

THE STATE AGRICULTURAL COLLEGE
OF COLORADO

The Thirtieth Annual Report

OF

The Agricultural Experiment
Station

FOR 1917



The Colorado Agricultural College

FORT COLLINS, COLORADO

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BREEZE BOYACK, B.A., M.S.....	Assistant in Agronomy
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G. E. EGGINTON, B.S.....	Seed Analyst

LETTER OF TRANSMITTAL

To His Excellency, Julius C. Guiter, Governor of Colorado:

In accordance with the law of Congress, I have the honor to transmit to you herewith the Thirtieth Annual Report of the Colorado Agricultural Experiment Station.

The financial statement is for the Government fiscal year ending June 30, 1917. The other portions are reported substantially for the state fiscal year of 1916-17.

C.P.GILLETTE,
Director.

Agricultural Experiment Station,
Fort Collins.
December 20, 1917.

**FINANCIAL REPORT OF THE COLORADO AGRICULTURAL EXPERIMENT
STATION FOR THE FISCAL YEAR ENDING JUNE 30, 1917**

DR.

Receipts

From the Treasurer of the United States as per appropriations for the fiscal year ended June 30, 1917, under acts of Congress approved March 2, 1887 (Hatch Fund) and March 16, 1906 (Adams Fund).....	Hatch Fund	Adams Fund	State Appropriation Fund	Sales Fund	Horse Cash Fund	Special Fund	State Mill Levy Fund	Total Fund
Balance on hand July 1, 1916.....			\$6,645.18	\$ 656.92	\$1,105.54	\$2,563.59	\$ 1,478.59	\$12,449.82
Other sources than U. S.....	\$15,000.00	\$15,000.00	\$5,000.00	476.15	3,403.92	988.54	31,542.55	41,411.16
Total Receipts								\$83,860.98

Disbursements

By Salaries	\$10,607.37	\$13,139.95	\$13,206.14				9,200.28	32,949.60
Labor	1,256.63	398.72		107.25	225.96	8.75	2,063.79	5,387.24
Publications	784.47			3.68			2,930.99	3,719.14
Postage and Stationery.....	275.45	19.60	6.77	3.90	10.00	45.46	586.16	947.34
Freight and Express.....	28.88	129.02	233.89	2.08	9.25	1.00	136.98	541.10
Heat, Light, Water and Power.....			45.95		6.00			51.95
Chemicals and laboratory supplies.....	141.45	149.80		11.41			40.90	343.56
Seeds, plants and sundry supplies..	100.72	140.24	33.75		161.35		460.09	896.15
Fertilizers								
Feeding stuffs	4.25				2,476.22		5,106.30	7,586.77
Library	264.82			20.00	16.00	11.61	398.46	710.89
Tools, machinery and appliances..	53.03	12.18	1,061.98		52.55		536.50	1,716.24
Furniture and fixtures.....	220.80	6.65		4.00	11.18	3.50	187.92	434.05
Scientific apparatus and specimens.	281.03	510.10		91.73			167.03	1,049.89
Live stock				225.00			100.00	325.00
Traveling expenses	919.15	336.85	129.28	36.15	1.35	394.64	2,946.28	4,763.70
Contingent expenses	20.00						4.00	24.00
Buildings and land.....	41.95	156.89	3,582.42		186.43		462.55	4,430.24
Total expenditures	\$15,000.00	\$15,000.00	\$ 6,645.18	280.20	3,156.29	464.96	25,330.23	65,876.86
Balance			5,000.00	\$52.87	1,353.17	3,087.17	7,690.91	17,984.12
			\$11,645.18	\$1,133.07	\$4,509.46	\$3,552.13	\$33,021.14	\$83,860.98

REPORT OF THE DIRECTOR

To the President:

I have the honor to present the following brief report upon the work of the experiment station during the State fiscal year closing November 30, 1917. The financial statement on the preceding page is for the Government fiscal year which closed June 30, 1917.

The year has been a rather strenuous one for the station force because of extra duties that many of the men have been obliged to carry on account of war conditions. We have been very fortunate, however, in that all heads of sections are still with us except Mr. Wm. P. Little who was in charge of the cooperative horse breeding work. His place has been filled recently by the appointment of Mr. David D. Gray who is now in charge. But few of the assistants in the various sections have left during the year, but from present prospects we are not likely to fare so well in the year that is just ahead.

The unusual demand upon the institution for services along extension lines has interfered with the research work to a considerable extent. On this account the station has not been getting the portion of the services of its men in experimental work that it has paid for. However, all things considered, it appears that very good results have been reached from the work that has been put upon the projects of the year.

We are still experimenting on a dollar for dollar basis in the horse breeding work, in the irrigation investigations and in alfalfa seed production with the U. S. Department of Agriculture. We have in this way extended our funds for experimental work by fully \$10,000.00 the past year. The total money spent in station work during the past year aside from the \$10,000.00 just mentioned, is \$83,860.98.

We are in better condition than ever before to spend the station funds efficiently, in that all of our funds for station work are now quite definite in amount and certain to become available, so that we can plan the work ahead with the assurance that we shall be able to carry it through.

One new section or line of investigation has been taken on during the year, namely: Home Economics.

Our General Assembly at its last session passed a bill known as the Pure Seed Act, which is referred to the experiment station for enforcement. A seed laboratory has been provided and well equipped in connection with the Botanical section, where the seed testing and analyses will be carried on.

The Chemical Section has continued its work in the study of soil conditions in the State and also the work that has been under way for the past two years or more to determine the causes leading to the poor quality of wheat and flour. The work in both these lines has been making good progress. The niter trouble has been extended considerably during the year and especially has this been true in the San Luis Valley and the Arkansas Valley within the State. We have received from this section four bulletins during the year, two of which are already in print and two are now going through the press.

The Bacteriological Section has continued its work on soil protozoa, nitrifying bacteria of soils and the effect of outside temperatures upon biological activities in the soil, and has produced one bulletin on "Denver Water Supply." Prof. Sackett has also prepared an article on "Bean Diseases" which was published in Bulletin 226.

At present Prof. Sackett has transferred his work for a few months to the Bacteriological laboratory of the University of Chicago, where he is devoting half time to a project entitled "Food Poisoning in Sheep and Cattle." This section continues to receive numerous calls for vinegar cultures and for the examination and analyses of water, milk and soils.

