscriptions to current serials and their binding costs us less than three other institutions in Colorado, but we are doing all we can do with current funds for maintenance. As for the binding, we have a great deal too much of unbound material and we should make provisions for much of it in pamphlet cases. We are now at work on the design of a new pamphlet case, a little better than anything we know now in use.

Binding costs a great deal of money and it should be faced as an inevitable expense. It costs a great deal of money to conduct any sort of good service, and good binding is an important part of library service.

CATALOGS AND BIBLIOGRAPHY.

We use a dictionary catalog of about 80,000 cards and a catalog of station literature of about 30,000 cards. We have a collection of document catalogs and the representative bibliographies.

All things considered, we have an excellent beginning, and this department of the service is growing rapidly. We have to thank our purchasing for intelligent support of this indispensable equipment.

FIRST THINGS NEEDED IN EQUIPMENT.

We need shelf room, floor space, desk and office equipment and what is generally known as "room to turn around in."

MAINTENANCE.

The librarian does not forget that the problem of the whole institution is larger than that of the library. The duty of the librarian, however, is to state his case with the library in mind.

The rate of increase in library maintenance is nearly fourfold in seven years, and, although we are behind our neighbors in maintenance, that is all a librarian can expect. We realize the difficulties in the growth of the institution and we are thankful for constant help as far as the money will go.

Because of an increase, we are enabled to keep the library open five nights each week for five months and in several other ways to make the library more and more a general service office. We are in actual need of larger maintenance in order to meet the demands made on our service.

MISCELLANEOUS.

Library instruction—Besides systematic instruction of the student body in the use of library and books, we have a few special students in the library. The instruction includes library science, library economy and library handicraft. We have supplied several librarians and assistants in Colorado and other States. The work is described in the annual catalog of the College. There should be a library school under the direction of the State Library Commission, but until that commission is provided with funds, we shall continue with some duty in the matter. The library situation in Colorado is calling for trained workers.

Correspondence and exchange, information bureau, extension work, donations, and several minor headings must be omitted from this report, but it should be noted that a large part of our donations is due to the recent system introduced by Mr. Wm. L. Post, Superintendent of Documents in Washington, who has done more for us that can be told in a brief report. Mr. Post has worked wonders for all libraries that mean business in document service. We can never give sufficient thanks to Mr. Post and to Mr. Franklin E. Brooks, who gave us our document designation.

SPECIAL COLLECTIONS.

We have now the Annie Jones collection, the Louis B. France collection, the B. O. Aylesworth collection and the Theo-

dosia Ammons memorial collection. All but the last have been noted in previous reports. The Ammons memorial was donated for the Domestic Science Department by the Colorado Federation of Woman's Clubs.

DEPARTMENT LIBRARIES.

This will require a special report, and when the time arrives this matter will prove one of the difficult problems of the College. Department libraries, department apportionments, custodianship and the best form of service for the greatest number are in a hopeless jumble of administration in the college and university libraries of the United States.

BOOKS IN THE LIBRARY.

It is not easy to make an accurate count of books in a library with so little shelving and so many books. Our actual shelf capacity measures (in the main library) about 30,000 and the floor holds several thousand more. If our material were recorded as usual in large libraries we should have a little more than 40,000 volumes, bound and unbound, but not counting pamphlets. The bound volumes in the library increase rapidly as we reduce the unbound and the pamphlets by binding. Our pamphlets have been reduced to 35,000 pieces, but will probably show an increase next year because we have no room for arrangement of pamphlets into volumes for binding.

STATISTICS,

Finances, Inventory, etc., are submitted to the Secretary and are not a part of this report.

I take this opportunity to thank those who have helped in the growth of this library. The recognition of the professional service of the librarian and of the importance of the library in the educational plan is the most gratifying event in our records for the year and will be most influential in the future of the library.

Respectfully,

JOSEPH F. DANIELS,
Librarian.

REPORT DEPARTMENT OF MATHEMATICS.

To the State Board of Agriculture:

Gentlemen—During the past year this Department has done considerably more work than is outlined in the catalog. Classes have been taught in the following subjects: Elementary Algebra, Plane Geometry, Solid Geometry, College Algebra, Plane and Spherical Trigonometry, Plane Analytics, Differential Calculus, Integral Calculus, Solid Analytics and Mathematical Drawing, Elementary Arithmetic, Commercial Arithmetic. The total number of students enrolled in these classes has been 458.

We are making a special effort this year to meet individual needs. Many worthy, hard-working students have a poor faculty for Mathematics, and in consequence either change to a course where Mathematics is not prerequisite or drop out of school. We have sought these out, and by special appointment daily have given them such suggestions and encouragement as to materially strengthen their work.

It seems to go without saying that a workable knowledge of Mathematics is the most vital feature in technical education. It has therefore been our purpose to make the Department of the utmost practical importance to both the Agriculturist and the Engineer. To this end we have striven to introduce numerous problems from practical affairs. Miss Frink is deserving of favorable mention in this regard. She has compiled some 125 problems relating to farm life, irrigation, etc., which we are teaching in the practical course in Agriculture.

Regarding my assistants I beg to say there has not been a discordant note during the year. The disposition has been constant devotion to duty. Out of the many hundreds of recitations I can not recall of a single instance in which a lesson has been missed on account of the absence of a teacher.

Permit me to remind you that since my last report five young ladies have elected to take advanced mathematics, and they have been eminently successful in their work. At the present time I am directing post-graduate work in Solid Analytics and in the History and Pedagogy of Mathematics.

Respectfully submitted to the State Board to whom I am grateful for continued courtesies.

S. L. MACDONALD,
Head of the Department.

December 1, 1908.

REPORT OF DEPARTMENT OF MECHANICAL ENGINEERING

To the State Board of Agriculture:

Gentlemen—I have the honor to submit the annual report of the Department of Mechanical Engineering.

The course in Mechanical Engineering as presented at the Colorado Agricultural College is such as is given at the best technical schools of the United States.

The instruction is intended to be thorough, and the equipment is of the very best, care being taken when obtaining apparatus that each piece shall be of the greatest usefulness for its purpose.

Colorado is forging ahead magnificently along industrial lines, and with the development of the vast natural resources within her borders new industrial enterprises are springing up everywhere, while the older ones are becoming more firmly established.

With this industrial growth comes a demand for men competent to solve the problems connected with such enterprises. Young men from the College are in many of these establishments, occupying positions of trust and responsibility.

We are trying, first, to teach the general underlying principles of engineering, then to add as much detail and special technical knowledge as a course extending over four years will permit.

We believe our methods of teaching are in conformity with the best modern practice, and while we are practicing no freak or short-cut methods, we are trying to give our students real, substantial values.

We have a larger number of older students this year than usual, and it is gratifying to note their interest and earnestness of purpose.

The various lines of study seem to articulate very well, and our young men find very little difficulty in putting to practical use the technical knowledge they have acquired while at the College.

The Course in Farriery is patronized to about the same extent as it was last year, and the young men are interested in the work.

The Short Course in Mechanic Arts has a few students who are taking the work, but it will have to be discontinued next

year as the studies in this course are taken from those of the preparatory school, and as the studies can not be given next year, these students can not be accommodated.

While we are doing well with the equipment we have, I desire to outline for your consideration some few improvements which will make for progress and add greatly to the usefulness of the Department.

The Department of Mechanical Engineering, while specifically training students for the work of the Mechanical Engineer, is, at the same time, in many of its divisions of work, training the students of several other departments of the institution. Drawing is taught to the Freshmen and Sophomores in several of the courses, steam boilers, also the several lines of shop work. This requires a large amount of room to accommodate the students in some features of the work, and we have arrived at a point where more room ought to be provided.

The drafting room, the wood room and the forge room are the places where the most pressure is felt, and I make the following suggestions as a remedy for these conditions.

Build a third story upon the north wing of the present Mechanical Engineering building in which a drafting room and class rooms may be fitted up.

Enlarge the present blacksmith shop by taking in with it the foundry room, and then build a new foundry room adjoining the present one.

To satisfy the demand in the wood room the present benches with their equipment should be doubled in number. The requisite number of benches can be put in by crowding them into the room now used as a carpenter shop.

We have no trouble in holding the interest of the students in their work, and the above changes would tend to simplify very much the arrangement of work.

Respectfully submitted,
J. W. LAWRENCE,
Professor of Mechanical Engineering.

November 15, 1908.

The State Board of Agriculture:

Gentlemen—I have the honor to submit the following report for the semi-annual period ending November 15, 1908:

The progressive instruction in infantry drill regulations, as outlined by general orders from War Department, has been carried out as far as possible; lack of a suitable rifle range and limited time allowance prevented the prescribed course in target practice. Lectures bearing upon the subject and also on field service have been given, together with theoretical and practical instruction in signaling. The report of the Military Inspector for the year 1907-8, now on file in the President's office, is the most favorable one yet received. The Battalion at present consists of thirteen (13) officers and one hundred and fifty-four (154) N. C. O's and privates, divided into four infantry companies and band. The figures show a falling off in attendance; however, the present students are larger, stronger and more capable of doing advanced work. The band is furnishing good music, and I believe that it is deserving of all possible assistance and encouragement. The medals and flag so kindly donated by Captain B. F. Rockafellow were the means of stimulating a friendly rivalry amongst the students, and in the final contest twelve cadets entered. Sergt. H. B. Scammel won the gold and Sergt. Victor Cram the silver medal. Company "B" won the flag.

Very respectfully,

H. D. HUMPHREY,
Captain U. S. Army.
Professor Military Science and Tactics.

REPORT OF DEPARTMENT OF MODERN LANGUAGES.

To the State Board of Agriculture:

Gentlemen—The work in the Modern Language Department is noticeably stronger this year, since no student lower than the sophomore class is allowed to take it. Two-year courses in both French and German are offered, and one year in Spanish. The work is obligatory for all but the Agricultural and Veterinary Departments.

It must be understood that this work is not of an academic or classical nature, that it is in harmony with the spirit of this institution, and as scientific and practical as we can make it.

In consideration of the fact that all our work is college work and that there is so much of it that I have had to have an assistant this year, I most respectfully ask for my Department and for my professorship. This is my fourth year in connection with the College (one year spent at the Universities of Berlin and Paris), and I have waited from year to year expecting this Department to be recognized by the Board. It is in no way dependent on any other Department, nor has it been for the last seven or eight years.

If you would be so kind as to give this matter your consideration, I should be most grateful.

Respectfully yours,

SARAH I. KETTLE,
Instructor in Modern Languages.

REPORT OF THE CONSERVATORY OF MUSIC.

To the State Board of Agriculture:

Gentlemen—I beg to report an enrollment of one hundred students for the past year. At present there are five teachers employed in the Department. The growth of the Conservatory has been rapid and consistent. Since September, 1908, to date, we have registered eighty-two students, an increase of thirty-two per cent. over the corresponding period of 1907.

We are greatly hampered in our work for lack of room, and respectfully ask you to investigate our needs, so that we may be in a position to take care of our increasing registration.

Respectfully submitted,

ALEXANDER EMSLIE,
Director of the Conservatory of Music.

REPORT OF THE PHYSICAL DIRECTOR.

To the State Board of Agriculture:

Gentlemen—No improvements have been made and no apparatus has been added to the Gymnasium since my last report.

I again call your attention to my report for shower baths. Good health, cleanliness and convenience make these absolutely necessary.

Since the faculty has ruled that Gymnasium is compulsory, it becomes a crime against cleanliness and common decency to force students to exercise freely without giving them the opportunity to cleanse their bodies. As it is at present there is not even a wash room. Many of our students are at rooming places where it is not possible to take a bath, which makes the need of this equipment for our Gymnasium all the more urgent.

My report last year and also two years ago called your attention to this need. Conditions are becoming more aggravated, and I trust that you will see your way clear to give this matter your prompt attention.

I will gladly confer with any committee you wish to appoint to look after this matter.

Respectfully submitted,

C. J. ROTHGEB.

REPORT OF DEPARTMENT OF PHYSICS AND ELECTRICAL ENGINEERING.

To the State Board of Agriculture:

Gentlemen—The work in Physics is being done according to the schedule of studies of the various courses. No preparatory work is offered, but a class for such work will be organized beginning with the winter term, to help those freshmen who were conditioned or failed in this subject as sub-freshmen last year.

This term we are teaching in all seven classes for a total requirement of twenty-three term hours with a total enrollment of one hundred men. The students are doing good work. They are responding to our stronger requirements for credit with an enthusiasm that is most encouraging, and strengthens the belief that students desire the best the College can give and are quite willing, nay anxious, to do their share of the work. That men do not leave an institution because the work is hard, but because it is of low standard, and that the best way to hold students in school, to make them enthusiastic in their loyalty and firm in their devotion to their alma mater, to weld them into a powerful organization for winning new students, is to set a high standard of scholarship and maintain it at any cost.

The limited laboratory quarters makes the work of instruction difficult and arduous. The hours of teaching are increased and the work of preparation and maintenance of apparatus practically doubled. Fortunately, the subject has a strong hold on the interest of the boys and they work under the increased difficulties in a very commendable manner, and show a desire to be helpful that goes far in easing the work of the instructors.

The installation of a large motor-driven fan has solved the ventilation problem. We can now keep the air sufficiently pure that it is no longer a menace to health to spend two hours daily in the laboratory. On cold days we still freeze out unless we open the window leading to the space under Mr. Hawley's office and through this rob the furnace room of its hot air and the boiler of its draft. This difficulty should be overcome as soon as the extra radiators for heat and ventilation are installed that were ordered in August. Unfortunately, the company having the contract has been unable to secure any indirect radiators and can not proceed with the work which embraces the installation of an indirect radiator outside of and above each of four windows of the

laboratory. These will be boxed in so that air can be drawn through them and into the room while classes are in session. Provision is made that each radiator can be shut off not only to prevent freezing at night, but also to relieve the strain on the boiler while the building is being heated up in the morning.

The change in the course of study, particularly in Horticulture and all Engineering courses, has increased the need of more apparatus. Before this change most of the work was given to preparatory classes, little was offered above the freshman year. The laboratory was fitted for this grade of work, and much of the apparatus is not of the kind needed for college classes and can no longer be used. While this difficulty was foreseen and partially provided for, the funds available have not been sufficient for the needed equipment; through the desire also to help economize when the institution was curtailing expenses, the coming need has not been strongly emphasized. More equipment is imperative if College standards are to be maintained. To meet the necessity of training students for radically different lines of work, the equipment must necessarily be varied and extensive, and the purchasing of this should not be by single piece and spasmodically as heretofore, an expensive and uncertain method, but a certain known sum should be available each year for new equipment. Knowing that a fixed sum was available, the head of the department could plan his purchases systematically to best fit its needs, could take advantage of special bargains and get the more liberal discounts of large orders, particularly imported apparatus. I commend the needs of the department and this plan of apportioning funds to your consideration.

ELECTRICAL ENGINEERING.

The growth of the course in Electrical Engineering, and the interest and enthusiasm shown by the students, prove the wisdom of your action in reinstating the course in the curriculum of the College, and abundantly justify the expense that has been necessary so far. The records show an enrollment of ten juniors out of a total of twenty-four and of fourteen sophomores out of a total of thirty-three in all engineering courses. All but three sophomores of last year returned; one of these will enter school this winter term, and another is earning money to return next year. We are teaching in all two classes for a credit requirement of ten term hours and have a total enrollment of twenty-four. The Mechanical Laboratory has been partially fitted up for work in electrical measurements. The work of teaching is heavy; in part because all apparatus is kept in the Physical Laboratory and must be carried back and forth; in part on account of the unfinished condition of the installation. The students are making the best of the unfavorable conditions and are helping to whip things into shape.

The new equipment installed last summer is giving excellent service and is proving very well adapted for the purpose intended.

As much as possible of this work was done by student labor and furnished good experience. On account of an unforeseen delay in getting the last machine, the work is not completed and it has not been possible, as yet, to use electric power in the shops. There is therefore no basis for comparative cost of steam and electric power, but we are confident that the latter will prove enough cheaper to save the cost of its installation inside of five years. The cost of power for electrical measurements has not exceeded 60 cents per month so far.