In the Agronomy Section the same projects are being carried as were mentioned in my report of last year, to which has been added an Adams project entitled "The Relation of Soil Moisture to Structural Development and Acre Yield in Small Grains." This last named project is now well under way and promises to give important data that will have to be carried on for a period of years before definite conclusions can be drawn. The experimental work has been broken into very heavily during the year because of the need of assistance in extension lines.

The bulletins from this section during the past year have been "Bean Growing in Colorado," Bulletin 226 and "Dry Farming in Colorado," Bulletin 227.

The Irrigation Investigations Section has been devoting its energies very largely during the year to the Poudre Valley project. This project is now practically completed, so far as the collecting of data is concerned, but there are months of work ahead before the data can be correlated and put in shape for publication. It is

also probable that some further surveys may have to be made another year in order to supplement some data that have been collected. It is probable that the work of this section during the coming year will be directed more largely along the line of drainage investigations.

We believe that the data collected on the Poudre Valley irrigation system will be of great value in making suggestions for the improvement of the irrigation methods that have been or are to be practiced in this and other states, where it is necessary to artificially apply water to lands for agricultural purposes. We have had one Bulletin, No. 228, on "Divisors" from this section during the year. Two technical papers have been published in the Journal of Agricultural Research and one Farmers Bulletin on "Farmers' Weirs" from the Department of Agriculture.

The Entomological Section has put its principal efforts during the past year upon two projects, namely "The Study of Habits and Life Histories of Plant Lice," and a "Study of the Life History of the Codling Moth." Since early in July this section has also had to devote considerable attention to alfalfa weevil extermination on account of a serious infestation which was discovered by Mr. J. H. Newton, one of our senior students, at Paonia, in Delta County. Fortunately our State Legislature was in session at the time this discovery was made, which made it possible to introduce a bill asking for an appropriation of \$6,000.00 for the present biennial period, to enable to State Entomologist to do all in his power to prevent the spread of this pest to other alfalfa sections of the State. The services of Mr. Claude Wakeland have been secured and he is now giving his full time to a study of the habits of this insect and the enforcement of quarantine regulations that have been established to prevent its spread.

The Horticultural Section has completed its work for the present at least on the "Management of Niter Soils." I am glad that Dr. Sandsten was able to report success in this work, as it will mean a great deal to the farmers in many parts of Colorado to be able to prevent the development of the nitered areas and be able to again grow crops upon soil that has become unproductive. The results of these experiments were published in Bulletin 235.

This section has taken on one new project which has for its object to determine what effect, if any, ill-shapen or diseased seed potatoes have upon the quality of the succeeding crop.

The Animal Husbandry Section is continuing its "Steer Feeding" project of last year and is also carrying on "Ration Experiments with Lambs," which will soon be concluded.

The Veterinary Section is carrying four specific and one general project. During the past year special emphasis has been placed on the "Contagious Abortion" project and "Sheep Losses in Feed Lots." A technical bulletin on Brisket Disease and a popular bulletin covering the same subject have been received from this section during the year. Both of these manuscripts are in the hands of the printer at the present time.

The Botanical Section has been carrying five projects on Hatch and State funds and one bulletin, No. 224, on "Native Vegetation and Climate of Colorado," has been published during the year. Bulletins on "Colorado Forage Grasses" and on "Millet Smut" are now in preparation. As stated above this section is in charge of the enforcement of the Pure Seed Act passed by the last session of the Legislature.

Prof. House of the Irrigation Engineering Section has completed the first part of his project on the Duty of Water on the College Farm. I am hoping to be able to set aside sufficient funds to enable him to take up the second phase of this work during the coming season, which is the "Improvement of Irrigation Systems on the College Farm." A bulletin covering the work that has already been carried on is now under way.

There has been no change in the lines of work being carried on in the Forestry Section. The Dandelion project is practically completed, however, and a bulletin covering the results of the experiments is now in the hands of the printer. Further work on this project will probably be in the nature of demonstrations.

The Horse Breeding experiment is progressing satisfactorily. The Board of Survey has modified its original plans quite materially. The aim now is to produce a light, active, durable, farm horse that will also be a valuable horse on the road. Such a horse, it is believed, is much needed, especially for the dry farming and mountainous sections of this and other states.

It will also be the plan in the future to work these horses on the college farm, both as a means of making them useful and to determine their fitness to be retained as foundation animals of the new breed.

There has been some serious doubt as to whether or not it is best to continue this cooperative project. I have suggested to the Board of Survey, and especially to Dr. Rommel, that there is some thought that it might be better to devote our funds to other lines of station investigations, as the light automobile has so largely taken the place of the driving horse in our farming communities. These men express a very strong hope that this experiment may not be discontinued at present and seem to be very strongly of the

opinion that the light, active type of farm horse is a real need in the country today, both for farm and military purposes and that this need will continue for a considerable time to come. There is no other American type, at least, that will fill the need.

Mr. David D. Gray, now in charge of this experiment, desires to make the work as instructive and experimental as possible in every way. My recommendation would be that the experiment be continued for the present. There are now 65 animals of all ages in the experiment. A few stallions are stationed in farming communities each year and there are calls for other that cannot be filled.

The number of bulletin manuscripts presented for publication during the year has far exceeded that of any preceding twelve months in the history of the station.

PROJECTS IN FORCE DURING THE YEAR

Chemical Section

A Study to Determine the Factors Causing the Softening of Wheat. Adams Fund.

Rio Grande River Waters. Adams Fund.

Niter Studies. Adams Fund.

Bacteriological Section

A Bacterial Study of Alkali Soils in Relation to Nitrogen Fixation. Adams.

Value of Certain Carbon Compounds as a Source of Energy for Azotobacter. Adams Fund.

Associative Action of Bacteria in Soils. Adams Fund.

A Bacterial Disease of the Wragg Cherry. Hatch and State.

Food Poisoning in Sheep and Cattle. Adams Fund.

Entomological Section

Plant Lice Investigations. Adams Fund.

Life Habits of the Syrphus Flies. Hatch Fund.

Control of Insects by Egg Treatment. Hatch and State Funds.

Codling Moth Studies. Hatch and State Funds.

Grasshopper Control. State Funds.

General Insect Investigations. State Fund.

Irrigation Investigations Section

Drainage of Farm Crops and Drainage Factors. Adams Fund.

Pump Irrigation. Hatch Fund.

Seepage. Hatch Fund.

Concrete. Hatch Fund.

Evaporation Experiment. Hatch Fund.

Duty of Water in the Poudre Valley. State Funds.

Grand Junction Indian School Drainage. Appropriation.

Current Meters. Adams Fund.
 The Venturi Flume. Adams Fund.
 Weir Construction. Adams Fund.

Agronomy Section

Relation of Soil Moisture, Structural Development and Acre Yields in Small Grains. Adams Fund.
 Correlation of Characters in Grain. Hatch Fund.
 Alfalfa Breeding. Hatch Fund.
 Methods in Selection Breeding. State Fund.
 High Altitude Crops. State Fund.
 Feed Crop Improvement. State Fund.
 Rotation of Crops for Colorado. State Fund.
 Plain Crops and Management. State Fund.

Horticultural Section

Hardy Stock for Apples. Hatch and State Funds.
 Pear Growing in Eastern Colorado. Hatch and State Funds.
 Management of Nitrogen Soils. Hatch and State Funds.
 Potato Investigations. Hatch and State Funds.
 Small Fruits for High Altitudes. State Funds.
 Hardy Tree Fruits for High Altitudes. State Fund.
 Seed Potato Growing in High Altitudes. State Fund.
 Effect of Diseased and Ill Shapen Seed Potatoes on Succeeding Crop. Hatch and State Funds.

Veterinary Section

Infectious Anemia. Hatch Fund.
 Sheep losses on Winter Feed. Hatch and State Funds.
 Contagious Abortion. State Funds.
 Necrotic Stomatitis. State Funds.
 Animal Disease Investigation. State Funds.

Horse Investigations

To Establish an American Breed of Carriage Horse. State Appropriation Fund in cooperation with Bureau of Animal Industry.

Animal Husbandry Section

Acre Value of Pasture for Dairy Cows. State Fund.
 Steer Feeding Experiment. State Fund.
 Lamb Feeding Experiment. State Fund.

Botanical Section

Native Vegetation as an Indicator of Crop Possibilities. Hatch Fund.
 Microscopy of Poisonous Plants. Hatch Fund.

Anatomical and Microscopical Study of Flinty and Yellow-berry Wheat Kernels. Hatch Fund.

Colorado Forage Grasses. State Fund.

Fungous Disease Investigations. State Fund.

Proso Millet Smut. State Fund.

Forestry Section

Dandelion Studies. Hatch and State Funds.

Studies in the Decay of Wood. Hatch Fund.

Irrigation Engineering Section

Duty of Water on the College Farm. State Fund.

Sub-irrigation Investigations. Special Fund.

Home Economics Section

Utilization of Raspberry and Plum Juices. State Fund.

Following are the reports of the heads of sections as transmitted to this office.

Respectfully submitted,
C. P. GILLETTE.

Director.

REPORT OF THE AGRONOMIST

To the Director:

I am submitting herewith my annual report for the fiscal year 1916-17:

During the past year we have worked upon two Hatch projects, namely the "Alfalfa" project and the "Correlation" project. I am attaching herewith a copy of Mr. Blinn's report on the alfalfa work, which is a complete outline of the alfalfa project.

From time to time during the year, I have submitted progress on the correlation project. This project has progressed to such a point that we can begin to follow certain definite lines, somewhat different than those laid out in our original plans. As a method of study to determine the other factors, the statistical method employed in the correlation studies has proved exceedingly valuable. It is enabling us to study factors governing yields. We are applying the statistical methods to the study of progeny of crosses, and we are also applying the methods to the study of different treatments.

Work has progressed far enough so that we can close up some lines of inquiry, a part of them with negative results and a part of them with positive promise of further results, with some results

which might be put forth at the present time if it were not advisable to delay because of the fact that some of the findings are rather the opposite of an established opinion.

In addition to these projects, one project on the Adams fund was started on the "Critical Periods in Cereal Production." Work upon this project was started the spring season of 1917. Potometers are under way testing out four different methods of potometer management, temperature and moisture control. In addition to the potometer work a series of plats are being run. The plats are protected by artificial covering from precipitation and by a protective embankment from the addition of water from uncontrolled sources. Since this work has just started, we have no results to report. In fact, a part of this year's work is experimental as to method of attack.

On the Station Tax fund we have carried on a series of dry land studies in Farm Management. The records for these studies were taken in five Colorado dry land counties the summers of 1916 and 1915. The computations from the records have been made during the winter season. This work has led to some interesting findings in Farm Management, and some very good data in dry land crop management.

In addition to these projects, we have conducted some experimental work at Fort Lewis. This work has been planned at this office, but has been carried out in the field by Mr. J. T. Copeland. Thru carelessness after Mr. Copeland had returned to the Fort Collins plant, a portion of the crops which were gathered and stored were destroyed so that the results for the 1916 season were lost. The alfalfa plantings which had been made for type tests were accidentally plowed up by a careless workman on the Fort Lewis farm after Mr. Copeland had left Fort Lewis late in September, 1916. These annoyances have necessitated starting everything over in 1917. The experience gained, and the notes on the behavior of crops, of course, we have as an indication of work done. Some of the direct crop results, however, were lost.

The work at Fort Lewis has been planned to be simple in nature. The first work is mainly a piece of test work in types of barley, oats, wheat and alfalfa, with a large number of variety tests of field peas. It is hoped as experience and appliances are increased, to increase this work to include irrigation and dry land treatment at different altitudes. The Fort Lewis reserve offers possibility of altitudes of from nearly 7000 to nearly 9000 feet, both under irrigation and under dry farming. We consider the most important work for a new country is to determine what crop types are best adapted, and second, to determine the best varieties

within that type, and, third, cultural methods and soil treatment. Accordingly, the work has been planned with these principles in mind. We have not had funds to put in this work other than Mr. Copeland's salary, the work itself being supported by funds appropriated for the use of the Fort Lewis School as this work is drawn up under a project agreement with Fort Lewis, the arrangement being in accordance with that project contract.

No projects have been completed during the past fiscal year,—at least not completed to the point of final report. Some lines which have given nothing but negative results are completed, but these will be parts of projects rather than complete projects.