The work of this course is so promising and its field of usefulness is so large that it deserves your earnest consideration. It has started out without a building and with meager equipment; the boys who are placing their faith and hope in the training it is to give are entitled to all the help you can bestow. If you consider the money spent per student in Physics and Electrical Engineering last year and keep in mind also the high cost of apparatus, I believe you will agree that our requests have been moderate and that we are entitled to a more liberal allowance. We are competing with schools where Electrical Engineering has been long established, where both laboratory and testing rooms are well equipped. To get our share of students, it will be necessary not only to put the work of instruction on a par with the best technical schools, but also to furnish the equipment that makes this possible. I believe you will agree with me that the money spent so far makes a creditable showing. At least double as much should be available for this year if full preparation is to be made for the entire work of the course next year.

Two of us, with the help of two student helpers and a student mechanician, are carrying all the work of teaching and general supervision. Mr. William E. Bracket, our able assistant, last year resigned in August to accept a call from the State University, and Mr. Fred G. Person, a graduate of Colorado University, and for three years principal of the Montrose County High School, took his place in the department. Mr. Person is proving himself a strong man in the work and is carrying his share of it in a very satisfactory manner.

The regular requirements of the curriculum will be so heavy another year that another teacher will be needed in the department; serving as it does each of the four years of College work in some of the several courses, the demands made upon it are severe. The training in Physics is fundamental and must be good. The work in Electrical Engineering must be high class if your plans for it are to come true. I trust you will consider this need of more instructors at your mid-winter meeting, so we can begin an early search for a strong, energetic, well-trained young man, preferably a graduate from one of the great technical schools of the East, for associate professor in Electrical Engineering next year.

Respectfully submitted,

CHARLES A. LORY,

Professor of Physics and Electrical Engineering.

SUPPLEMENTAL REPORT.

Department of Electrical Supplies.

The Department of Physics and Electrical Engineering, with the help of student labor, is taking care of all electrical work, new wiring and repair, on the Campus. Although the system has not been worked up to the efficiency we hope to get, in many respects it is far more satisfactory than the old method of contract service. Its most commendable feature is the chance it offers the Electrical Engineering students for practical experience. A better system of keeping check on the supply room is being worked out; the difficulties of this problem would be much less if we had better storage room. Our method of buying supplies also needs improvement. The cost on small orders of electrical supplies is high, practically no discount being offered. On large quantities the discount may reach 40 per cent. It should be possible for the College to make some arrangement with a local supply firm whereby we could get supplies in small quantities as needed, and yet, on account of the volume of business for the year be entitled to very nearly wholesale-order discount rates.

A number of much-needed repairs to our transmission lines were made last summer. All the power wires in the Mechanical Engineering Building were installed in iron conduits, and the distribution system as a whole was overhauled. Nearly all the buildings are still without main service switches and adequate fuse protection. These should be provided as soon as possible. I recommend for your consideration the installation of incandescent lights at the portals of all the buildings, especially those of the Main, Civil Engineering, Domestic Science and Chemical Buildings, and at the fountain for illuminating the Campus. This plan will be cheaper than the use of arc lamps, and will serve the purpose admirably. The lights would be turned out by the night watchman at any desired hour.

I recommend for your consideration also the installation of metallic filament lamps in all sockets not within easy reach of the students. Their use would increase our illumination and decrease the cost of energy. The use of clear lamps in the Chapel is very trying on the eyes, and spoils what otherwise is a very pleasant effect; frosted lamps only should be used in this room, and if Tungsten lamps were used the cost of energy per candle hour would show a decrease of fully 40 per cent., or a decrease of over 20 per cent. if Tantulum lamps were used. Our present method of exchanging lamps, i. e., free renewals with the power

station, is neither satisfactory nor advantageous. We are forced to use a 115-volt lamp on 104-volt circuits, which means poor illumination, and the low efficiency lamps furnished by the Company means high meter bills. Conditions are such that we will soon be forced to our former plan of buying our own lamps. The high cost of the new metallic filament lamps will prevent their use in sockets accessible to the students. We have had a great many lamps stolen this fall, many students apparently believing it legitimate to replenish their incandescent lamp stock at the College. The trouble has become so bad in some buildings that the use of a special lock socket is advisable. In sockets not easily accessible the new high efficiency lamp should be used, because, in spite of first cost the saving of energy their use makes possible will warrant their installation.

Respectfully submitted,

CHARLES A. LORY,
Professor of Physics and Electrical Engineering.

REPORT OF THE DEPARTMENT OF VETERINARY SCIENCE.

To the State Board of Agriculture:

Gentlemen—In my report of one year ago this prophetic statement was made: "In one particular this course of study (Veterinary) is to be looked upon as entirely different from others. In the ordinary vocations of life, a question is seldom asked as to a man's preparation for his work, whether within college walls or otherwise; it simply remains for him to prove what he can do. In the profession of medicine it is quite different, for here he is judged by his co-workers uncompromisingly according to the reputation of the school from which he received his degree.

"This department has now launched out as a full-fledged veterinary college, and we shall need to look to our educational standing that we may compare favorably with older schools. I fully appreciate the moral responsibility devolving upon us to see that our graduates are eligible to employment in the Bureau of Animal Industry and to membership in the American Association of Veterinarians.

"The American Association have their eyes upon us, and they carefully investigate every school seeking recognition, and have black-listed several. The graduates from such schools are without standing. They are not employed by the Department of Agriculture, neither are they granted certificates to practice in many of the states.

"To rank among the list of recognized veterinary colleges, we must have at least three veterinarians on the regular faculty who are eligible to membership in the American Association. The curriculum must be satisfactory and the subjects therein named must be actually taught with a degree of efficiency that will be beyond question. And lastly, the equipment must be ample, and a large clinic is indispensable."

Within a few months after this report was made, the Department of Agriculture appointed a committee of five to investigate the Veterinary Schools of America. The committee visited us unexpectedly, and before we had scarcely opened our doors five months as a full-fledged veterinary school. We were placed in Class C, which would make our graduates, if we had any, ineligible to the Civil Service Examination, and which in substance practically black-listed us among Veterinary Colleges.

The committee, after making their report, addressed the following letter, indicating where we had failed:

EXHIBIT "K."

"COPY OF REPORT ON THE VETERINARY DEPARTMENT COLORADO STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, BY THE COMMITTEE ON VETERINARY EDUCATION."

"After having visited the Colorado State College of Agriculture and the Mechanic Arts, Department of Veterinary Science, on March 13, 1908, and obtained all available information, the following are submitted as the most important points at which that institution must be strengthened in order to come up to the minimum standard of requirements deemed essential by this committee:

"1. The faculty of this institution has on it an insufficient number of veterinarians teaching major subjects. At the time of our visit instruction was being given to only first and second year students. It is the opinion of the committee that the faculty as at present constituted lacks veterinarians who have had adequate training and experience in veterinary lines. There are at present only three veterinarians on the faculty giving sufficient time to college work, and two of these—I. E. Newsom and H. E. Kingman—have not had the necessary veterinary college training to render them eligible to membership in the American Medical Veterinary Association or to the civil service examination for employment in the United States Department of Agriculture."

"2. The buildings and equipment for offices, bacteriological laboratory, and class rooms are inadequate to the needs of the institution. It also appears that the material available for clinical instruction is insufficient."

Previous to the investigation made by the Department of Agriculture, we were trying to line up to the standard set by the American Veterinary Medical Association. We had three veterinarians on the teaching staff and otherwise were trying to come up to their standard. It could scarcely be expected that within a few months after opening our doors that we would be fully equipped and up to the standard of older schools.

The Department of Agriculture has now set a higher standard for us and which we are obliged to live up to or be discredited everywhere.

Their report, Recommendation No. 10, reads: "That there shall be at least five qualified veterinarians on the faculty of every veterinary college, each of whom shall have had not less than three years' experience in teaching or in practicing veterinary science subsequent to graduation from a veterinary college."

Recommendation No. 12: "That five veterinarians on the faculty of each veterinary college shall have charge of and teach the following major subjects: (1) Anatomy, (2) Pathology, (3) Practice of Comparative Medicine, (4) Surgery, and (5) Materia Medica, or Physiology, as the respective colleges may elect."

Recommendation No. 5 is a course of study given as a minimum for veterinary colleges, and also indicates how these subjects shall be taught and the minimum number of hours that shall be devoted to each subject.

As a whole the requirements are very exacting, but in no respect unreasonable, and are, we must admit, fully in accord with the up-to-date idea of veterinary education in America.

We have been bending every effort to meet these requirements before the termination of our period of probation, which is June 10, 1909.

Dr. I. E. Newsom and Dr. H. E. Kingman were perfectly competent and efficient in every way, but were caught by a technicality and they immediately resigned to continue their work in the Kansas City Veterinary College.

There is no change in our "buildings and equipments for offices." A temporary shift has been made to meet their criticism of our bacteriological laboratory by using a small room in the horticultural building. As to their criticism that our "class rooms are inadequate to the needs of the institution," I can only say that it is true. We have one new class room, but the largest one will scarcely hold the forty-five students registered for the work.

I trust that we may be permitted to ask the incoming Legislature for a special appropriation for at least one wing of a veterinary building. I feel sure that we will be able to meet every criticism this year, save the one respecting our buildings, class rooms and laboratories.

Their next criticism: "It also appears that the material available for clinical instruction is insufficient." This objection has been entirely overcome. We have exercised every effort to enlarge upon the practical work and have been rewarded with a clinic which will successfully refute any objections in this respect in the future.

OUR TEACHING STAFF.

Dr. B. F. Kaupp is a leader in the veterinary profession of America. He is the author of a standard text-book on parasites and a teacher and writer of national repute.

Dr. C. L. Barnes is a graduate of Cornell University, and is an experienced teacher and practitioner. He has been generous enough to place in the hospital for use, temporarily, several hundred dollars' worth of veterinary instruments.

Dr. Robert Bird, of Greeley, has kindly consented to come over twice a week and help us. He will help us, however, only

during the winter term of this year. At the beginning of the spring term we shall need to make some other arrangements.

Dr. F. W. Culver, of Longmont, comes up twice a week to lecture. These last two men are only temporary and will need to be replaced by permanent instructors to make the required five teaching major subjects.

Here is a matter that is causing me much concern; we are required to have five Veterinarians in charge of and teaching five major subjects, and two of these men, Drs. Bird and Culver can only help us until the spring term. There are no other local Veterinarians qualified to take up the work; besides, there would not be much difference in the expense of employing two men regularly, and several men from the outside who can only give us three or four hours a week, and are always more or less inefficient and at best uncertain.

Under the present regimen, the three classes in the regular Veterinary Course, the two in the practical Short Courses, and two in Farriery, require eighty-five hours per week of actual teaching, to be done by Dr. Kaupp, Dr. Barnes and myself. This amount of labor makes good work prohibitive if continued long, and portends an early departure to the world beyond. I am struggling with these difficult problems, trying to build up a department which will be a credit to the College and the State.

MICROSCOPES.

Twenty-five more microscopes are absolutely essential to the work in our several Veterinary Laboratories next year. By ordering these microscopes about March 1, from Germany, they could be gotten here by September and save us three hundred dollars.

TO SECURE RE-RATING.

Recommendation No. 17 reads as follows: "That these Colleges not now in Class A shall be put in that class at such time as they shall submit sufficient evidence to convince the Department of Agriculture that they are fully and faithfully complying with the minimum standard of requirements indicated in this report."

In compliance with this recommendation we have already forwarded to Washington a full and complete report of our work and now confidently await their will and pleasure.

PATHOLOGY MUSEUM.

We have already gotten together a Pathology Museum of which we are proud. It not only is an appropriate acquisition to a school of this kind, but greatly facilitates the teaching and represents an intrinsic value of possibly five hundred dollars.

VACCINE.

We have undertaken the manufacture of black leg vaccine, and, in conjunction with the Experiment Station, hog cholera serum. We now have the vaccine ready for distribution. Its manufacture involves much painstaking labor, but does not represent much money invested. We can make a vaccine in our laboratories which will be of superior quality, and sell it to the farmers and stockmen of Colorado at a price that will be a great saving to them and at the same time render a substantial support to the Veterinary Department, if you will authorize its being so used. He now have about two thousand dollars' worth ready for distribution.

HOSPITAL.

The practical work in Veterinary education is indispensable. At the hospital we have worked up a good clinic and done it in the only way that it could be done, by going out and working for it. We charge a reasonable fee for some of the cases treated and this goes a long way toward paying the expense of operating it.

PROSPECTUS.

While I am having my difficulties in getting this Department on a secure footing, yet I feel rewarded in the evidence of appreciation by all concerned and especially in the loyalty of the student body.

Last fall, while we were discredited as a Veterinary school and the institution in other respects was undergoing a turmoil, the young men that were with us the year before were loyal enough and had faith enough in us to come back and cast their lot with us. We now have forty-five registered, and next year, if we succeed in getting placed in Class A and are properly supported, we may confidently expect fully one hundred.

The Kansas City Veterinary College has over five hundred students registered in Veterinary Science and each one of them pays an annual tuition of one hundred dollars. Veterinary education is popular now, and we may expect to see this Department grow commensurate with the popular wave and with the support which it receives.

Respectfully submitted,

GEORGE H. GLOVER.

REPORT OF THE YOUNG MEN'S CHRISTIAN ASSOCIATION.

To the State Board of Agriculture:

Gentlemen—This report includes the principal activities of the Association from the close of last school year to the present date.

SUMMER WORK.

Sixteen men attended the Student Conference which was held at Cascade, Colorado, from June 12th to 22d. This number included two faculty men and the retiring and present secretaries. The present secretary attended, also, the Student Secretaries' Conference at Geneva, Wisconsin, June 23d to July 6th.

NEW STUDENT WORK.

Letters of welcome and information, concerning both the Association and College, were sent to all prospective students. A complete list of the rooms and boarding places was secured and the greater part of both the old and new students were aided in getting located. During the opening day, the trains were met by men with badges from the Association and all newcomers were taken in charge and helped in every way possible.

SOCIAL DEPARTMENT.

The Association recognizes the need of a social life that will reach *all* the students, and they have carried out the following plans thus far:

The "Stag Social" (Sept. 11th) was held the first Friday night and almost every man in College attended. "Stunts" were so arranged that all had a full evening of fun.

The "Joint Reception" (Sept. 18th) was given in conjunction with the Young Women's Christian Association, and was attended by about two hundred people.

Bible-class parties have been held on different Friday evenings in the Rest room. Most of the men and women in the classes have been entertained in these small parties, and it shall be the aim of the Associations to provide social life for those who most need it throughout the year.

BIBLE STUDY.

Two courss are being offered this year by the Association in Bible study, "Men of the Old Testament" (Willman) and

"The Life of Christ" (Murrey). The student leaders are in a Normal Training Class led by the Secretary. Sixty-five men are now enrolled in these classes.

RELIGIOUS MEETINGS.

The plans of the Religious Meetings have been changed this year. The regular Sunday meeting has been held as usual, but due to the chapel hour being abolished; the mid-week meeting is held with the Young Women's Christian Association each Tuesday evening at 6:45 for three-quarters of an hour. The mid-week meeting is strictly a student meeting, while the Sunday meetings are addressed by the ministers and men from the outside.

Some special meetings have been held, two of which I shall especially mention. Dr. Winfield S. Hall, dean of Northwestern University, addressed 350 men with his noted lecture on "Reproduction and Sexual Hygiene," and "Dad" Elliott, an international traveling secretary, held a three days' campaign here the first of November.

EMPLOYMENT.

Some men have been placed in permanent positions and a large number have been given odd jobs to do. The first month of school there was about $50.00 worth of work obtained for the students through the Association employment bureau.

PRACTICAL COURSE STUDENTS.

Letters were sent to all the Practical Course Students, and they were cared for the same as the Regular Students when they came. They were aided in securing room and board, a place to get their washing done and all the necessities that were required; in addition they were given special attention and advice as to the different activities of college life.

FINANCES.

The income thus far this year has been $388.00. This includes the balance on hand, subscriptions paid, convention funds repaid, mission pledges and some small items. The expenditure has been $195.81, leaving a balance on hand of $192.19.

It is estimated, by careful figuring, that we shall have to raise at least $175.00 more than has been pledged to meet the current expenses this year.

ADMINISTRATION.

The Association office has been supplied with good magazines and literature and it is open most of the time for the stu-

dents to read and study in. A number of the students are making use of it.

The vacancies in the Cabinet have been filled and the machinery of the Association is now working very well.

The Secretary wishes to express his appreciation of the hearty co-operation of the State Board in so materially aiding the Association in making it possible for this work to be carried on.

Respectfully submitted,

WARD E. HALL,
General Secretary.

November 15, 1908.

REPORT OF THE DEPARTMENT OF ZOOLOGY AND ENTOMOLOGY.

To the State Board of Agriculture.

Gentlemen—I have the honor to present the following report from the Department of Zoology and Entomology for the year just closing.

The personnel of the department has not changed during the past year.

Professor S. Arthur Johnson is associate professor in the Department. Mr. L. C. Bragg looks after the College Museum and gives considerable of his time to the Entomological work of the Department. Miss Palmer does most of her work for the Experiment Station and also does some teaching and some breeding cage work and keeping of records.

On account of my devoting more time to research and other Experiment Station work I find it necessary to turn the teaching over quite largely to Professor Johnson, who has proven himself very successful as an instructor of college students.

During the past year I have attended six Short Courses of one week each, and a considerable number of farmers' meetings of one day each, and given addresses, chiefly along the line of economic entomology.

The utmost harmony has prevailed in the work of the Department throughout the year.

There have been a few donations to the College Museum during the year, but on account of the lack of money to make any purchases either of speciments or needed cases, the museum is practically in the same condition that it was one year ago.

Appended hereto is an invoice of College property cared for in this Department.

Respectfully submitted,

C. P. GILLETTE.

Fort Collins, Colo., October 30, 1908.

AUDIT OF

State Agricultural College

FROM

DECEMBER 1, 1906, TO NOVEMBER 30, 1907

AND

DECEMBER 1, 1907, TO NOVEMBER 30, 1908

Hon. B. F. Rockafellow,

President State Board of Agriculture,

Fort Collins, Colorado.

Dear Sir—Pursuant to the instructions of your Executive Committee, we have made an audit of the books and accounts of the State Agricultural College, from December 1, 1906, to November 30, 1907, inclusive, and herewith submit our findings:

SECRETARY'S CASH.

All collections have been properly accounted for and paid over to the State and College Treasurers.

DISBURSEMENTS.

All disbursements are evidenced by duly authenticated bills, and all vouchers are properly approved by the Finance Committee.

COLLEGE TREASURER.

We verified the balances shown as in the hands of the College Treasurer as of date November 27, before issuance of November warrants, at which time the balance, per books, was—

		$29,918.56
Warrants outstanding		
Tax Fund, No. 154	11.15	
Tax Fund, No. 921	50.00	
Tax Fund, No. 1012	89.09	
Experiment Station Appropriation, No. 1	62.50	
Experiment Station Appropriation, No. 18	6.52	
Bank balance		$30,137.82

STATEMENTS.

The following statements exhibit the transactions of the past year:

SECRETARY'S CASH ACCOUNT.

RECEIPTS.

Secretary's Office, Sales	$ 1.50	
Agronomy Division, Sales	20.00	
Animal Husbandry Division, Sales	7,422.27	
Farm Division, Sales	77.30	
Farm Mechanics Division, Sales	33.90	
Botany and Horticultural Division, Sales	127.95	
Chemical Division, Sales	100.00	
Domestic Science Department, Sales	24.86	
Library	32.80	
Insurance, Return Premium	5.40	
Transfers, College Funds	9,285.73	
Text Book Department, Sales	2,795.03	
Entrance Fees	330.00	
Commercial Department	60.00	
Agronomy Section	183.71	
Animal Investigation Section	1,568.87	
Veterinary Section	45.85	
Western Slope Fruit Investigation	375.00	
Transfers, Experiment Station	5,038.52	
Government Horse Breeding	170.00	
Delta County Fruit Investigation	700.00	
Horticultural Section	76.13	
COLLEGE SPECIAL FUND—		
Paid State Treasurer		$ 2,655.14
Paid College Treasurer		16,564.88
EXPERIMENT STATION, SPECIAL FUND—		
Paid College Treasurer		9,202.30
HATCH FUND—		
Paid College Treasurer		52.50
	$28,474.82	$28,474.82

RECEIPTS AND DISBURSEMENTS.

	Balance Dec. 1, 1906.	Receipts	Transfers to	Transfers from	Disbursements	Balance State Treasury	Balance College Treasury
Agricultural College							
Tax Fund	$ 1,994.55	$ 69,780.05	$ 7,400.00	$ 2,366.56	$ 89,130.22	$ 221.07	$16,532.35
Land Income Fund	358.95	8,188.04	.....	.....	5,422.66	963.96	2,159.47
Special Fund	3,210.80	9,934.29	9,285.73	.....	15,690.25	.....	5,240.57
*Secretary's Revolving Fund	.....	.....	.....	.....	.....	.....	1,500.00
Mechanical Arts (U. S.)	8,854.56	30,000.00	.....	.....	24,100.17	.....	14,754.39
Purchase Fund	.....	13,585.25	.....	7,400.00	6,185.25	.....	.....
Appropriation, Farmers' Institute	.....	10,000.00	.....	2,724.83	712.36	5,000.00	1,562.81
Appropriation, Land and Water	.....	7,500.00	.....	.....	7,500.00	3,750.00	3,750.00
Appropriation, Irrigation Building	.....	16,633.84	.....	4,194.34	.....	.....	12,439.50
Experiment Station—							
Hatch Fund	286.47	15,000.00	52.50	.....	12,785.00	.....	1,981.03
Adams Fund	455.26	5,250.00	.....	.....	8,605.81	.....	2,900.55
Special Fund	1,065.84	4,216.28	4,986.02	52.50	9,147.33	.....	1,068.31
Appropriation, Animal Investigation	.....	6,000.00	.....	545.21	1,996.36	3,000.00	458.43
Appropriation, Plant Industry	.....	4,000.00	.....	1,292.03	339.90	2,000.00	368.07
Appropriation, Grain House	.....	2,000.00	.....	.....	.....	1,000.00	1,000.00
Appropriation, Farm Mechanics	.....	2,000.00	.....	.....	.....	1,000.00	1,000.00

Appropriation, Veterinary	.....	500.00	.....	172.54	67.50	250.00	9.96
Appropriation, Fruit Investigation	.....	8,000.00	.....	2,969.74	423.12	4,000.00	607.14
Appropriation, Horse Investigation	.....	5,000.00	.....	6.50	473.23	2,500.00	2,020.27
	$11,663.49	$217,587.75	$21,724.25	$21,724.25	$182,579.16	$23,685.03	$22,987.05

*In Secretary's hands.

DISBURSEMENTS, COLLEGE FUNDS.

Agricultural Department—	
General Division	$ 2,855.26
Agronomy	1,156.94
Animal Husbandry	7,933.17
Farm	7,537.65
Farmers' Institute	5,316.04
Farm Mechanics	619.55
Advertising	2,820.39
Botany and Horticultural Department	1,790.29
Bookkeeping and Farm Accounts	34.58
Chemical Department	181.88
Civil and Irrigation Engineering	1,093.28
Constitutional History and Irrigation Law	2.75
College Campus	2,308.64
Current Expense	2,389.28
Domestic Science	931.24
Firemen and Janitors	4,161.78
Fuel and Lights	4,626.42
Furniture and Fixtures	849.43
Girls' Dormitory	731.00
General Repairs	1,262.34
History and Literature	36.87
Insurance	1,389.75
Library	2,081.57
Mathematical Department	44.85
Mechanical Department	1,661.71
Military	478.14
Music Department	75.83
President's Office	854.70
Physical Training Department	8.35
Physics Department	996.88
Permanent Improvements	18,223.37
Quarterly Bulletins and Reports	1,335.76
Rhetoric and Composition	58.20
Salary	65,993.93
Secretary's Office	673.87
State Board of Agriculture	1,358.20

DISBURSEMENTS, COLLEGE FUNDS—Concluded.

Student Labor	3,421.19	
Text-book Department	389.99	
Veterinary Science Department	511.22	
Zoology and Entomological Department	544.62	
Total		$148,740.91

DISBURSEMENTS, EXPERIMENT STATION.

Agricultural Section	$ 69.55	
Agronomy	1,753.41	
Animal Investigation	6,394.64	
Arkansas Valley Field Agent	63.56	
Bulletins and Report	2,004.22	
Chemical Section	598.38	
Director and General	1,054.68	
Delta County Fruit Investigation	387.46	
Entomological Section	645.47	
Fruit Investigation	423.12	
Horticultural Section	809.65	
Horse Investigation	473.23	
Irrigation Section	765.34	
Library	671.59	
Plant Industry	339.90	
Salary	15,186.16	
Veterinary Section	285.89	
Western Slope Fruit Investigation	1,912.00	
Total		$33,838.25

GENERAL COMMENTS

BOOKS AND RECORDS.

Our recommendations of last year have been carried out, and the books consolidated into two Voucher Records, one Journal, and one Ledger.

DISTRIBUTION

Has been made in accordance with our former recommendations.

CASH DISBURSEMENTS.

The Secretary has now been provided with a Revolving Fund to be used in making petty cash payments, as recommended.

OFFICE METHODS

Have been much improved and the labor decreased, by drawing all funds from the State Treasurer in bulk and making disbursements through the College Treasurer only; thus avoiding the unnecessary duplication of vouchers.

BILLS AND REQUISITIONS.

The practice still obtains, in many instances, of purchasing goods first and obtaining requisition later.

STUDENT LABOR.

We renew our recommendation that these items be paid on a regular form of Pay Roll, by the Secretary, one voucher to be made monthly for the total.

CERTIFICATE.

We have made an audit of the books of The State Agricultural College, from December 1, 1906, to November 30, 1907, inclusive; and in accordance therewith we certify that the foregoing statements correctly represent the transactions for the period named.

THE CONTINENTAL AUDIT COMPANY,

(SEAL) E. F. ANTHONY,
E. F. ARTHUR, Secretary.

Dated December 4, 1907.

AUDIT STATE AGRICULTURAL COLLEGE.

December 1, 1907, to November 30, 1908.

HON. B. F. ROCKAFELLOW,

President State Board of Agriculture,

Fort Collins, Colorado:

Dear Sir—Pursuant to the instructions of your Executive Committee, we have made an audit of the books and accounts of the State Agricultural College from December 1, 1907, to November 30, 1908, inclusive, and herewith submit our findings.

SECRETARY'S CASH.

All collections have been properly accounted for and paid over to the College Treasurer.

DISBURSEMENTS.

All disbursements are evidenced by duly authenticated bills, and all vouchers are properly approved by the Finance Committee.

COLLEGE TREASURER.

We verified the balances shown as in the hands of the college treasurer, as of date November 30, 1908, at which time the balance, per books, was $37,133.66

Warrants outstanding—

Tax fund	No. 2505	80.00
Tax fund	No. 2570	2.00
College special	No. 265	75.00
Experiment station appropriation.....	No. 293	14.00
Bank balance		$37,364.63

STATEMENTS.

The following statements exhibit the transactions of the past year:

SECRETARY'S CASH ACCOUNT.

RECEIPTS.

Agronomy Division	$ 10.23
Animal Husbandry	4,527.27
Farm Division	438.12
Farm Mechanics	9.25
General Agriculture	67.15
Farmers' Institute	2,424.00
Botany and Horticultural Department	53.70
Chemical Department	238.54
Civil and Irrigation Engineering	393.35
Domestic Science	26.38
Library	49.73
Mechanical Department	38.25
Military Department	3.00
Physics	86.34
Veterinary	59.59
College Campus	3.55
Girls' Dormitory	64.54
Text-book Department	83.40
Entrance Fees	569.70
Miscellaneous Sales	34.00
Agronomy Division	491.39
Animal Investigation Division	7,021.13
Chemical Section	9.20
Horticultural Section	121.69
Fruit Investigation	35.00
Plant Industry	28.30
Horse Investigation	524.20
Delta County Fruit Investigation	100.00
Government Horse Breeding	5.00
Transfer from Appropriation	6,710.62

DISBURSEMENTS.

College Special Fund—		
Paid College Treasurer		$ 9,180.09
Experimental Special Fund—		
Paid College Treasurer		15,046.53
	$24,226.62	$24,226.62

RECEIPTS AND DISBURSEMENTS.

	Balance Dec. 1, 1907						Balance Nov. 30, 1908	
	State Treasurer	College Treasurer	Receipts	Transfers To	Transfers From	Disbursements	State Treasurer	College Treasurer
Agricultural College—								
Tax Fund	$ 221.07	$16,532.35	$ 72,578.34	.....	.....	$ 80,522.31	$ 1,299.41	$25,554.66
Land Income Fund	963.96	2,159.47	11,497.40	.....	.....	14,116.26	461.36	43.21
Special Fund	.....	5,240.57	9,180.09	.....	.....	14,319.34	.....	101.32
*Secretary's Revolving Fund	.....	1,500.00	.....	.....	.....	.....	.....	1,500.00
Mechanical Arts (U. S.)	.....	14,754.39	35,000.00	.....	.....	29,349.90	.....	20,404.49
Appropriation, Farmers' Institute	5,000.00	1,562.81	.....	.....	.....	6,562.81	.....	.....
Appropriation, Land and Water	3,750.00	3,750.00	.....	.....	.....	.....	.....	.....
Appropriation, Irrigation Building	.....	12,439.50	.....	.....	.....	12,439.50	.....	.....
Experiment Station—								
Hatch Fund	.....	1,981.03	15,000.00	.....	.....	15,005.49	.....	1,975.54
Adams Fund	.....	2,900.55	14,256.22	.....	.....	9,955.83	.....	1,399.84
Special Fund	.....	1,068.31	8,335.91	$ 6,710.62	.....	5,219.82	.....	10,895.02
Appropriation, Animal Investigation	3,000.00	458.43	.....	.....	$ 1,816.74	1,641.69	.....	.....
Appropriation, Plant Industry	2,000.00	368.07	.....	.....	739.72	1,628.35	.....	.....
Appropriation, Grain House	1,000.00	1,000.00	.....	.....	.....	2,000.00	.....	.....
Appropriation, Farm Mechanics	1,000.00	1,000.00	.....	.....	643.19	1,356.81	.....	.....
Appropriation, Veterinary	250.00	9.96	.....	.....	113.98	145.98	.....	.....

RECEIPTS AND DISBURSEMENTS—Concluded.

	Balance Dec. 1, 1907						Balance Nov. 30, 1908	
	State Treasurer	College Treasurer	Receipts	Transfers To	Transfers From	Disbursements	State Treasurer	College Treasurer
Appropriation, Fruit Investigation	4,000.00	607.14	.....	.....	1,574.12	3,033.02	.....	.....
Appropriation, Horse Investigation	2,500.00	2,020.27	.....	.....	1,822.87	2,697.40	.....	.....
Totals	$23,685.03	$22,987.05	$165,847.96	$ 6,710.62	$ 6,710.62	$199,994.51	$ 1,760.77	$10,764.76

*In Secretary's hands.

DISBURSEMENTS, COLLEGE FUNDS.

Agricultural Department—	
General Division	$ 1,877.97
Agronomy	979.15
Animal Husbandry	7,725.58
Farm	8,901.09
Farmers' Institute	8,246.63
Farm Mechanics	361.92
Advertising	3,062.46
Botany and Horticultural Department	2,415.66
Chemical Department	458.57
Civil and Irrigation Engineering	790.83
Constitutional History and Irrigation Law	69.60
College Campus	1,368.06
Current Expense	2,434.96
Domestic Science	753.63
Firemen and Janitors	4,227.32
Fuel and Lights	4,398.07
Furniture and Fixtures	797.83
Girls' Dormitory	366.00
General Repairs	2,762.68
History and Literature	26.57
Insurance	315.00
Irrigation Building	12,439.50
Library	1,452.50
Mathematical Department	13.37
Mechanical Department	1,189.55
Military	186.68
Music Department	219.13
President's Office	677.78
Physical Training Department	28.35
Physics Department	1,256.77
Permanent Improvements	2,016.35
Quarterly Bulletins and Reports	1,347.80
Rhetoric and Composition	45.47
Salary	75,526.20
Secretary's Office	458.57
State Board of Agriculture	1,578.23
Student Labor	4,027.46

DISBURSEMENTS, COLLEGE FUNDS—Concluded.