It is planned to carry forward the projects described above during the coming fiscal year.

During the past year the following bulletins have been prepared and published—No. 226, "Beans in Colorado and Their Diseases," and, No. 227, "Dry Farming in Colorado." Bulletin No. 227 incorporates a great deal of the matter we have obtained as the result of the Farm Management Surveys in the following dry land Colorado counties—El Paso, Lincoln, Kit Carson, Cheyenne, Adams, Morgan, Logan, Phillips.

Material has been prepared for publication on a portion of the correlation project, but owing to a difficulty with the printing of color plates, it has not been possible to get out this bulletin because we do not yet have the plates. In a way this has been disappointing, but it will enable us to include the work of two more seasons, so that the publication will be more complete when it comes out than it would have been if the publishers had been prompt with the color plates.

In addition to these station publications, this department prepared a bulletin on corn which was published by the Extension Service. It also prepared a bulletin on Irrigation Farming and a bulletin on Dry Farming, both of which were published by the Colorado State Board of Immigration. These publications are not station publications, but should be mentioned at this point because they were prepared by the Agronomist and station material and information was liberally used in their preparation.

As a side line of some of the projects under way, we have originated a number of new things in grain, and some new things in alfalfa. I want to take this occasion to call attention to the matter of having a special fund set aside to increase, to test out under various state conditions, and to properly advertise and distribute those things which are found to be good. The need of this is not only very great for the State, itself, but it is important because it will be of material assistance in maintaining the prestige of the

Experiment Station with the farmers of the State. In other words, it is a simple means which the station might use to justify itself to the taxpayers of the State.

Kansas has just published to the world that it has originated a new wheat which it calls Kanred. The Agronomy Division in its increase fields this year will have approximately 8000 bushels of the seed of this wheat for distribution in Kansas. The wheat is a superior wheat. Its introduction will materially increase the quality and yield of winter wheat in Kansas. The putting forth of this variety among the wheat growers of Kansas is helping the wheat growers and at the same time helping the Experiment Station.

In our work here, we have created some new things which look as promising for our territory as the Kanred wheat for Kansas, but we do not have the means to properly increase and properly test under controlled conditions these productions in our own State. Such a condition should not be allowed to persist for any length of time. We should have our own growers coming to us for superior wheats, superior oats and superior barleys, and not going to Kansas and Wisconsin. We have creations at our Experiment Station better adapted for our own conditions than the things which will be imported, but we do not at present have the means of increasing these valuable productions in quantity and for distributing them under control.

I hope that in the very near future, this matter can be taken care of. It means the help of an extra assistant who can devote his time, under the direction of the head of the department, to this work of increasing and distributing, and it means sufficient funds to pay for the necessary expense which must be incurred. Hatch or Adams funds may not be used for such purposes. Except for the small fund which we have had for survey purposes, we have had no State funds. Thus our hands have been tied. If we could have a fund of approximately \$5,000 annually for this work, I am sure we could in a very short time have our growers coming to us for superior creations, and our State getting the benefit of these creations, as well as the credit.

Thru the School of Agriculture, we are gradually building up an association which may be used largely in such campaigns, but we must have a source of supply of seed. This means that the superior strains must be increased. We can produce superior strains in our investigations under the Hatch fund, but we may not grow seed for general distribution. This is a matter which merits very serious consideration, and one which will give returns on

research work; and I see no other way of getting practical returns except thru some such method of State help under station control.

The Farm Management work has not been pushed as vigorously as its importance justified, because the means have been insufficient. The Farm Demonstrator employed by the Extension Division must have certain farm management records in order to be able to demonstrate farm management principles. Collecting these records is not investigation, but determining the results or findings which the records show is investigation. Accordingly, the Department of Agriculture at Washington is beginning to bring pressure to have the Experiment Station responsible for the taking and interpretation of records, and the Extension Service responsible for demonstration of proved facts only. Therefore, it is not possible for our farm demonstrator to make investigations under the present ruling, and if some arrangement could be made whereby he could spend part time with the Experiment Station and thus be in touch with the work, it would probably help out the work as long as there are not sufficient funds to finance a worker in this special field.

As it is at present, we are obliged to make use of a fraction of a teacher's time and part time of advanced students, or, in lieu of advanced students, to hire a computation clerk. The hiring of a computation clerk would work up the records more quickly than the use of advanced students, but it would not give us a force of trained men coming on who could accept outside positions, or be helpful to us.

My opinion is that the best arrangement would be a special man on the work. If this cannot be done, a joint arrangement with the Extension Service might possibly be effective. At least it is worth discussion and consultation.

The results which we have obtained from our Farm Management Surveys have been almost invaluable to us in our work in College and School classes, because we have been able to illustrate principles of management by actual examples from Colorado farms. During the present season we hope to make enterprise surveys, giving cost of production on certain selected crops under both irrigation and dry farming. These surveys constitute part of the planned work in Farm Management. The report of Mr. P. K. Blinn, Alfalfa Specialist is attached hereto.

Respectfully submitted,

ALVIN KEZER,
Agronomist,

Rocky Ford, Colo., November 15, 1917.

To the Agronomist:

I herewith submit the following report of the alfalfa work during the past fiscal year, ending July 1, 1917.

The alfalfa investigations have been outlined under five different schedule topics—

1. Testing our different strains and varieties.
2. Selecting and propagating plants of superior merits,
3. Experiments and observations on cultural methods.
4. Investigations to determine factors that influence seed production in alfalfa,
5. Tests and experiments on alfalfa seed production for increase of commercial seed.

TESTING OUT DIFFERENT STRAINS AND VARIETIES

After testing a large number of different strains of alfalfa for several years under uniform comparison, the results would seem to warrant the conclusion that the northern grown strains of alfalfa, especially the Baltic and Grimm and varigated strains of Lucerne, are the best suited for Colorado conditions, and that much of the winter killing and dying out of plants in the alfalfa fields is due to the non-hardy type that predominates in much of the "ordinary" alfalfa. Another deduction that may be drawn from the results of the comparative testing of different strains of alfalfa is that there is a wide variation in the traits and types of plants found in almost all the different strains of alfalfa, and there is an opportunity to improve alfalfa by systematic selection of seed.