Text Book Department	250.00
Veterinary Science Department	967.60
Water Assessments	1,198.44
Zoology and Entomological Department	90.79
	$157,310 12

DISBURSEMENTS, EXPERIMENT STATION.

Agronomy	$ 668.74
Animal Investigation	3,725.93
Arkansas Valley Field Agent	184.19
Bulletins and Reports	3,290.41
Buildings	450.00
Chemical Section	799.82
Director and General	977.71
Delta County Fruit Investigation	417.57
Entomological Section	683.32
Farm Mechanics	1,375.72
Fruit Investigation	3,354.28
Grain House	2,000.00
Horticultural Section	2,730.11
Horse Investigation	3,004.28
Irrigation Section	915.37
Library	123.20
Plant Industry	1,722.48
Salary	16,034.88
Veterinary Section	226.38
	$ 42,684.39

CERTIFICATE.

We have made an audit of the books of the State Agricultural College, from December 1, 1907, to November 30, 1908, inclusive; and in accordance therewith, we certify that the foregoing statements correctly represent the transactions for the period named.

THE CONTINENTAL AUDIT COMPANY,

E. F. ANTHONY, Secretary.

(SEAL.)

Dated December 7, 1908.

THE STATE AGRICULTURAL COLLEGE
OF COLORADO

TWENTY-FIRST ANNUAL REPORT

OF

THE AGRICULTURAL EXPERIMENT STATION

FOR

1908

THE AGRICULTURAL EXPERIMENT STATION.

FORT COLLINS, COLORADO.

THE STATE BOARD OF AGRICULTURE.

	Term Expires.
Hon. J. L. CHATFIELD, Gypsum	1909
Hon. B. U. DYE, Rocky Ford	1909
Hon. B. F. ROCKAFELLOW, *President,* Canon City	1911
Hon. E. H. GRUBB, Carbondale	1911
Hon. R. W. CORWIN, Pueblo	1913
Hon. A. A. EDWARDS, Fort Collins	1913
Hon. F. E. BROOKS, Colorado Springs	1915
Hon. J. L. BRUSH, Greeley	1915

Governor HENRY A. BUCHTEL
President BARTON O. AYLESWORTH } *ex-officio.*

A. M. HAWLEY, *Secretary.* CHARLES SHELDON, *Treasurer.*

EXECUTIVE COMMITTEE IN CHARGE.

B. F. ROCKAFELLOW, *Chairman.* A. A. EDWARDS.

B. U. DYE.

STATION STAFF.

L. G. CARPENTER, M. S., *Director*.....Irrigation Engineer
C. P. GILLETTE, M. S.....Entomologist
W. P. HEADDEN, A. M., PH. D.....Chemist
WENDELL PADDOCK, M. S.....Horticulturist
W. L. CARLYLE, M. S.*.....Agriculturist
G. H. GLOVER, M. S., D. V. M.....Veterinarian
————†.....Agriculturist
W. H. OLIN, M. S.*.....Agronomist
W. G. SACKETT, B. S.**.....Bacteriologist
R. E. TRIMBLE, B. S.....Assistant Irrigation Engineer
F. C. ALFORD, M. S.....Assistant Chemist
EARL DOUGLASS, M. S.....Assistant Chemist
S. ARTHUR JOHNSON, M. S.....Assistant Entomologist
B. O. LONGYEAR, B. S.....Assistant Horticulturist
E. B. HOUSE, M. S.....Assistant Irrigation Engineer
F. KNORR, B. S.....Assistant Agronomist
P. K. BLINN, B. S....Field Agent, Arkansas Valley, Rocky Ford
E. R. BENNETT, B. S.....Potato Investigations
MIRIAM A. PALMER.....Artist
L. C. BRAGG.....Assistant in Entomology

STATE FRUIT INVESTIGATIONS.

O. B. WHIPPLE, B. S., Grand Junction....Field Horticulturist
GEORGE P. WELDON, B. S., Delta***....Field Entomologist

President, BARTON O. AYLESWORTH, A. M., LL.D.

L. G. CARPENTER, M. S.....Director
A. M. HAWLEY.....Secretary
MARGARET MURRAY.....Clerk

*To October 19, 1908.

**From May 1, 1908.

†To be filled.

***From March 1, 1908.

LETTER OF TRANSMITTAL.

To His Exellency, Henry A. Buchtel, Governor of Colorado:

In accordance with the conditions of the act of Congress which requires a full and detailed report of the operations of the Experiment Station, I have the honor to present herewith the twenty-first annual report.

The financial statement is for the fiscal year ending June 30, the other portions being reported substantially for the current year.

The publication of the investigations is made in separate form as bulletins, and these are freely distributed among the people of the State.

L. G. CARPENTER,
Director.

The Agricultural Experiment Station, State Agricultural College, Fort Collins, Colorado, December, 1908.

To the State Board of Agriculture:

Gentlemen—I have the honor to submit my report for the past year as Director of the Experiment Station, with accompanying reports of the various sections.

As usual, believing that the purpose will be best served, I have had prepared two reports by each, a brief one for your special information, and a longer one for publication. The reason for this is that you need to have information to act intelligently on questions. The steps are not of public interest and need not be published. The public not being in touch with the detail, needs much fuller statements in order that they shall understand the situation. I have asked each member of the station staff to prepare a brief report and a long report with these two purposes in view, and to some extent the purpose has been reached in covering these two objects.

In this report to you the principal thing besides calling attention to some features of the work will be to call attention to the line of development and the changes that are coming in station outlook, largely as a consequence of the Adams fund, and the new relations which it introduces.

The work in the office of the Director has very much increased. While ten years ago the available funds outside of the fixed charges were very small, they have very much increased. The fixed charges, like salaries, etc., cause no particular question to to arise in the office administration. The other, or unassigned sums, introduce a great many questions, and thus, the calls from this source are ten or twenty times as much as they then were. The office work has thus correspondingly increased. The increase in the number of funds has made considerable bookkeeping necessary in the Director's office. It has been necessary to keep an account with each fund in order to foresee the needs and to prevent some of the funds running short. The mailing of the bulletins alone is a serious task. There are now over 16,000 names on the mailing list. An edition of an ordinary 32-page bulletin weighs nearly a ton. The correspondence and routine work have also very largely increased. With the increase in the number of bulletins, a larger amount of space and more system has had to be used in keeping our files. The number of engravings in our different bulletins has so increased that it has become necessary to make special provision for indexing and cataloging the cuts. The increase in the revenue also has introduced a large number of experimental projects and it has become necessary to keep closer account with each of these projects. The increasing value of the stations throughout the United States brings a large variety of correspondence on incidental

questions. The result of all of these is to throw a large additional amount of work into the Director's office, and also upon all of the members of the station staff.

The office work has required three stenographers and clerks and was so divided as to give routine work to each, all under the charge of Miss Murray. Since the first of August we have been short one office helper. The consequence is that some of the routine work which could be postponed has been set aside, but much of this that has been postponed would be better to be kept up. It has thrown a good deal of routine work, especially the dictation, upon Miss Murray, in addition to the many other responsibilities.

Through the activity of Prof. Cottrell in farmers' institutes last year, the names on our mailing list have very materially increased, so that now we have more than 16,000 names on the list. Ten bulletins were issued during the year, amounting to 194 pages, or a total of 2,310,000 printed pages. The bulletins envelopes to mail a single edition cost $50. To lessen this expense, as well as to lessen the labor of mailing, several bulletins are mailed together.

The matter of bulletins brings up a number of serious questions. One is of ways and means, and the other is the scope of the bulletins which we should print. The pressing demand for information, and the attempt of the stations to meet the demand—because there has been no other source—has led to the issuance of many popular bulletins. These have not been scientific in character and consist sometimes largely of compiled information. These have been published in the name of the stations so as to have the advantage of the franking privileges, though the expense of the compilation has been borne by other funds. This has been especially true of Cornell, and this practice has led to misapprehension in other states concerning the scope of the stations where other funds have not been available. There is much doubt whether the Hatch fund should be chargeable with the expense of such bulletins, and I presume, with the development of the stations, which seems to be coming, that objection will be made by the government to such use of the Hatch fund.

The increase in the number of names and the general demand for popular bulletins makes a very large expense. Our printing bill for the fiscal year amounted to $3,000. No way has yet been found to distribute these publications so that many copies will not be wasted. In many states the station funds do not have to stand this expense, as the state prints the bulletins from other funds, and thus the activity of the stations, which results in more bulletins, does not have the effect of cutting down the funds available for work.

Bulletins which come as the result of scientific investigation are, with few exceptions, scientific in character, and usually can

not be expected to be popular, and will have a limited use. It has not, so far, seemed to be practicable to classify the names on the station list according to the subject that they are interested in, and, in fact, I doubt if this is advisable. The Geneva station, of New York, long ago adopted the practice of issuing two sets of bulletins—a popular edition, giving the main contents of the bulletins, but free from all technicalities, and from two to four pages in length. This means editorial supervision, and of a kind which the scientific author is not prepared to give. In that case the longer bulletin is mailed only on request. It has been found, however, that the shorter bulletins answered the purpose of most people. With the increase in our mailing list, and the probable larger number of bulletins, the expense of printing will be an increasingly serious one, and it may be necessary to adopt the Geneva plan or else to lessen the bulletins, which does not seem desirable.

In considering any new line of work and obtaining an appropriation from the State, I consider it very desirable that the sum appropriated should be large enough to cover any printing that would be required and the publication of bulletins. The propriety of using the Hatch fund to pay for printing of inquiries, which are not chargeable to the Government funds, is very doubtful, and if the propriety were not doubtful the expediency is, for, with the increase in the number of investigations which cluster about the Experiment Station, it would soon result that the Hatch fund would become nothing but a printing fund.

Last year a more systematic classification of the projects of investigation was undertaken, and blanks prepared, whereon each investigator outlined the projects which he wished to investigate, and gave definite details. The necessity for this had been increasingly evident, and the definite purpose was twofold. One, to cause each one to make a more definite plan than it had been customary; to consider in advance the definite object to be accomplished, definite methods for that purpose, and an estimate of the cost in time and in money. The second definite purpose was to cause each one to bring before himself a clear idea of the demands in time which his projects would require, and thus to cause him to reduce the number of attempted investigations. The number of questions in this State is so great that the temptation has been to undertake too many. In one case an investigator found that his projects, which he expected to complete in a year, would require nearly three years of his own time and nearly as much of an assistant.

In this, as in previous years, the Director has not attempted to interfere with plans and projects, but to guide and assist, and to cause a clear view of the element cost and time; to know in advance what to expect, and to prevent the entering upon projects which it would be impracticable to thoroughly carry out. I will not need to speak to any extent of the work in detail.

Notwithstanding these improvements in conditions, the same general fact has existed that nearly everyone has been tempted to undertake more than he could carry through. This has been partly due to an overestimate of the time available and an underestimate of the time and work required. The time required by the interference of other duties has almost always been underestimated. Other matters have this year prevented the scientific force from being able to work under the most effective conditions. Activities, as shown by the bulletins, have been maintained, but the scientific activity, which requires rather peculiar conditions, has certainly not been increased.

Some questions relating to this I will speak of more particularly in speaking of the development of the Station.

The revenue of the Station has been as follows:

From the U. S. Government, Hatch Fund	$15,000.00
From the U. S. Government, Adams Fund	8,756.22
From State Appropriations	24,500.00
From Other Sources	9,164.85
Total	$60,421.07

The conditions attached to the governmental funds—of both the Hatch and Adams—are such that they must be completely expended within the fiscal year ending June 30. In case there is any balance it is confiscated. In case there are any bills outstanding they can not be paid. This is true of each fund separately, so that it requires very careful prevision in order to bring them out exactly. The fact that the Adams fund is not even $9,000 for the last fiscal year is because the Department of Agriculture ruled that certain bills could not be paid from the Adams fund. Their previous practice had given reason to think that were proper. These were bill for books, such as Bailey's Cyclopedia of Agriculture, which were too general to be considered as required by specific scientific researches.

The State fund is the appropriation for two years. The Adams fund has special requirements, and, as previously indicated to you, has not had the effect of relieving our finances, but has required other expenditure, in order to take full advantage.

The State fund was that appropriated by the last Legislature, and includes the appropriations for special purposes. The appropriation of the Hatch fund is for

> "the purpose of paying the necessary expenses of conducting investigations and experiments, and for printing and distributing the results."

The Adams fund is

"for paying the necessary expenses of conducting original scientific research, etc."

The scientific investigations provided for by both appropriations need to be supplemented by additional funds. That is, while the experiments of an investigator leading, for example, to the production of a rust-resistant cantaloupe or the production of an improved variety of wheat, may be right and proper under the Hatch fund, the growth of that seed for distribution and its distribution is held as not being an expenditure that would be proper by the Government funds. Likewise, for example, the investigations that have led to the production of black-leg vaccine or serum for hog cholera, may be proper charges on the Government funds, yet, when it comes to the application of these to stock for commercial purposes, it passes the domain considered experimental, to the economic field. This can not be done by the Experiment Station under the Government appropriation, but might be done if other funds are provided. Now it is unnecessary to say that this part of the work is of great importance and needs to be provided for. It brings the work of the Station into actual contact with the economic needs of the farmer, and is a work which is immediately appreciated. It is for such purposes that appropriations from the State or other sources are actually needed. The State appropriations can be given under broad enough conditions, both to expand the work of the Experiment Station and to do this important work, which the Government funds can not be used for, even if they were large enough.

I attach a memorandum of the appropriations as passed by the last Legislature, and suggest that some action be taken to decide on what is desirable for the coming biennial period. The embarrassment which has been caused in the past because the State appropriations were not available until late in the fall is known to you. Our financial situation with regard to these funds is better now than it was two years ago. Having a local treasurer, it is possible to carry some of these funds, so that the balance in each, unless it be the Plant Industry and Animal Industry, will tide us over until the close of the Legislature.

In asking for additional appropriations, I would suggest that the appropriation in each line should be sufficient to pay all expenses, both direct and indirect, caused by the additional work. Thus the Fruit Investigation will illustrate. In this case the appropriation pays not only the traveling, office and other expenses, but also the salaries of the two men who are employed. It is also desirable to pay the expense of printing that is called for by it. The only expense thrown upon the Station and College is, therefore, the time required by the Horticulturist and the Entomologist, and of office work and some minor printing, etc., in all a very small amount.

The arrangement has been different with, for instance, the Plant Industry, where no salaries have been charged to this fund, except the wages of the laborers employed from time to time. In this case, therefore, the aid from the State causes the College to spend a large additional amount of money, and the same thing has been true of some of the other appropriations. I would therefore recommend that the amount asked for for Plant Industry, Animal Industry, etc., should be large enough to pay a proportional amount of the salaries of the men called for. Thus, for instance, the potato investigations for the past two years have been maintained by the College, and a small portion from the Experiment Station. This ought to be provided for by the legislature.

The memorandum is made as a suggestion. An explanation of the memorandum is attached to it.

It is proper to undertake some additional lines of work. Considerable call has been made at times for so-called experimental farms in different parts of the State. There is some good in these if too much is not expected. The community is apt to consider them as model farms, which is different even from demonstration farms or experimental farms. If a demonstration farm, the principal purpose would be teaching—that is, to show the application of principles already well known. A great difficulty is to get capable men. If a sub-station is established the community is apt to consider it as a model farm, and the superintendent is thus judged by the community by the way in which he maintains the place. Each one also expects a specialist who knows more about each crop than the most skilled man in the community. It is impossible for one man to meet all these standards, and especially for the sum of $800 to $1,200 per year, which is usually the amount available. There is, however, a field for demonstration farms or for test farms, in different parts of the State. It is objectionable and misleading to call them experimental farms. They are, however, expensive, and the same amount of money can do much more good in some other ways. The number of people who visit one of these places is small, so that as an educational influence its field is very limited. Calls have been made for such on the Plains. It is found that only a few visit these places, and the advantage, judging from past experience, would not be any better over many selected farms. Eastern Colorado is so big that the same amount of money could reach many more people by collection and distribution of information over that extensive area. Desires have been expressed for some such station in northwestern Colorado.

If it be thought best to undertake anything of this kind the assured income should be not less than $3,000 for each one per year. It would probably be better and more economical to arrange with some farmer in these localities and possibly make a

contract with him so that he will carry out instructions and raise crops as directed under approved methods, and in that case the cost might be brought down. The difficulty then would be for our present force to find time to give the necessary attention. One man might take up this special line of work and enough test farms of this kind be taken in different parts of the State to give him a reasonable amount of employment. In that case the assured income ought to be not less than $1,000 per annum for each. Such a method might avoid the necessity of buying farm machinery, teams and other equipment, which runs very quickly into money, and means a continuing expense to maintain.

The problem of the Plains has been brought up at various times. Some desire has been expressed for a substation there. The present condition calls for distribution of information rather than for additional substations. Their need is immediate. If there were the funds available a series of special institutes or meetings might be of very great value on the Plains, so as to meet the problems to some extent that are confronting the people there. The indications are that many have already moved out and that many more will move out before spring, or be pushed by dire necessity.

HORSE BREEDING WORK.

No report is available concerning the conditions of this investigation. The peculiar form of agreement with the U. S. Department of Agriculture has left the duties of the Director in somewhat ambiguous state, and the Director's office is possessed of little information. There have therefore been no reports in times past concerning the progress of the work, except a very short statement in the annual report. I learned sometime since that the Committee on Purchasing had recommended that a number of these colts be sold, and I obtained a copy of the report by applying to the Department of Agriculture at Washington. The opinion of all concerned is that the quicker these are sold the better, as it would relieve the investigation of the care and maintenance of these animals. The money derived from the sale of these colts would be returned to the Station or College as a portion of the cost. As the matter is somewhat in doubt, I bring it to you for action to order the sale of these animals, or to authorize the Director to take action. The sale might be either by public auction or a private sale. In the latter case a minimum price might be fixed. A third method has been suggested and that is to send these animals to Chicago or Omaha, so that their identity might be lost, and thus they could not be represented as being from the Government breeding station here. When this contract with the Government comes for revision I would be inclined to suggest some minor changes. As an administrative matter there should not be ambiguity concerning those relations to the Station and to the College. The

present ambiguous condition has rendered it possible to interpret so that knowledge of the development or progress has not been on record either in the office of the Secretary, President or Director.

FUTURE DEVELOPMENT OF THE STATION.

A large part of the recent meeting of the College and Experiment Stations was taken up with the consideration of the question of research, and Station organization and policy. These questions have become of greater importance with the changes brought about by the Adams fund. Nearly all of the Stations are feeling the effects. A noticeable fundamental effect is the changed outlook upon scientific work. The Hatch appropriation was considered as secondary to college work. The tendency was to take up chemical work or entomological work, or any other line, because the College had a chemist or an entomologist. The fund was looked on somewhat as a means to obtain superior men for College work and to help pay them. The fund was therefore looked upon as an addition to the College.

The Adams act and its requirements change this. It now makes the scientific project the unit and bigger than the man The chemist, for instance, is now employed because chemical investigations are required. The changes thus introduced in the outlook of the Station and its relation to the College will be fundamental, and will cause the Experiment Station of the United States to occupy a very different position in the course of a few years. It is not at present a question whether we look on these changes as desirable. They seem to be inevitable if the law remains as it is, and there seems to be no probability that any change will be made. With the increased revenue of the Stations, and this change in outlook, and the additional supervisory power given to the Department of Agriculture, the Stations will become more and more institutes of research in the narrow sense. The requirements of the Adams bill will react upon the Hatch fund, and will undoubtedly alter the view of many scientific investigators.* There is no doubt that we have been undertaking too much and that much more has been attempted by each man than he could do. The work of teaching has generally been considered primary, and such investigational work as has been done has been done at odd times or in vacations and as a secondary matter. If there was conflict the teaching kept the first place, and this meant that the Station work suffered.

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*In the Experiment Station Record for December, issued since this report was read, the U. S. Department of Agriculture says that a stricter interpretation will be given the Hatch Act, and "no longer to permit expenditures from that fund for Farmers' Institute work, extension teaching or the preparation of compilations."

It is to be expected that the Government will require the Institutions to provide the best conditions for scientific work, and that the men who are on the Adams fund must consider this work as primary. If there be conflicts between the scientific work and teaching, for instance, then the Government is in position to insist that the scientific work shall not suffer. These changed conditions, therefore, are affecting other Stations as well as our own, and makes this a period of transition from the former loose basis to the future one where scientific investigations will be primary. The Stations are working this out, but as yet have not all reached the same conclusions as to method.

The general recommendation for carrying out the policies is toward reducing the number of lines of work; to select a few important subjects and then to let the work of the various men cluster about these projects. This prevents some of the distribution of effort on unimportant work, which may seem to be popular, but is unimportant in the long run. The tendency is to reduce the amount of teaching. Nearly every investigator is also a good teacher, and, under pressure of demands as well as his own impulse, he is apt to teach more than is desirable. Teaching even an hour a day breaks up the continuity of the investigator's work of the highest class. Extension work and work of Farmers' Institutes, and likewise work which is called popular, is apt to be in conflict. There is often pressure for Stations to do inspection work, as the inspection of fertilizers, injurious insects, animal diseases, etc. All of these are proper in their own line, but also are considered objectionable. Each of these questions bring up serious matters for consideration. Some Colleges are taking the position that the Experiment Station should be entirely separate from the College, and thus have, for example, two chemists and a duplication of other officers, so that the teacher does not investigate and the investigator does not teach. It is in this way that some of the Institutions interpret the provision of the law that the Station shall be a department of the College. In others, like our own, the Station work is a part of several departments, and the various departments are the unit. There is carried on in each department both teaching, investigation and extension work. While the majority of institutions are separating the Stations, I am inclined to think that our arrangement is better for our conditions, at least for the present, both for the College and for the Station.

A Committee of six of the most prominent Directors in the United States formed a committee on Station organization and policy. Their report, or even their conclusions, is too long to repeat. Concerning inspection work the committee recommend that this be kept entirely separate from scientific work, and that if it be undertaken that it be from separate

funds. They recommend that the investigator should be free from the routine of teaching, and further recommend in their conclusions that the ideal policy would be for the investigator to be free from such responsibilities, and, as a step, that the teaching be limited to a maximum of three hours per week for one term in each year, and that this be along the lines of his specialty.

This report and also the report by the Committee on Scientific Research, of which David Starr Jordan, of California, was chairman, will be read in full to the members of the Station Staff.

The reprint of this Committee is too long for quotation, but their conclusions which were accepted as the conclusions of the association deserve weight as the conviction of men who are giving much attention to these problems, and is worth quotation as bearing on the general question of Station policy reached in the study of relation between research and administration and also upon the matters affecting the continuity of Station work.

RELATION BETWEEN RESEARCH AND ADMINISTRATION.

"(1) The station exists primarily for research in the interest of the public service. If, however, this research is to be made effective there must be administration as well as investigation, and both reason and the dictates of justice demand that the scientific worker and the administrative officer be mutually sympathetic and helpful each to the other.

(2) The unit of work is the individual, and nothing should come between him and his research. That organization is best, therefore, which most accurately defines the field of each station worker, protects him in his investigations within that field, insures funds and equipment for the pursuit of research, and in the end secures results that are useful to the public that pays the bills.

(3) Administration as such does no work. At best its function is correlation as between internal interests on the one hand and as between these and the external or public interests upon the other. In theory all administration means delay and some necessary interference with individual initiative. This is unfortunate, but inevitable, though its compensation lies in the increased certainty that interests will not clash within and that the public needs may be well served, an end that requires the counsel of many minds. In interests of work, therefore, the less administration the better, if only the proper ends are attained, but workers must recognize the necessity of something like organization, which means administration.

(4) The chief functions of administration in respect to a piece of investigation may be enumerated as follows:

(a) To help to determine in advance whether the proposed research is profitable and altogether advisable from the stand-

point of the public, whose representative for the time being the administrative officer must be.

(b) To assist in determining what lines of experimentation are calculated to throw profitable light upon the problem.

(c) To help to determine whether the work is best carried on by one individual representing a single line of inquiry, or by two or more working in conjunction, and if the latter, to secure in advance a complete understanding as to mutual duties, rights, and responsibilities. Upon all these points the judgment and the point of view of the administrative officer is not only likely to be broader, but certain to be freer from personal bias than is that of the professional investigator.

(d) The experiment once decided upon, however, and the funds provided, administration is over until results are due, when it begins again and does not cease till reports are published and circulated. The less administration during the progress of the work the better for all interests, and if the need of it becomes clear it is the best of evidence that administration was remiss at the outset. Your committee cannot too strongly point out the necessity of the entire freedom as to methods of investigation on the part of the staff worker who has been employed because of his expert knowledge of the matter and methods of work in a highly specialized field.

(5) To secure these two ideals of administration efficiency and sympathetic helpfulness without interference requires for administrative officers men not only of good business methods and large outlook, but also with the highest obtainable training along some important line of science as related to agriculture.

(6) If the organization be large the department plan will of necessity be employed, and administration will be exercised largely through the head of the department. Besides his administrative function the department head will have, or should have, a special line of his own, and as he himself values a free field with no interference, so should he accord the same privilege to every member of his department; that is, he should take no advantage of his administrative superiority to invade the field of work of another. Such an individual, exercising the double function of administration and work, must needs exercise great care as to when he operates under the one capacity and when under the other.

(7) This principle is best fixed by an illustration in a large department, containing men of all degrees of proficiency, from the novice with the title of assistant up to the skilled investigator with a title equivalent to that of full professor. Over the one the department head must needs exercise much supervision, even to the point of daily direction, but over the other he only injures the work by presuming to direct. The point is that when an officer, holding the double function of worker and of administrator, directs the work of another he does it not

as an administrative officer, but as a department superior directing his assistant.

(8) The principle applied to the director means that as director he is not responsible for and should not attempt to control, much less direct, the details of procedure in a scientific investigation. Again, the principle gets its best illustration in a case where the staff worker is not only entirely capable of conducting the details of research, but is greatly the superior of the director himself as to skill in scientific method. Such cases are not rare; indeed, if our stations were equipped, as they should be, with large numbers of strong and independent men, this would be the common occurrence, in which case the director could not presume to expert knowledge in all its various fields of research and experimentation.

(9) If the station be small, the director occupies much the position of a department head, and if the workers are young and inexperienced, he will of necessity keep close to the work. Nevertheless, it is even then better for the director to carefully refrain from exercising administrative pressure or authority in respect to investigations and couch his influence in terms of advice and sympathetic assistance. This is the only way to develop strong investigators from young men, as it is the only way to deal with investigators if they are strong already, and until we can fix the principle that in station work the labors of the scientist shall be free from administrative interference, we shall not be able to attract into agriculture the ablest men or to hold them when we get them. Your committee is credibly informed that instances are not wanting in which good men have left the work because the director felt free to criticise, even to direct, in scientific details about which he knew practically nothing.

(10) As a means of establishing and maintaining a strong organization without a galling and depressing effect of too much administration, three things are helpful: First, that every administrative officer fully respect the position of every other, whether superior or inferior, and never go around him for any purpose whatever; second, that a regular succession of administration be established, so that, in the absence of any officer, another at once steps into his place, exercising not quasi, but actual, authority so long as he occupies the position, all of his acts to be as fully respected as are those of the regular appointee; and, third, that there be frequent and full conferences between administrative officers and all others where work and administrative duties come together. In all these ways a full understanding will be assured, and nearly everybody, at some time or other, will get some experience with administration.

(11) The committee does not favor a weak organization, but, on the other hand, one that is strong enough to recognize the interests of the whole Station as above those of any other department or separate interest, and strong enough to enable the entire

influence of the whole body to be exerted in any desired direction on short notice. If this is to be accomplished, everybody must feel free, and not the object of arbitrary rulings. The test of the esprit de corps of such an organization is whether or not it will support, as it should, a position that needs to be taken by the highest administrative officers."

CONTINUITY OF STATION WORK.

"The following are claimed to be some of the frequent causes of lack of continuity of effort:

(1) Too frequent changes in the working force.

(2) The dropping of work before its completion in the effort to meet some actual or supposed popular clamor for new lines of investigation.

(3) Insufficient and too infrequent advances in the salaries, particularly of the older men, and their consequent withdrawal to accept more lucrative positions elsewhere.

(4) Lack of equipment and facilities for investigation; for example, the lack of fields for experimental work at the outset, involving shifting from one place to another; also delay in undertaking some of the most vital problems and the necessity of taking up less important lines of work as temporary expedients.

(5) Government by a Station council rather than by a director, resulting in a change of policy with changes in the personnel of the council.

(6) The assumption, in some cases, of the function of the director by the president. For example, relief of the director from all financial responsibility, a policy which deserves strenuous discouragement.

(7) The amount of teaching and extension work required of Station officers.

(8) The forcing upon the stations of men in the colleges who are not adapted to do research work.

(9) The occasional appointment of incompetent men as directors or heads of departments, which necessarily involves poorly planned experimental projects and necessitates changes at a later date; also the appointment of politicians and of others for political or personal considerations.

(10) Occasional sudden changes of entire boards of management in certain states and territories, resulting frequently in abrupt and most serious changes in policy.

(11) Undertaking too many lines of work and attempting to cover too wide a field."

Under the terms of the Adams act the projects undertaken are subject to the approval of the Government, and, after once undertaken, it is then almost necessary for the Station to carry them through. We are limited in the expenditure of money to

the approved projects and to the necessary equipment and expenses in connection therewith. This helps to force a continuity of effort and carefulness in planning. Thus, last winter, when it became evident that some lines of work which had been planned in plant diseases could not be carried out by Professor Paddock, this pressure made it necessary to consider how the work could be carried on, and led eventually to the necessity of obtaining a special bacteriologist, Mr. W. G. Sackett, who was employed entirely at the expense of the Adams fund, and who gives his entire time to Adams fund investigations. There has been considerable desire for him to teach, but, manifestly, this could not be done until arrangement was made for paying at least a corresponding part of his salary from other than Station funds. The arrangement with Mr. Sackett was that he was to come at $1,600 per year, and that, if satisfactory, he should be raised to $1,800 by the end of the year; and, as this has been the case, I would recommend that, starting from the first of January, his salary be $1,800 from the Adams fund. If it be desirable that he teach during the winter term, then that $1,500 be paid from the Adams fund and $300 from the College funds.

Some of the special problems which are brought about by our Station organization are those relating to the staff and the calls of the College. There are some who are paid only a small amount from the Station, and some who are paid none at all, and some who are paid a large amount from the Station. The tendency has been to increase the amount paid by the Station to those who are devoting a large part of their time to scientific work, and especially to Adams fund work. The general experience seems to be that it is better to obtain fewer men and to pay a larger part of their salaries from this fund. The pressure toward reducing the amount of teaching necessarily means that some others in the same department must spend a larger amount of time in teaching. This creates some dissatisfaction, as there is a triple standard to which the different members are held. Some are inclined to think that the whole duty of the professor is to teach. People who attend the farmers' institutes are disappointed unless they hear the heads of the departments. The larger world will judge a man by his Experiment Station investigations. It is impossible for the heads of departments to meet all of these demands. The tendency has been for one to still be the responsible head and to direct the general work, and to be relieved of some of the routine work, so as to be able to give such time to the problems on which he is working. The general conditions may force a reduction in the number of the Experiment Station staff, but this is not, perhaps, to be desired. There are, however, a number who have been paid a small sum—for instance, $100 per year—partly as a means of saving embarrassment in the departments. It is a question whether, from the Station standpoint, this course is advantageous. As it has been in the past, the Station men have

received less pay than those on the College, where the requirements are greater, and, as a whole, they have been held to more strenuous requirements; so, in departments where some men are on the Station roll, some on the College, the fact that the College men are relatively free concerning their hours, and may be entirely free during the summer vacation, has sometimes caused complaint among the Station men. It is undoubtedly proper for the College to aid the Station, either by direct appropriation or by paying men who may be assigned for more or less of their time to Station work. The law, however, does not permit the Station to pay men for the purpose of aiding the College. It might be considered that the expenditure by the College has been more than offset by the fact that the Station appropriation enables the College to do work that its own funds have not been sufficient to do. I doubt if the practice of paying a small sum to meet this embarrassment is good policy. The embarrassments that have arisen in times past have been brought to your attention before. They involve some questions of College policy, and may lead to a question of special understanding with each person. So far as the question involves the Station, the embarrassment may be relieved if the Board should see fit to rule that those who are in departments forming sections of the Experiment Station should be under the direction of their chief during the summer as well as during the rest of the year. There would still remain some dissatisfaction as between such departments and those where work is not carried on at all during the summer.