During the past year, we have added to the list of varieties a few new ones,—two upright Falcatas, Mongolian alfalfa, and a few plants of a proliferating strain of Falcata; also the seed from a large plant grown near Moffat, Colorado, and a small quantity of seed from a very prolific seed producer grown near Burns, Oregon. Many of the inferior strains that we have had in the alfalfa nursery at Rocky Ford have been eliminated.

SELECTING AND PROPAGATING PLANTS OF SUPERIOR MERIT

There are a number of contrasting traits and qualities found in different plants of alfalfa. In some plants two or more of these points of merit may sometimes be found associated or combined together. The object in view has been to select plants that would combine the greatest number or degree of the desirable traits in alfalfa.

The following traits have been the points of merit that our selections have had in view:

Hardiness—freedom from winter killing.

Vigor of growth—and good forage qualities to make good, fine, leafy hay.

HEAVY SEED PRODUCTION

Disease-resistance. Many minor points, such as early blooming habits, color of bloom, early and lateness of season's growth, are some of the points of selection that have been made to improve alfalfa.

The four points first named have been found to be transmittable thru seed selection. The plan has been, when desirable plants have been found, to make a number of cuttings by dividing the crown. These cuttings are usually made early in the spring before growth starts much—when they will readily take root if kept in moist ground. From four to eight cuttings are usually secured. Thus, the seed production of select individual plants is multiplied by the number of cuttings established, and sufficient seed may be secured to make a comparative test under normal field conditions.

During the past year, seed from a number of select plants multiplied by cuttings have been secured, and a comparative test under very uniform conditions has been sown. In the test, each selection is sown in three different parts of the field in plats 5 by 50 feet and each plat separated from the others by a 12 inch space. All the plats are then treated as an ordinary field of alfalfa as regards irrigation and any cultural care. When the hay is ready to be cut, each plat can be cut by one width of a five foot mower. The hay is cut and weighed green, thus eliminating the variation in curing that might be due to inclement weather. We now have two nursery tests of this kind, and the results seem to promise an efficient method of determining the best selections under actual field conditions.

We have now planned the increase of one very promising selection of Baltic alfalfa, which has had a long history for good seed production and good average hay production. We have eight acres sown from increase on which we expect to secure seed for distribution.

EXPERIMENTS AND OBSERVATIONS ON CULTURAL METHODS

There have been two experiments carried on for the past four years.

1. *The relative yields of hay from different rates of seeding.* The results warrant the statement that there is little or no difference in hay yield on different rates of seeding if the stand of plants is reasonably uniform. The quality of hay and freedom from weeds makes the heavier rates of seeding more desirable, but where there are good conditions for good germination of seed, results would indicate that six to ten pounds of alfalfa seed per acre is sufficient.

2. *A comparison of hay yields on alfalfa sown in rows and broadcasted.* The results of this comparison are not so definite in terms of different weights in yield as in handling the crop. Alfalfa sown in rows is very difficult to harvest. The ground is rough for haying machinery, the fields are apt to be weedy and a clean job of cutting can hardly be done. If the field is cultivated, the soil is loose and a great deal of dirt is gathered up in the hay. Hence, the growing of alfalfa in rows for intertillage can hardly be advocated except on dry-land conditions, and for seed production. Here the results are better than thick stands of alfalfa.

INVESTIGATIONS TO DETERMINE THE FACTORS THAT INFLUENCE SEED PRODUCTION

The setting of alfalfa seed is uncertain and moisture conditions seem to play an important part. To determine the effect of moisture in different amounts in the soil on seed yields, twenty-four cement cisterns have been constructed and alfalfa plants propagated from cuttings have been established in each cement pit or pot. The growth of the plants has been very uniform. During the present season, moisture has been applied to the plants in varying amounts at different times, ranging from a very small quantity to very heavy watering. The growth of the plants seems to be in proportion to the amount of water applied, and it is hoped that the cause of alfalfa bloom failing to set will be revealed in the varying amounts of moisture supplied to the different plants.

Another line of investigation is that of space effect on alfalfa seed setting. In 1915 a series of duplicate plats and check plats were seeded to alfalfa and then spaced out in the rows to different distances. The different distances were 7, 14, 21, 28, 35, 42 and 60 inches. In this test there seemed to be a wider variation of the different individual plants in the same spacing than there was in the different distance of spacing. This experiment was abandoned to be tried on another planting of alfalfa grown from seed from an individual plant selection.

A third factor that seems to influence alfalfa seed setting is that of inherent tendency, seemingly characteristic of individual plants. Selections along this line seem to be producing results that are very promising in materially increasing alfalfa seed yields.

In the spring of 1916 a portion of a plat of alfalfa was root pruned. A plow without a mold board was used to cut the tap roots of several thousand alfalfa plants. The plat was watered so as not to kill out the plants cut off. This experiment was tried in hopes that seed setting could be induced by cutting off some of the root growth, but the plants that were root pruned did not set seed any better than the unpruned part of the plat.

An experiment of clipping alfalfa several times early to reduce the rank growth that usually characterizes the first growth of alfalfa in order to induce seed setting was again tried out the past season, but with negative results.

TESTS AND EXPERIMENTS ON ALFALFA FOR INCREASED SEED PRODUCTION

During the past season, two experiments were conducted to produce alfalfa seed by methods that could be adapted to commercial seed growing.

1. Seeding alfalfa in wide rows (40 inches apart). This test comprised five commercial varieties, Grimm, Baltic, Canadian Varigated, Black-Hills and Kansas Grown. The seed was sown at the rate of about two pounds per acre. Moisture was withheld from part of each plat, but the growth of all varieties was too rank and seed did not set successfully on this series of plats of two year old alfalfa.

2. A test to increase the seed of one of our best selections of Baltic alfalfa for distribution was attempted on a scale of about eight acres. The history of this selection extends back over ten years, and each year it has been a fair seed producer, and several times has produced very good yields. This seed was sown in four-inch rows with a row of spring wheat sown between the rows of alfalfa, with a view to absorbing some of the moisture applied to the alfalfa, and thus induce seed setting in the alfalfa. Part of the field was sown without wheat. A light crop—about 120 lbs. of clean seed was produced from the seedling growth of alfalfa. A very heavy rain of three inches in one day in August very seriously affected the seed yield, but, on the whole, the test could be counted a success. The presence of the grain did not seem to be of any special advantage. The growth of the alfalfa was heavier where there was no wheat sown, and there was not much difference in the alfalfa seed yield the first season, but the presence of grain growing with the alfalfa seemed to show evidence that the alfalfa was held back some, and another year's test will be necessary to prove results. In the fall of 1916, rye was sown in a few rows to further test this plan of alfalfa seed production. At the present time—June 1, 1917—the rye is headed out and the alfalfa seems to be held up or supported by the rye, and the field looks very promising for a good crop of seed.