The adjustment of teaching so as to be of best value to the department and Station is another matter that will gradually work its way out.

Is it proper for the Station to print popular bulletins of information, especially from the Hatch fund? There is undoubtedly a call for these. How is that to be met and to what extent should Station people do such work? There is undoubtedly a feeling among Station men that the so-called popular work is not the proper work for the Station investigator, and it is evidently the belief that fundamental work is of more importance. There is also a lingering doubt in the minds of Station workers of the expediency of trusting themselves too entirely to scientific work because of the feeling that there is not at present a proper recognition by the public and by the Boards of Control of what constitutes scientific work and therefore proper moral support.

Foreseeing these questions I have given a good deal of thought during the past few years to the development that was eventually coming. In many cases I have not reached conclusions that I am satisfied are best. The change, however, is taking place as fast as conditions require it, and all the Stations in the United States are working at the solution of the same general questions. As I called to your attention some

years ago, the fact of the passage of the Adams act would not be to relieve the College finances as was hoped, but increased our responsibilities more than it increased our revenue.

The tendency undoubtedly will be to reduce the lines of work, but may require as many, if not more, people. Thus, for instance, in the past we have done something concerning alkali from the chemical side, because we had a chemist on the Station. Now the tendency would be to take up the alkali question, for instance, and then the different members of the Station would work in unison upon that problem. The chemist from the chemical side taking up the chemical features; the bacteriologist the side of bacteria of alkaline soils; the irrigation engineer from the standpoint of drainage and of prevention, and perhaps the botanist from the standpoint of determining what vegetation may be grown on alkaline soils, etc.

Thus with this development the different Stations would take up different general questions. Some Stations become known for their work in feeding, and the results of such investigations would be valuable everywhere; other investigations in fruit questions; and other investigations in poultry culture.

Our conditions in this State, the development of our State, has made irrigation the foundation question, and our natural development is on the lines related to it. This does not mean that such is the only question, but on it we stand under unique conditions.

RECOMMENDATIONS.

The general statements above show in some degree the character of the questions that have had to be considered in a broader way in the year past, and some of the tendencies which I think are affecting us, and will cause a readjustment of Station work. We will have to settle some of these in the light our own conditions. Many will settle themselves as fast as can be expected.

There are comparatively few matters that I have to bring up for direct recommendation. One is concerning the salary of Mr. Sackett, that provision be made to raise it from $1,600 to $1,800 per year, beginning with the first of January.

I would recommend that a determination be made of what should be asked from the Legislature. This list attached is simply a memorandum as a basis for consideration.

In the above report I have called attention to conditions, but have not attempted to make specific recommendations, for most of these I think are in condition to solve themselves, with some patience and some guidance.

As a whole the problems in this State are interesting and important in character, and the work that the Station has done has met recognition both here and elsewhere. In the long run

the Station will be judged by the work of a thoroughly scientific character, which may or may not be popular at the time. It is, however, this kind of work that is the fundamental work for the Station's usefulness. The so-called popular work must be founded on the scientific work, and the scientific work must, therefore, go ahead of the popular work.

The distribution of the results through extension or demonstration work, is a duty that is owed to the people, but, as I have attempted to show, is only to a limited extent chargeable to the Government funds, therefore, must be supplemented by State appropriations or other sources of revenue.

Prospects are bright, and while the Station and its work is in the transition period, yet it will be worked out under conditions as they develop with the purpose of being of the greatest value to the agricultural interests of the State.

The reports of the separate sections are collected and give many details of work not here referred to. Request was made early in October for reports, but none were presented by those whose responsibility ceased in that month.

Respectfully submitted,

L. G. CARPENTER,
Director.

NEEDS.

1. Fruit Investigation, past appropriation $8,000, only sufficient for the payment of the men at Delta and Grand Junction. The scope of the bill is broader and something ought to be done in other parts of the State. The amount ought to be at least $10,000.

2. Plant Industry, for the last two years $6,000. This does not pay any salaries, and includes $2,000 for building. This amount is not large enough, and ought to be either $8,000 or $10,000.

3. Animal Industry, $6,000 for the past two years. It ought to be as much for the coming two years, or probably more. The previous sum was available both for investigations concerning stock, also concerning feeds and feeding. The feeding problem is important enough to be considered separately, and I would recommend that a separate sum be asked for experiments in feeds and feeding.

4. The potato investigation did not have an appropriation the last biennial period. We had $1,000 for the biennium before. The Experiment Station has paid $600 of the salary of Mr. Bennett, and the College has paid the rest of the sum. Part of the expenses have been borne by the Station. This work is largely of the nature of teaching and extension work. This work should require for the

two years $6,000. This would only allow $1,200 besides salary, and would be sufficient to publish one bulletin, and pay the field expenses.

5. Animal Diseases. $500 received for the last biennial period. The development of the Veterinary department has largely taken the time of Dr. Glover. If an appropriation could be had there might be a start made in the distribution of serum for hog cholera, and special investigation of other diseases. This serum distribution is not a proper charge on the Experiment Station funds.

6. Farm Mechanics, $2,000 received during the past biennial period, of which one-half was used for building. There is still a balance of $600.

7. Horse Investigation, $5,000 was received. There are beginning to be some receipts, but nowhere near enough to maintain this breeding work. There ought to be as much more available during the next two years. There is a balance of $1,500. No salaries have been charged to this fund. There was $1,000 used for land; a large part of the rest has been used for equipment in the way of sheds, feeding racks, fences, etc.

8. Irrigation Investigations. Nothing was asked for in the previous period. This can be one of the most fruitful lines, and a systematic investigation of the water resources and application of water would be of very great benefit, and I would therefore recommend that from $6,000 to $10,000 be asked for for this purpose.

9. Lands. This previous bill provided for $7,500 for lands. The College is in debt for a large amount and it would be desirable to obtain as much as possible.

10. Building and equipment of the Irrigation Building. To complete and equip the building would require at least $70,000.

FINANCIAL REPORT OF THE COLORADO AGRICULTURAL EXPERIMENT STATION FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

RECEIPTS.

DR.

From the Treasurer of the United States, as per appropriations for the fiscal year ended June 30, 1908, under acts of Congress, approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund)	Hatch Fund.	Adams Fund.	State Fund.	Special Fund.	Totals.
	$15,000.00	.....	.....	.....	.....
	.....	$ 8,756.22	.....	.....	.....
Appropriation by State Legislature	.....	.....	$27,500.00	.....	.....
Balance on hand July 1, 1907	.....	.....	.....	$ 842.33	.....
*Transfer	.....	.....	.....	3,716.18	.....
Other sources than the United States	.....	.....	.....	9,164.85	.....
Total receipts					$64,979.58

DISBURSEMENTS.

	Hatch Fund.	Adams Fund.	State Fund.	Special Fund.	Totals.
By Salaries	$ 9,273.16	$ 5,749.78	$ 1,647.50	$ 1,045.00	$17,715.44
Labor	620.80	5.45	1,548.86	867.43	3,042.54
Publications	3,042.55	.....	.....	.....	3,042.55
Postage and Stationery	337.94	9.32	212.45	62.55	622.26
Freight and Express	112.20	107.58	192.78	214.19	626.75
Heat, Light, Water and Power	.....	120.64	14.85	16.00	151.49
Chemical Supplies	137.80	175.35	1.00	14.90	329.05
Seeds, Plants and Sundry Supplies	48.58	103.17	420.26	57.53	729.54

Fertilizers	.....	.....	.....	.....	.....
Feeding Stuffs	.....	.....	1,084.89	434.77	1,519.66
Library	165.86	25.53	.....	107 23	298.62
Tools, Implements and Machinery	2.75	3.00	56.10	557.30	619.15
Furniture and Fixtures	565.60	555.35	17.80	111.75	1,250.50
Scientific Apparatus	37.97	942.25	98.23	51.36	1,129.81
Live Stock	.....	15.80	1,652.34	1,642.39	3,310.53
Traveling Expenses	489.79	493.00	251.90	446.70	1,681.39
Contingent Expenses	15.00	.....	343.78	184.25	543.03
Buildings and Land	50.00	450.00	1,943.85	602.35	3,046.20
Total Expenditure	$15,000.00	$ 8,756.22	$ 9,486.59	$ 6,415.70	$39,658.51
†Transfer			4,986.02		4,986.02
			$14,472.61		$44,644.53
Balance			13,027.39	7,307.66	20,335.05
			$27,500.00	$13,723.36	$64,979.58

*Special appropriation by State Legislature for the two years from December 1, 1906, to November 30, 1908, inclusive.

†To reimburse for funds advanced before funds provided for by Legislative appropriation became available.

Advanced from College Funds.....$1,269.84

Advanced from Special Funds..... 3,716.18

Transferred from Appropriation.....$4,986.02

BULLETINS ISSUED DURING CALENDAR YEAR OF 1908.

No. 126. Cantaloupe Breeding, by P. K. Blinn.

No. 127. Climate of Colorado, Temperature 21 Years' Record at Fort Collins, by L. G. Carpenter and R. E. Trimble.

No. 128. Alfalfa Studies, Progress Report, by P. K. Blinn.

No. 129. Extraction of Beeswax, by F. C. Alford.

No. 130. The Evergreen Trees of Colorado, by B. O. Longyear.

No. 131. Arsenical Poisoning of Fruit Trees, by Wm. P. Headden.

No. 132. Destruction of Concrete by Alkali, by Wm. P. Headden.

No. 133. A Few Orchard Plant Lice, by C. P. Gillette and E. P. Taylor.

No. 134. Orchard Plant Lice and Their Remedies, by C. P. Gillette and E. P. Taylor.

No. 135. Australian Salt Bush and Notes on Russian Thistle, by Wm. P. Headden.

BULLETINS ISSUED DURING YEAR 1908.

No.	Pages.	Edition.	Total No. of Pages.
126	10	15,000	150,000
127	12	15,000	180,000
128	8	15,000	120,000
129	16	15,000	240,000
130	32	15,000	480,000
131	28	15,000	420,000
132	8	10,000	80,000
133	48	5,000	240,000
134	16	15,000	240,000
135	16	10,000	160,000

EXCHANGES.

BOOKS, PAMPHLETS, SCIENTIFIC PROCEEDINGS, ETC., 1908.

AUSTRALIA:

Journal of Department of Agriculture, Victoria.

Bulletins 31-40, inclusive.

AUSTRIA:

Sugar Beet Seed Breeding Station.

CANADA:

Appendix to Report of Minister of Agriculture; Experimental Farms.

Bulletins 57, 58, 59, 60.

Experimental Farm, Lethbridge, Alberta; Alfalfa Growing.

Le Naturaliste Canadien.

Annual Report of Department of Agriculture, Province of Saskatchewan.

Report of Cattle, Horse and Sheep Breeders' Association.

Report of Department of Agriculture and Immigration.

CUBA:

Circular 27, Black Leg and Vaccination.

Circular 29, Wounds of Animals and Their Treatment.

Bulletins 9, 10, 11.

ENGLAND:

Bulletins 177, 178, 179, 183, 187, 188, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204.

Circular 18.

Production of New Types of Forage Plants, Clovers and Grasses.

Report on Injurious Insects in Midland Counties.

Journal of Royal Horticultural Society.

FRANCE:

Journal d'Agriculture Protique, Paris; September, October, November, December.

FINLAND:

Berattelse ofver Skadeinsekters upptradande i Finland.

GERMANY:

Station fur Pfanzonschutz ozu Hamburg Sonderdruck 5.

Station fur Pfanzonschutz ozu Hamburg Sonderdruck 3.

Station fur Pfanzonschutz ozu Hamburg Sonderdruck 4.

Station fur Pfanzonschutz ozu Hamburg Sonderdruck 9.

Notizblatt des Konigi botenischew Gartens und Museums zu Berlin—Gaglenn, Index and Appendix 1 to 9.

Bulletins 1 to 42.

EXCHANGES—Continued.

INDIA:

Memoirs of the Department of Agriculture in India.

Annual Report of Agricultural Chemist.

The Agricultural Journal of India.

ITALY:

R Stazione Di Patologia Vegetale, Studi sul Marciune delle radici nelle viti fillosserate.

Bolletino della Arboricoltura italiana.

JAMAICA:

Department of Agriculture.

JAPAN:

Bulletin of the Imperial Central Agricultural Experimental Station, Japan.

The Insect World, Gifu, Japan.

MEXICO:

El Agricultor Mexicano La.

La Reproduction Del Ganado Vacuno, Chihuahua.

Algunas Plantas Forrajeras.

Veinte Plagas De La Agricultura.

Los Silos Economicos.

La Canagria.

Cantidad De Agua Necessaria Para Riegoo.

NEW SOUTH WALES:

The Agricultural Gazette, Sydney.

Report of Second Session, Legislative Assembly; Botanic Gardens and Government Domains.

Improvement of Cereals by Crossing and Selection.

NEW ZEALAND:

Extracts from Fourteenth Annual Report; Reports of 1906, Experiment Station.

Bulletins 1, 2, 5, 10, 12, 16, 17, 18, 19.

Leaflet 10.

Agriculture in New Zealand.

Fifteenth Annual Report of Department of Agriculture.

Poultry Report.

Report of Division of Biology, Horticulture.

New Zealand Official Year Book.

Agriculture in New Zealand.

Immigrants' Guide and Settlers' Hand Book.

EXCHANGES—Continued.

SOUTH AMERICA:

Boletin da Agricultura. Sao Pauls.

Boletin del Ministerio de Fomento, Lima, Peru.

Boletin del Ministerio de Agricultura, Biunos Aired.

Boletin da Agricultura.

Boletin del Ministerio de Fomento, Lima, Peru,

A Lavoura Boletinda Sociedade de Agricultura; December, January.

Boletin da Agricultura.

Boletin del Ministerio de Fomento, Lima, Peru,

Boletin da Agricultura.

A Lavoura, Boletin da Sociedade Nacional de Agricultura.

Boletin del Ministerio de Fomento.

O Criador Paulista.

Boletin de Agricultura.

Boletin da Instituto Agronomico.

Boletin y Registro Official de la Dirrecion Obras Publicas e Irrigacion

Anales de Muses Nacional.

Ballettino Arboricottura Xlatiana.

Cronica Agucila.

SOUTH AUSTRALIA:

Journal of Department of Agriculture of South Australia.

The Codling Moth; Results of Experiments with Arsenate of Soda.

Butter and Cheese Factories, Milk Stations and Condensories.

Bureau of Horticultural Inspection, New York.

Transactions of Massachusetts Horticulture Society.

Journal of Department of Agriculture of South Australia. (Adelaide.)

Bulletin 27; Roseworthy Agricultural College; Second Report on the Permanent Experimental Field.

Bulletin 29; The South Australian Wheat Yield Season.

Report of Department of Agriculture and Intelligence.

Boletin del Ministerio de Fomento.

Notes on Agriculture in South Australia.

SOUTH AFRICA:

The Transvaal Agricultural Journal.

SPAIN:

The Great Millet or Sorghum in Madras; Bulletin 55.

SWEDEN:

Tidskrift No. 405.

No. 12, Uppsatser Praktisk Entomologi, Stockholm.

No. 13, Uppsatser Praktisk Entomologi, Stockholm.

EXCHANGES—Continued.

No. 14, Uppsatser Praktisk Entomologi, Stockholm.

No. 15, Uppsatser Praktisk Entomologi, Stockholm.

No. 16, Uppsatser Praktisk Entomologi, Stockholm.