The history and results of this improved Baltic seems to warrant its increase for commercial planting. The seed secured last year has been distributed to the county agents in several parts of the State as Pedigreed Baltic Alfalfa No. 1. The seed has been furnished to the county agents to be placed with reliable farmers

who will seed it with a view to seed production, with the understanding that the seed produced will be kept pure, that an option on the seed will be given to the Colorado Experiment Station for two years, or that the grower will turn back to the Experiment Station one bushel of clean seed from his first successful crop of seed for each ten pounds of seed furnished him by the Station.

PHILO K. BLINN,
Alfalfa Specialist.

REPORT OF THE BACTERIOLOGIST

To the Director:

I have the honor to submit herewith the annual report of the work of the Bacteriological Section of the Experiment Station for the fiscal year 1916-17.

Three lines of investigation have been carried on under the provisions of the Adams fund and one under the Hatch fund. One of these has been completed and material progress has been made upon the other three.

In addition to our research work, we have continued to supply vinegar cultures to those who desired them. An increasing amount of miscellaneous, routine work in the shape of the examination of water, milk, soil and plant disease specimens has devolved upon our laboratory which has demanded no inconsiderable amount of our time. The correspondence incident to service of this kind is, in itself, an item not to be lost sight of.

I. Bacteriological Studies of Alkali Soils.

Under the general project, we have considered three different topics, namely, (1) the soil protozoa, (2) the nitrifying bacteria, (3) the effect of outside winter temperatures upon the different biological activities in soil.

So far as our studies on the first have progressed, we find, much as a year ago, that the total number of protozoa as well as the number of species is smaller than that reported for eastern soils.

Concerning the second, successful isolations of the nitrifying bacteria have been accomplished, and the systematic classification of these will be carried out as soon as possible.

The results of one season's observations on the relation of winter temperatures to biological activities in soil are now available, the study of some 320 soil samples covering a period of five months having been completed, however, it seems advisable to collect further data before publishing the facts at hand.

II. Bacterial Disease of the Wragg Cherry.

Spraying experiments were continued at Crowley, Colorado, for the control of the bacterial spot of the Wragg Cherry. This year we employed as bactericides, commercial lime sulfur solution, self-boiled lime sulfur and Bordeaux mixture. Unfortunately for our work, the attack of the disease this season was very mild compared with that of the past two years, and as a further complicating factor, the niter trouble made its appearance for the first time. Any one of the spray materials used appears to be helpful in controlling the spot, however, their use seems to be attendant with more or less dwarfing of the fruit.

The following bulletins have been published by this section: Bulletin 225, "A Comparative Bacteriological Study of the Water Supply of the City and County of Denver, Colorado," and Bulletin 226, "Beans in Colorado and Their Diseases," the latter in conjunction with Professor Kezer.

Practically my entire time during 1917-18 will be spent at the University of Chicago on a study of Food Poisoning in the Lower Animals.

In different phases of my work, I have been assisted by Mr. C. R. Koontz and Mr. J. H. Newton to whom credit is due for their efficient services rendered.

Very respectfully submitted,
WALTER G. SACKETT,
Bacteriologist.

REPORT OF THE ANIMAL HUSBANDMAN

To the Director:

Progress was made during the past year upon the project on ration experiments with steers. We could publish some of this data, but would prefer another year's work first.

Projects in force this year are Ration Experiments with Lambs; Acre Value of Pasture for Dairy Cows; and a tentative project continuation on the Ration Experiment with Steers.

No bulletins have been issued by this section during the past year.

The work is in much better shape this year than it has been for some time past. A regular budget, a man on full time in the Animal Investigation work, and office help have aided in making the work much more accurate.

Yours respectfully,
GEO. E. MORTON,
Animal Husbandman.

REPORT OF THE BOTANIST

To the Director:

I submit herewith the annual report on the experimental work of the Department of Botany.

The following projects have engaged our attention during the past year:

(1) Native Vegetation as an Indicator of Crop Possibilities in the Colorado Transition Area.

(2) Microscopy of Stock Poisoning Plants.

(3) Microchemical and Anatomical Study of Yellow-Berry Wheat.

(4) Millet Smut.

(5) Native Forage Grass Studies.

Progress has been made on each of the above projects during the past year, and each will be kept alive during the coming fiscal year.

Bulletin 224, "Native Vegetation and Climate of Colorado in Their Relation to Agriculture," was issued as a preliminary bulletin in connection with project No. 1.

This is the second season's work on the Millet Smut project carried on by Professor H. E. Vasey. A bulletin setting forth control measures for millet smuts is now in preparation.

There is also in preparation a popular bulletin on the forage grasses of Colorado. This is being written in co-operation with State Forester W. J. Morrill.

The microchemical and anatomical study of yellow-berry wheat was made by the undersigned, while on leave of absence, in the Hull Botanical Laboratories of the University of Chicago. I take this opportunity to express my appreciation for the facilities offered there and for guidance by members of the staff.

The object of project No. 2, The Microscopy of Stock Poisoning Plants, is, through an histological study of the principal poisonous plants of western ranges, to lay a basis for the microscopical examination of the stomach contents of animals with a view of aiding in determining the cause of death. Attention is also directed to the development of methods for the diagnosis of stomach contents. The results to date are most gratifying.

Respectfully submitted,

W.W. ROBBINS,

Botanist.

REPORT OF THE CHEMIST

To the Director:

The Chemical section had at the beginning of the year the following projects: "The Rio Grande Waters," "The Occurrence of Nitrates in Colorado Soils," and "A Study of Colorado Wheat." These projects are all on the Adams Fund.

"The Rio Grande Waters" required that further samples should be taken and that a number of analyses should be made. This work was made to coincide with some of the work on nitrates so that less traveling would be necessary. The work on the Rio Grande Waters has been presented in Bulletin 230 which is now in press.

The subject of the nitrates has grown even more important during the past season than heretofore. They are appearing in excessive quantities in new localities and have done serious damage in the Arkansas Valley, especially to cherry trees. In this case the effects were so intense that I attempted to find out whether some other cause might not also be operative and really be the chief cause of injury. This subject is not yet decided, though at the present time I cannot see any other cause for the injury done. The very significant and persistent condition that obtains is, the wide distribution of these nitrates in injurious quantities. I have, of course, known of their occurrence in portions of the San Luis Valley for 12 years or perhaps a little longer. I described one of these occurrences in Bulletin 155, but they are now scattered over portions of the valley where they were formerly absent. The land is beginning to be spotted in its productiveness to such an extent that it is attracting the attention of the owners of the land and is now creating some concern. Up to the present time I have found no reason to believe that I have made any big mistakes in my work on this subject, nor does it yet appear that we can attribute the injury to cherry trees observed this season, 1917, to any other cause than to the nitrates that are present.

The wheat project has been continued this season on the same lines that we followed in previous years. We have milled all of the small samples gathered from the beginning of the work and have this season's samples to mill and the baking tests to make.

As the bulletins published on this work were issued in limited editions and the results were largely unavailable to the general public, I have prepared a small bulletin giving the most important results obtained. This seemed to me advisable as there is no doubt but that the farmers can, if they will, very greatly improve the quality of the wheat produced without sacrificing the yield or

increasing the cost materially. A great deal of our wheat is of the second and third grades, whereas it can be made to grade much better. The bulletin here referred to has for its object the making known of the facts in the case. Of course, you know that it is only within the last few weeks that our wheat have been closely graded. Bulletin 219, July 1916, remains the last one issued on this project.

An outgrowth of the work on the Rio Grande Waters is the conclusion that the prime cause for the bad condition of the eastern half of the northern section of the San Luis Valley is the prevalence of sodic carbonate. Some of the facts which have been ascertained in this connection have been presented for publication as Bulletin 231, entitled "Black Alkali in the San Luis Valley."

This is a subject which perhaps it might be quite worth the while to prosecute in some detail for it is quite possible that there are other conditions contributing to the very bad state of affairs in this section of the valley. There is some nitrate in places but this is insignificant in comparison with the general conditions.

I have also prepared a bulletin on the general subject of "Alkalis in Colorado, including the Nitrates." This bulletin is the outgrowth of 25 years of observation and study of this general subject. I believe this effort to be timely. The bulletin is intended for general distribution.

There are features of this subject which could be made the subject of specific investigation possibly with profit, especially as they might throw some light on other features of the alkali question which are not wholly clear. These questions may not be capable of a satisfactory solution or the reactions now going on may only be transient ones which in a few years may give place to others. One such specific question presents itself in the appearance of the chlorids of calcium, magnesium and sodiums over very considerable areas of the San Luis Valley. I estimated, by stepping off the length and breadth of one of these occurrences, that it included rather more than 12 acres of land. I saw a number of smaller areas and one very much larger. The first I observed of this was about 3 years ago.

Respectfully submitted,

WM. P. HEADDEN,

Chemist.

REPORT OF THE ENTOMOLOGIST

To the Director:

The experimental work in the Entomological section of the experiment station has been confined to the projects mentioned

on a preceding page. The major portion of the work has been done on the "Plant Louse" and "Codling Moth" projects. In both of these lines we now have a large accumulation of data, portions of which are being tabulated for publication.

In the Grand Valley we continued our life history and control studies with the codling moth in cooperation with the Federal bureau of Entomology.

In Delta County we carried on life history studies of the codling moth to determine the best periods for orchard spraying in that section.

An infestation of the alfalfa weevil, *Phytonomus posticus*, was discovered by Mr. J. H. Newton near Paonia, in a limited area well shut in on the north and east by mountains and on the south and west by uncultivated lands. Fortunately, the Twenty-first General Assembly was holding a special session at the time this infestation was discovered, so that an appropriation of \$6,000.00 for the present biennial period was promptly made for the purpose of enabling the State Entomologist to do whatever was possible to exterminate and control the spread of this pest to other sections. While it is hardly to be hoped that we shall be able to exterminate the weevil, we are very strongly in the hope that we may be able to greatly retard its spread to other sections of the State. It seems very probable now that we shall be able to cooperate with the Government Bureau of Entomology in this work of weevil control.

No bulletins have been published from this section during the year, but the following circulars have been published from the office of the State Entomologist:

Circular

Number

Title

- | | |
|----|---|
| 20 | The Wyoming Ground Squirrel in Colorado with Suggestions for Control, by W. L. Burnett. |
| 21 | Eighth Annual Report of the State Entomologist of Colorado. |
| 22 | Colorado's Amended Horticultural Inspection Law. |
| 23 | Pocket Gophers with Suggestions for Control, by W. L. Burnett. |

During the year the following papers have appeared in technical entomological journals:

Migratory Habits of *Myzus Ribis* (Linn), by C. P. Gillette,
Journal of Economic Entomology, 1917, P. 338.

Two New Aphid Genera and Some New Species, by C. P. Gillette,
Canadian Entomologist, 1917, P. 193.

Additional Notes on Heredity and Life History in the Coccinellid

Genus *Adalia* (Nuls), *Annals Entomological Society of America*, 1917, P. 284, by Miriam A. Palmer.

Respectfully submitted,

C. P. GILLETTE,
Entomologist.

REPORT OF THE FORESTER

To the Director:

I herewith submit a brief report of the work done in the Forestry Division of the Experiment Station for the fiscal year 1916-1917.

Two projects have been worked upon during the year. The first, dealing with the various methods of controlling the dandelion, has been practically completed and the results of experiments covering several years have been submitted for publication as a bulletin. Although this project may be considered as completed, so far as further experiments are concerned it may be well to conduct some further work of a cooperative nature on a larger scale than that recorded in the bulletin. Some spraying work of this kind was tried in one of the city parks in Denver during the past summer but with rather indifferent results. It seems that very careful supervision of such work is needed to ensure success in the control of dandelions on a large scale by this means.

The second project, dealing with comparative studies in the decay of timber, is still in progress and should be continued through the coming year. All of the samples of a few species under investigation have been taken from the test-box and the data is being compiled for comparative study. No definite results are yet ready for publication in connection with this project, except that steady progress is being made.