No. 17, Uppsatser Praktisk Entomologi, Stockholm.

Handlinger Och Tidskrift, Stockholm.

Journal of Agriculture, Volume 4.

Chemistry as a Factor in Agriculture. (Melbourne.)

Journal of Agriculture, Volume 3.

Closer Settlements Regulations Governing the Acquisition and Disposal of Lands.

The Victoria Settlers' Guide and Hand Book of the Land Laws.

Orchard Pests and Their Treatment.

The Journal of Department of Agriculture, Volume 5.

UNITED STATES:

Annual Report (30th), Providence Public Library.

Annual Report (31st), State Board of Health, New Jersey.

Annual Report of State Board of Horticulture of Missouri.

Annual Report of Michigan State Board of Agriculture.

Bulletin, Georgia Department of Agriculture; Commercial Fertilizers.

Bulletin, Department of Agriculture of Pennsylvania.

Bulletin, Marathon School of Agriculture, Etc., Wausau, Wisconsin.

Bulletin, North Carolina Department of Agriculture; Report of Farmers' Institute.

Bulletin, North Carolina Department of Agriculture; Stock Feeds.

Bulletin No. 14, New York Botanical Gardens, No. 19.

Bulletin, State Horticultural Society; Plants of Iowa. (Des Moines.)

Bulletin, State Board of Health of Maine.

Bulletin, Wisconsin Natural History Society.

Bulletin, North Carolina Department of Agriculture.

Cornell Rural School Leaflet; Ithaca; Nos. 1 and 2.

Crop Reporter.

Clarkson Bulletin.

Colorado Scientific Society; Esperanto and its Availability for Scientific Writings.

Department of Agriculture of Alabama; Report on Fertilizing and Soil Surveys.

Department of Agriculture of Maine; The Orchards of Maine.

Florida Quarterly Bulletin, Tallahassee, Florida.

Georgia State Board of Entomology; Circular No. 6.

Georgia State Board of Entomology; Bulletin 25.

EXCHANGES—Continued.

Georgia State Board of Entomology; Peach Leaf and Yellows.

Georgia State Board of Entomology; Circular No. 8.

Journal of New York Entomological Society, New York City.

Journal of New York Botanical Garden.

Kentucky Crop Report.

Laboratory Bulletin 13, Oberlin, Ohio; Development of Nestling, etc.

Long Island Agronomist.

Maine Department of Agriculture.

North Carolina Department of Agriculture; Feeding Stuff Laws.

North Carolina Department of Agriculture.

Pure Products.

Proceedings of the Colorado Scientific Society.

Plants of Iowa; Bulletin of State Horticultural Society.

Production of Lumber, Lath and Shingles.

Report of Secretary of Canadian Seed Growers' Association, Ottawa, Canada.

Report of Kansas State Board of Agriculture.

Report of Kansas State Board of Agriculture.

Report (18th), Missouri Botanical Gardens.

Report of the Kansas State Board of Agriculture.

Report of the West Virginia State Board of Agriculture.

Report and Catalog of Louisiana State Museum.

Report (4th), Biennial, Montana State Board of Horticulture.

State Crop Pest Commission of Louisiana; Circulars Nos. 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21.

Smithsonian Institute; United States National Herbarium Studies of American Tropical Ferns.

Training School.

Transactions of Iowa Horticultural Society.

Transactions of Massachusetts Horticultural Society.

Therapeutic Notes.

Tuberculosis in France; Daily Consular and Trade Reports.

University of Illinois Bulletin; A Study of Roof Trusses.

University of Illinois Engineering Experiment Station; Comparative Tests of Carbon, Metallized Carbon and Tantaleum Filament Lamps.

University of Illinois Engineering Experiment Station Bulletins.

Wilson Bulletins.

Wisconsin State Horticultural Society. (Spraying.)

Year Book, Rubber Planters' Association of Mexico.

Zoological Bulletins.

EXCHANGES—Continued.

SCIENTIFIC PERIODICALS:

Insect World, Gifu, Japan.

Kungle, Landtbrusk-Akademiens Handlinger Och Tidskrift, Stockholm, Sweden.

Le Naturaliste Capadieu, Chicoutimi, Quebec, Canada.

AGRICULTURAL JOURNALS:

American Miller, Chicago.

American Farm World, Augusta, Me.

Agricultural Southwest, Wichita, Kan.

American Sugar Industry and Beet Sugar Gazette, Chicago.

Agricultural Advertising, Chicago.

Agricultural Epitomist, Spencer, Ind.

American Hay, Flour and Feed Journal, New York.

American Fertilizer, Philadelphia.

American Farm Review.

Colorado Fruit Grower, Paonia.

Colman's Rural World, St. Louis.

Elgin Dairy Report, Elgin, Ill.

Farm Scientist, Chicago.

Farmers' Guide, Huntington, Ind.

Farmer and Breeder, Sioux City, Iowa.

Farmers' Tribune, Sioux City, Iowa.

Farm Stock Journal, Rochester, N. Y.

Fruit Grower, St. Joseph, Mo.

Farmers' Advocate, London, Ont.

Farmers' Review, Chicago.

Farm Stock and Home, Minneapolis, Minn.

Farm Progress.

Farm and Stock, St. Joseph, Mo.

Farm Life, Chicago.

Farm and Home.

Farmers' Digest.

Fruit Grower, St. Joseph, Mo.

Homestead, Des Moines, Ia.

Indiana Farmer, Indianapolis.

Kimball's Dairy Farmer, Waterloo.

Live Stock and Dairy Journal.

Missouri Agricultural College Farmer, Columbia, Mo.

Metropolitan and Rural Home.

Modern Farmer, St. Joseph.

EXCHANGES—Continued.

Modern Miller.
Minnesota and Dakota Farmer, Brookings, South Dakota.
Modern Farming, Richmond, Va.
Jewish Farmer.
Iowa Horticulture.
New Southwest, The, St. Louis, Mo.
National Farmer and Stock Grower, St. Louis.
New Zealand Dairyman, Wellington, N. Z.
Nebraska Farmer, Lincoln, Neb.
National Stockman and Farmer, Buffalo, or Chicago.
Nebraska Farm Journal, Lincoln, Neb.
Nut Grower, The.
Oklahoma Agriculturist, El Reno, Okla.
Practical Fruit Grower, Springfield, Mo.
Pacific Fruit World, San Francisco.
Poultry Husbandry, Waterville, New York.
Prairie Farmer, Chicago.
Planters' Journal, Memphis, Tenn.
Ohio Farmer, Cleveland, O.
Orange Judd Farmer, Chicago, Ill.
Ruralist, The, Sedalia, Mo.
Rural Home, New York, N. Y.
Rural New Yorker, N. Y.
Rural World.
Rural Advocate, Battle Creek, Mich.
Ranch News, Denver, Colo.
Strawberry, The, Three Rivers, Mich.
Southern Farm Magazine, Baltimore, Md.
Southern Agriculturist, Nashville, Tenn.
Successful Farming, Des Moines, Iowa.
Station Farm and Dairy, Sydney, N. S. W.
Surface Creek Champion, Cedaredge, Colo.
Southern Planter, The, Richmond, Va.
Texas Farmer, Dallas, Tex.
Wallace's Farmer, Des Moines, Iowa.

NEWSPAPERS:

Fort Morgan Times, Fort Morgan, Colo.
Illuminated World Life.
Mark Lane Express, London, England.
Palisade Tribune, The, Palisade, Colo.

EXCHANGES—Concluded.

Pueblo Chieftain.

The Republic, St. Louis, Mo.

The Salt Lake Herald, Salt Lake, Utah.

WEATHER BUREAU:

Colorado Section.

Illinois Section.

New England Section.

New Mexico Section.

Oregon Section.

Wyoming Section.

REPORT OF THE ENTOMOLOGIST.

To the Director:

I beg to present herewith the annual report of the entomological section of the Experiment Station for the year now closing. The various projects for the year have been under the Hatch fund, the Adams fund, and the general fund and are referred to separately below.

HATCH FUND.

Project 1. Miscellaneous Insect Pests. This project was proposed to enable the section to give such attention as might be necessary to unusual or unexpected insect outbreaks that might occur during the year, both for the purpose of accumulating information concerning them and also for the purpose of testing methods of keeping the insects in check. There has been very little call for special work in this line during the year.

The Beet Plant Louse (Pemphigus betae) has occurred in unusual numbers in the Arkansas Valley and in a portion of the beet raising section in the northern part of the State, and considerable attention has been given to the louse for the purpose of determining some points in its life history, the extent of its injuries, both to the farmer and to the sugar companies, and possible means of prevention or remedy.

The Clover Louse (Aphis bakeri) has also been unusually numerous on the Western Slope and has attracted considerable attention in the orchards. We have succeeded in working out its life history quite fully, and also the remedies that should be applied to keep it under control. The life history of this louse was very imperfectly known before.

Two of the vegetable feeding mites, commonly known as the red spider and the brown mite, have also been quite destructive this year, especially to raspberry bushes on the Western Slope. Mr. Weldon gave some special attention to a test of remedies for destruction of the mites and met with good success.

While the work upon the lice here mentioned might also be placed under the Adams fund project, I am placing it here because of the unusual outbreaks of these insects calling for special attention.

Project 2. Collecting and Rearing Insects. Nearly all the work under this project during the past year has been confined to the plant lice and their enemies. A small number of other insects have been taken as good opportunities presented themselves, all of which have been properly labeled and placed in the insect collection.

We now have one of the largest collections of plant lice in the West, and perhaps the largest collection of western plant lice to be found anywhere, including close to 1,000 balsam mounts and a somewhat larger number of alcoholic vials. These lice are in greater part determined to species and systematically arranged for study.

Project 5. Experimental Orchard. The objects in putting out an experimental orchard were: First, to have a good number of orchard trees that might be used in an experimental way for the purpose of rearing insects and testing various methods for their control. The trees have done well this year; we have infested them quite thoroughly with the green aphis and the woolly aphis for experimental purposes, and have succeeded in rearing the sexual forms and obtaining a good number of eggs of the latter species.

Project 7. The Potato Flea Beetle. The work under this project is a continuation of work that has been carried on by Professor Johnson for the past two or three years upon this insect. Professor Johnson hoped to be able this year to complete his observations upon the life history of the insect and to test a few remedies in a large way in the field. The testing of remedies was rendered impossible so far as obtaining satisfactory results is concerned, because of a very small number of the insects in the fields which he had chosen for the experiments.

ADAMS FUND.

Project 3. Plant Lice Investigations. The major part of the work under this investigation has been carried on in the vicinity of Fort Collins, though it has been necessary to make numerous trips into different portions of the State, and Mr. Weldon has also given this project a considerable share of his time on the Western Slope, especially to the collecting and rearing of the plant lice. Mr. Urbahns, while employed by this section, gave much of his time to the rearing of the parasitic and predacious enemies of the plant lice. Miss Palmer, aside from making numerous drawings in color and also in ink, has devoted considerable time to the study of the life habits of a few of our more common species of lady beetles, and has obtained some very interesting results.

The plant lice more especially studied are the green apple aphis *(Aphis pomi)*, the woolly apple aphis *(Schizoneura lanigera)*, the melon louse *(Aphis gossypii)*, the green peach aphis *(Myzus persicae)* and the clover aphis *(Aphis bakeri)*.

In addition to the work upon the species above mentioned we have also collected extensively, taking species that might be found either upon cultivated or native plants or weeds. This work we have found very important, as we often come upon one of the well known pests of some cultivated plant that is spending a portion of its year upon some unexpected weed or cultivated plant.

As a result of the plant louse studies, Bulletins 133 and 134 have been published, as well as several articles of a more technical nature, in the entomological journals. The more we do on this project, the larger becomes the field for future study and experimentation. So we hope to continue it for some years to come.

SPECIAL FUND.

Project 4.—Codling Moth Investigations. Work was planned both for the eastern and western slope for the purpose of determining more fully some points in the insect's life habits, and more especially to determine the proportions of poison to use in arsenical sprays for the destruction of the larvae before they enter the apples. The object in this part of the work was to determine the smallest number of applications and the weakest strengths of poisons that could be successfully used for the purpose of avoiding unduly filling the soil witih arsenic. On account of the spring freezes, which practically destroyed all the fruit on the eastern slope and which destroyed a large portion of it upon the western slope, this project was seriously interfered with. Mr. Weldon, however, carried through a series of experiments at Paonia and has obtained very satisfactory results, which are given in his report of this year. The project should be continued another year and should be carried through upon a larger scale.

Project 6.—West Slope Field Work. This project was proposed for the purpose of covering the general work that would be done chiefly by Mr. Weldon in his efforts to instruct the fruit-growers as to the best methods of controlling their orchard pests. This work is detailed quite fully in Mr. Weldon's report for the year. The writer has also made several visits to the western slope for the purpose of advising in this work both with Mr. Weldon and Mr. Whipple and the horticultural inspectors. I believe that much benefit to the fruit-growers has been derived from this work and I think it very important that it should be continued for many years to come.

Very respectfully submitted,

C. P. GILLETTE.

SUMMARY OF ANNUAL REPORT OF FIELD ENTOMOLOGIST.

Delta, Colorado.

Introduction.

It was found necessary to confine the work, more or less, to certain orchards, and on that account not so many were visited as we would have liked. Some little hard feeling may have been occasioned because of certain orchards not having been visited. An orchard was always visited upon request of the owner, so if any one was neglected they alone deserve the brunt of blame.

GENERAL CONDITION OF ORCHARD WITH REFERENCE TO INSECT PESTS.

Improved methods of spraying are generally practiced.

Parasitic and predacious enemies have been doing good work in the orchards and their attack, along with ordinary care in spraying by the owner of fruit tracts, leaves little room to worry over future prospects in controlling insect pests.

It is true in Colorado, as elsewhere in fruit sections, that the grower of a few trees is more troubled with insect pests than the man with a commercial orchard. The latter, depending on his trees for a livelihood, realizes the necessity of proper care. There are many men who should be compelled to spray their trees.

There is probably no possibility of ever exterminating some of our more serious insect pests, but they can be kept in check, so that little harm will result from their attack.

DIFFERENT PHASES OF WORK UNDERTAKEN.

1. Examination of Orchards.
2. Study of Spraying Methods.
3. Experiments with Insecticides.
4. Insect Pests of Orchards.
5. Control, natural and artificial.
6. Hindrances to natural control.

EXAMINATION OF ORCHARDS.

In the neighborhood of 100 orchards were visited and general conditions noted. Any unusual conditions, whether caused by insects or otherwise were always studied, and visits to such orchards as had problems of a Horticultural nature were on different occasions made in company with Mr. Whipple, Field Horticulturist at Grand Junction.

STUDY OF SPRAYING METHODS.

Probably in no other fruit section is spraying so generally practiced, and with such good results.

Apples are secured from 95 to 99 per cent. free of worms, through the use of thorough spraying methods. Other pests are not seriously dreaded as a rule.

Arsenate of lead is almost exclusively used in controlling the codling moth.

On account of the Arsenical poisoning of trees care must be exercised in its future use.

There are at least four principal ways whereby good may be obtained. 1—Arsenate of lead must not be used in such large quantities. 2—Trees must not be sprayed more than twice in a season. 3—Nozzle must not be held so that spray will be directed at trunk and larger limbs which will carry it to the ground. 4—Spraying must be done thoroughly without allowing excessive drip from the trees.

Spraying for aphis is not attended with the same dangers that beset one in spraying for the codling moth. There are two sprays now more generally used than any others in the control of aphis, viz.: "Lime and sulphur" and "Black leaf." The former is an excellent dormant spray to kill the eggs of all kinds of aphis that lay them upon the trees, the latter will kill every aphid touched in spraying when used at a strength of 1-75.

Soluble oils, kerosene emulsion, whale oil soap, etc., are giving place to the above sprays.

More failures in controlling aphis are due to careless work than to all other causes.

INSECT PESTS OF ORCHARD TREES.

The following is a list of pests found on orchard trees the past summer: Peach twig borer (Anarsia lineatella), Grain aphis (Aphis avenea), Clover aphis (Aphis bakeri), Cherry aphis (Aphis cerasi), Sweet clover aphis (Aphis medicaginis), Black peach aphis (Aphis persicae niger), Green apple aphis (Aphis pomi), Howard scale (Aspidiotus howardi), Climbing cutworms, Codling moth (Codia pomonella), Mealy bugs (Dactylopius sp.), Cherry slug (Eriocampoides limacina), Lecanium scale (Eulecanium cerasifex), Peach scale (Eulecanium nigrofasciatum), Plum aphis (Hyalopteris arundinus), Red spiders (Tetranychussp), Green peach aphis (Myzus persicae), Snout beetles (Cleonus collaris), Pea aphis (Macrosiphum pisi), Woolly aphis (Schizoneura lanigera), Brown mite (Bryobia sp.).

CONTROL OF INSECT PESTS.

Natural control. Lace-winged flies, Syrphus flies, and Ladybird beetles, along with other predacious and parasitic enemies, did excellent work in controlling aphis in many orchards.

Artificial control. Spraying is the most important, and practically the only artificial method used. Careful attention to details, such as cleaning up rubbish, etc., is often a great help.

Barriers to control. Many parasites work on both Syrphus and Lace-winged flies. Spraying also kills many beneficial insects, but not in proportion to the number of destructive.

EXPERIMENTS.

First. Experiments to determine the least strength of the Arsenate of lead that can be used effectively, and with the least number of applications. Two strengths were used in the regular experiment, 2 pounds per 100 gallons and 3 pounds per 100 gallons. Eighty-five trees were sprayed with these strengths at an interval of eleven days. Part of the rest of the orchard was sprayed by the manager, with 4½ pounds per 100 gallons, making two applications. The second began ten days after the first. The rest of the orchard was sprayed with the same strength, but received a third spraying about thirty days after the first. The purpose of the first two sprayings was to fill the calyx cups. One spraying would have been as good as two, provided the blossoms had come out with a little more regularity.

Counts of 15,469 Ben Davis and Jonathan apples showed the following results:

2 pounds per 100 gallons, 85% free from worms.

3 pounds per 100 gallons, 88% free from worms.

4½ pounds per 100 gallons, two sprayings, 95% free from worms.

4½ per 100 gallons, three sprayings, 97% free from worms.

Check tree, Ben Davis, 70% free from worms.

Second. Experiments to determine the effect of the different sprays upon the eggs of the Green apple aphis.

This experiment is still under way and we do not feel justified in drawing any definite conclusion from the work already done.

Three. Experiments to determine the effect of the "Black leaf" upon Red spiders.

This experiment indicated that "Black leaf" is an effective remedy for these pests. It was not found to be effective, however, in killing the eggs at the strength tried, 1-65 to 1-70.

GEO. P. WELDON.

REPORT OF CHEMICAL SECTION.

To the Director:

I have the honor to report that during the period elapsing since our last published report the work of the chemical section has consisted of those lines of investigation which had previously received your approval.

The portions of these projects completed within this period have been presented in the bulletins offered for publication by this section, i. e., Bulletins 124, 125, 129, 131, 132 and 135.

Bulletins No. 124 and 125 present the results of our study of the composition and comparative values of some of our Colorado hays, i. e., alfalfa hay, timothy hay, native hay, corn fodder, sorghum and hay made from one of our native saltbushes, *Atriplex argentea*. Bulletin No. 129, by Mr. Alford, presents the results of our study of the commercial methods of extracting and purifying beeswax. No. 131 treats of the arsenical poisoning of fruit trees. No. 132 of the destruction of concrete by alkali or alkaline waters, and No. 135 presents those features of our study of the Australian saltbush, *Atriplex semibaccata*, as we deem of general interest and advantage to the people of our State, in particular to those who have taken up their residences in sections of the State where the sufficiency of the annual rainfall for the production of good crops is usually a little uncertain and where a forage plant which will produce a good yield with a small amount of water is desirable. This section has presented Bulletin No. 135, in the hope that it may prove of immediate value to such sections of our State, but it has a further object; it presents the cultural and general data concerning the hay made from this saltbush which serve as a basis for its further study on these lines presented in Bulletins 39 and 124. It bears the same relation to a bulletin which I shall present in the future that No. 93 presents to No. 124.

The arsenical poisoning of fruit trees and the destruction of concrete by "alkali" are special features of our alkali problem, but are of such considerable and immediate importance that I deemed it justifiable to present these subjects by themselves.

This section has begun no new work, because the subjects already approved will engage our attention for some time to come.

The study of the changes in the waters of the Rio Grande and their relations to the soil conditions of the San Luis Valley has been continued and will probably be completed within the next year. The season of 1907 was unfavorable for the prose-

cution of this work, owing to the exceptionally high water in the river. We were, at least, afraid to proceed with the work during this season, 1907, because we feared that the unusual amount of water in the river would obscure the factors which we wished to determine. It seems now that we might have proceeded with safety, but we did not know this at the time and it required considerable proof to convince us that such was really the case.

The study of the composition of fodders and their comparative values has been advanced since the publication of Bulletin No. 124, by the study of the Australian saltbush, atriplex semibaccata, on which the analytical work has been completed and will be ready for publication sometime during the coming summer.

The general problems of alkalies in Colorado is being studied concurrently with our other work, but I am desirous of bringing it to an end at the earliest possible date, which, however, I can not hope to do very soon.

The subject of mountain irrigation and the composition of the hay grown under this system combines two lines of work previously studied separately, i. e., the changes of the irrigation waters and the composition and comparative value of fodders. I hope to actively begin this work during the next irrigation season. While this work forms a single study it will evidently have to be treated from these two standpoints, which it may be advisable to treat separately, but this is a matter for further determination.

The work done on the study of the deterioration of manure under our Colorado conditions is being put into shape for publication by Mr. Douglass, but he is so continuously engaged in other work that it will be sometime before he can complete it.

The systematic work planned for this section is more than sufficient to keep all of its force busy for at least two years, so there is no opportunity for doing miscellaneous work, for which there continues to be many applications, especially for analyses of soils and waters. Sometimes these miscellaneous matters are of general interest and even important, but usually they are not.

The equipment and appointments of our laboratory are adequate to our present needs.

Respectfully submitted,

WM. P. HEADDEN.

Fort Collins, Colo., Nov. 1, 1908.

To the Director:

On account of the demands upon my time, with which you are familiar, my part in Experiment Station work has not been pushed so vigorously as I could have wished; however, some progress has been made. But in the subsection the usual good work has been accomplished, as the reports from the men will show.

Taking up the schedule of work as outlined last spring, we find the work in the following condition:

Red Raspberry Industry, not yet written up.

Tomato Blight. Good results in controlling this disease were secured by growing the plants in sterilized soil. Almost no blight appeared in plants so grown. Further experiments desirable.

Raspberry Yellows. Considerable laboratory work has been done with this disease; a fungus was isolated and inoculation experiments show that it is capable of attacking raspberry canes. Another season will be required in which to complete the work.

Pea Breeding. This work is finished so far as the present experiments are concerned. A variety of suitable size has been secured, but whether it will meet the requirements of the canner can only be determined by an extensive field test.

The subjects of The Orchard Plant; Location; Site and Soil, and History and Development of the Fruit Industry have been written.

The Cold Storage investigation with vegetables has just been started. Results will not be secured until late in the winter.

Bean Breeding experiments, by Mr. Paull, were satisfactorily begun, but several years must elapse before results are secured.

The Strawberry Industry has been written by Mr. Longyear and is about ready for publication. Mr. Longyear has spent much time in studying the cause of the so-called black root of the strawberry plant. A much longer time will be required to complete the work.

Mention has been made in former reports of a bacterial blight of alfalfa. Since alfalfa is the basis of Colorado agriculture, and this disease is becoming more and more of a menace, it was thought best to devote considerable energy to determining the nature of the disease and the method of control, if possible. Accordingly, a bacteriologist, Professor W. G. Sackett, formerly of the University of Chicago, was secured to take up this work under

the Adams fund. Mr. Sackett has already got the life history of the organism well in hand and is making rapid progress with the work.

The potato investigations are proceeding satisfactorily, and, as a direct result of this, the output of the State will be increased this year many carloads. The principal work with potatoes is along the line of building up a better and more stable class of varieties by seed selection, as well as the investigation of potato diseases.

The fruit investigations continue to be satisfactory to all concerned. Mr. Whipple has the practical subjects, as outlined in his schedule, written and about ready for publication. These are as follows: The Grape Industry; The Dewberry Industry; Grafting; Packing; Fruit Buds and Pruning Mature Trees.

Respectfully submitted,

W. PADDOCK.

ANNUAL REPORT OF THE FIELD HORTICULTURIST.

To The Director:

Report of the Field Horticulturist.

During the year a total of nearly seven weeks of my time has been devoted to extension work in different parts of the State, four weeks to Short Course work and three weeks to one-day summer meetings. The rest of my time has been given to special lines of work connected with this office, trips to other fruit districts of the State, and general field work. Much of the time, however, has been devoted to work in Mesa county.

The special lines of work outlined at the beginning of the year by Prof. Paddock and myself consisted of investigations and experimental work upon the following subjects:

Pruning Mature Fruit Trees, Picking and Packing Fruit, Top-Grafting, Dewberry Growing, Grape Growing, Root Rots of Fruit Trees, Crossing Fruits, Bloom Notes, and Fruit Buds and Fruit-Bearing Habits. In addition to this, some special work, of a nature that could not well be anticipated, has been taken up throughout the year. One of interest has been the effect of frost upon bloom and fruit and the value of second-crop bloom considered from the standpoint of fruit production. Another line of investigation has been the effect of whitewashing peach trees, in toto, as a means of retarding the blooming season.

The work along the line of pruning mature trees has been largely observations in the field, the effects of the different methods of pruning as practiced. The manuscript for a bulletin is now prepared.

The object of the work in picking and packing fruit is the preparation of a bulletin for the instruction of fruit growers in the best methods of picking and packing fruit. The information has been gathered by observations in the field, with suggestions for improvement on present methods gleaned from the experiences of other sections.

The manuscript for a bulletin upon top-working fruit trees has been prepared and is intended to give information as to methods of top-working and when it is advisable.

The work upon the subject of root rots has been practically dropped, as it appears to come under the work of the Department of Chemistry. There are cases where the death of roots is not due to arsenical poisoning, but they are scattered and probably result from a variety of causes.

The object of the work in crossing fruit has been to obtain crosses between our common varieties of apples and the seedless apple, in hopes of getting a seedless seedling of merit. No progress has been made on account of the late killing frosts of the past two seasons.

Notes have been gathered upon the blooming season of the different varieties of apple and pear, with a view of ascertaining which varieties are suitable for interplanting to secure cross-fertilization. The observations have shown considerable variation; even the blooming seasons of two varieties do not always bear the same relationship to each other in different seasons.

The dewberry industry has been studied in the best dewberry sections of the State, and the manuscript for a bulletin has been prepared upon the subject.

After a thorough study of the condition of the grape industry in the State the manuscript for a bulletin is now being prepared. Methods of handling vineyards are not well understood and it is hoped that the growers may be encouraged to use better methods in growing grapes, especially to adopt better methods of pruning.

The information gathered upon fruit-buds and fruit-bearing habits has been incorporated in the manuscript for the bulletin on pruning.

The experiments undertaken to demonstrate the value of white-washing peach trees as a means of prolonging the dormant season showed very little benefit derived from the treatment. The trees were retarded only slightly, if any.

Observations upon the effect of frost upon bloom and fruit and the value of second-crop bloom have been assembled in a manuscript for publication as a bulletin, if worthy, or to be kept as a matter of record.

Work spoken of as general field work consists of answering calls for information upon the care of particular orchards or to give solicited suggestions upon the treatment of the orchard to overcome difficulties.

Respectfully submitted,

O. B. WHIPPLE,
Field Horticulturist.

REPORT OF THE BACTERIOLOGIST.

1908.

Beginning with May 1, 1908, a new line of work was introduced into the Experiment Station. Previous to that time only a limited amount of investigation work along bacteriological lines had been carried on, and with the increasing importance of the subject and with the new problems which were continually arising, it seemed advisable to take up more extensive as well as intensive studies in this field. Accordingly a laboratory for bacteriological research was established under the Adams act. This laboratory has been fully equipped with the most modern appliances for accurate work and will be in perfect running order in the very near future. While considerable time has been consumed with the furnishing, equipping and arranging of these new quarters, we have, nevertheless, been able to carry on some investigation work at the same time. Unfortunately not much laboratory work was accomplished the first two months, owing to lack of equipment, but since then our undertakings have been more fruitful.

The most important problem which has claimed our attention is a bacterial disease of alfalfa. We have been able to isolate the causal organism and to reproduce the disease on alfalfa cuttings under laboratory conditions with a reasonable degree of certainty. While the stems inoculated with laboratory cultures resemble closely those found in the field, they do not have exactly the same appearance as those naturally infested. This is undoubtedly due to the difference in outdoor and laboratory conditions.

The morphological and cultural reactions of the organism are now being worked out for the purpose of identification, and during the winter season it is expected to continue the inoculations upon greenhouse material and in the spring to carry this phase of the work into the field. Field inoculations this season were impracticable, owing to the late date at which the causal organism was isolated.

Greenhouse experiments are now being carried on with the view to ascertaining, if possible, how the natural infection of the plants occurs. Next spring it is expected to spend a large amount of time in the field where the disease occurs naturally, with the purpose of studying further the methods of natural

infection as well as to test out the pure cultures of the organism isolated by inoculations under field conditions.

Of the twenty-six different varieties of alfalfa which were planted on infested land at Gypsum, Colorado, over a year ago, with the idea of obtaining, if possible, a disease resistant plant, there is one variety and possibly two which look very promising. This variety work will be continued another season, with the hope that we may be able to solve the economic side of this question in this manner. Respectfully submitted.

WALTER SACKETT,
Bacteriologist.

POTATO INVESTIGATIONS.

The work on the Colorado potato industry has been carried on during the past year along practically the same lines as the year previous.

Varieties of potatoes secured from the United States Department of Agriculture, with some others from this State, were again planted on the E. R. Bliss ranch, near Greeley. The object of growing these varieties at Greeley was partly to test them for yield and general desirability, as compared with the standard varieties grown there, and partly to secure, if possible, a variety that will be resistant to the soil diseases that frequently attack potatoes in this State. Notes were kept as to habit of growth, size of plant, time of maturity, yield, etc., as compared with the standard varieties.

Only a few of the seventy varieties have given promise of being able to compete with the "Pearl" as market varieties.

Very little trouble from the soil diseases was had with any of the varieties, so no data as to resistance were obtained.

A plot of about three acres of potatoes was grown on the College land at Fort Collins. In this field experiments with different treatments of seed potatoes, methods of preparing seed and cultural methods were conducted.

This field was also used for a study of the diseases and insect pests. So much time has been spent in promoting the industry and advising growers in other parts of the State that much systematic study of the diseases has not been possible.

The survey of the potato-growing districts of the State has been carried on for the most part in connection with the institute work. During the season visits have been made to the valleys of the Eagle, Crystal, Roaring Fork, Grand and Uncompahgre rivers, the San Luis valley and to La Plata and Montezuma counties.

In promoting the industry and instructing the growers in regard to varieties, cultural methods, etc., talks have been made at sixty-nine places since the previous report.

Probably the most important work is that being carried on in co-operation with the growers in various parts of the State. The aim in this is the improvement in yields and quality of potatoes from planting seed that has been hand selected in the field.

Colorado is producing as good, or better, quality of potatoes than any state in the United States. The yield per acre was greater last year (United States Department of Agriculture Statistics) than any state except Wyoming. The cost of produc-

tion per unit is less than in other states. There is sufficient undeveloped land in the State adapted to potato culture to produce three or four times the present total output. This year Colorado will produce about 20 per cent. more potatoes than previous years. The value will probably reach six million dollars, or about twice that of all the fruit of the State.

If the growth of the industry in the State continues normally, Colorado ought in a few years to be one of the leading potato producing states of America.

CABBAGE INVESTIGATIONS.

Along with the potato investigation at Greeley data have been secured on cabbage growing in Colorado. This data have been secured for the purpose of writing up the industry in bulletin form for the benefit of the new comers to the State.

E. R. BENNETT.

RECEIVED