Respectfully submitted,

B. O. LONGYEAR,
Assistant Forester.

REPORT OF THE HORTICULTURIST

To the Director:

I beg to submit the following brief report on the experimental work in the Department of Horticulture for the year 1917:

1. The following projects have been in progress during the year: "Pear Growing in North Eastern Colorado"; "Growing Hardy Stock for Applies"; "Growing Fruits and Vegetables in High Altitude"; "Growing Potatoes in the Vicinity of Fort Collins"; "Orchard Survey of Mesa County"; "Management of Nitre

Soil in the Grand Valley," and "A Study of the Influence of Planting Small and Ill-shaped Seed Potatoes versus Selected Seed." Work has been carried on in all these projects, but some of them are of such nature as to require a number of years before any results can be obtained. They have been carried on in the usual way without any considerable amount of work. The potato projects have been pushed with more vigor as these are of more importance, especially at this time.

2. All the above listed projects are in force with the exception of the "Orchard Survey of Mesa County" and the "Reclaiming of Nitre Soils in Grand Valley," which projects have been completed.

3. The projects "Reclaiming Nitre Soils in Grand Valley," and "Orchard Survey of Mesa County" have been completed and bulletins published. All the rest of the projects are in force, but greater attention will be given to those which are more or less associated with food production. Especially the potato projects.

The following bulletins have been published by the department during the year:

Bulletin 220, "Potato Growing in Colorado"; bulletin 221, "Hot Beds and Cold Frames"; bulletin 222, "The Forcing of Strawberries"; bulletin 223, "Fruit Survey of Mesa County"; bulletin 232, "Harvesting and Storing Fruits and Vegetables for Home Use"; bulletin 235, "Reclaiming Nitre Soils in Grand Valley." In addition a biennial report has been issued by the State Horticulturist.

Respectfully submitted,
E. P. SANDSTEN,
Horticulturist.

REPORT OF THE HOME ECONOMIST

To the Director:

Beyond giving the statement of the project for the fiscal year of 1917-1918, this department has no report to render.

Utilization of Raspberry and Plum Juices is the title of the departmental project.

Respectfully submitted,
INGA M. K. ALLISON,
Home Economist.

HORSE-BREEDING INVESTIGATIONS

To the Director:

In response to your request for a report upon the work of the section, I will say that most of this has been done by Mr. Little prior to my arrival here, but will submit the following:

We have seventeen weanling colts and some of them are especially growthy large colts and bid fair to represent the type we desire to produce at maturity.

In regard to projects for the coming year will say that personally I desire to make some comparisons of the cost of production of the colts in my division as compared with the colts of the college of other breeds. I should also like to run some labor experiments regarding horse labor as compared with cost of maintenance, etc.

To my knowledge, no bulletins have been published the last fiscal year due to the extensive nature of our experiment. I think that one important feature of the work here is the manner of reproduction and care of the mares at foaling time as compared with the system now in use on a great many breeding farms. Our mares foal under natural conditions in the pasture unattended, and the percentage of loss at foaling is, I believe, much lower than the percentage when the mares are attended at foaling.

The use of alfalfa hay for horses seems to give very good results. Very few digestive troubles are experienced and these results are a contrast to the general belief regarding the feeding of alfalfa hay to hot blooded horses.

Very respectfully yours,

DAVID D. GRAY,

Animal Husbandman in Charge.
U. S. Horse Breeding Station.

REPORT OF IRRIGATION INVESTIGATIONS

To the Director:

The following is a brief report of the work done by the cooperative irrigation investigations during the year 1917.

Particular stress has been placed upon the field investigations on the use of water in the Cache la Poudre Valley. Six men were constantly employed in this work with additional assistance for surveys. Although the year was an exceptional one from an irrigation standpoint, it has been deemed best to close the project, two years results having been obtained. It is expected that these data will be available for publication by the spring of 1918.

The principal use of the hydraulic laboratory during the summer of 1917 was in connection with the investigation of cur-

rent meters. This has developed into a very complex project, despite its comparatively simple beginning, and until all of the data have been compiled it will not be known whether additional experiments will be necessary.

The hydraulic laboratory has also been used for some experiments with drops and different types of measuring devices which have been submitted for tests.

Interest in drainage has been unusual this year and has called for about half time of one man throughout the year. In addition to assisting individuals with plans and in some cases surveys for the drainage of their farms, assistance has been given several groups of farmers and three districts have been organized under the Colorado Drainage Law. This office has furnished plans and acted in a consulting capacity for the drainage of over 25,000 acres during the year.

The results of previous experiments on submerged orifices and the so-called Venturi flume, appeared in the Journal of Agricultural Research of the U. S. Department of Agriculture early in 1917. A bulletin on "Divisors" appeared as a station publication in June 1917.

Four men from this division have entered military service within the past few months and it is impossible to say how much of a force we shall have by next spring. An effort has been made to close certain lines of work which can either be completed or held in abeyance without serious injury, but if there is not a dearth of trained men, this work may be continued next season, or our efforts may be directed along lines which will give more immediate results in our National emergency.

Respectfully submitted,

V. M. CONE,

U. S. Engineer in Charge Irrigation Inv.

REPORT OF THE IRRIGATION ENGINEER

To the Director:

I submit herewith my annual report concerning the progress of the experimental work under the charge of the Irrigation Engineering Section for the past year.

We have been at work on two projects for the past five or six years. The first, The Duty of Water on the College Farm, is still in progress, and careful measurements of all water used for irrigation purposes on the different fields of the college farm have been made. Records of these have been kept in the usual way, and another year's records have been added to our list. It seems

to me that this work has been carried far enough at the present time, and that now we should enter upon the second phase of the work, namely, The Improvement of the Irrigation Systems upon the College Farm. I would, therefore, recommend that sufficient money be placed at the disposal of this department so that more up to date and efficient methods of irrigation may be installed upon the farm, that careful records be kept of irrigation under these new systems, so that a comparison can be made with the old system that has been practiced for years.

The second project, Sub-irrigation by Means of Underground Pipes, has been completed. No work was done upon this project last season, and it is not my intention to carry the work further. The data which we have on hand is available for a bulletin, and it is my intention to write this bulletin and submit it for your approval as soon as my other college duties permit.

Respectfully submitted,

E. B. HOUSE,

Irrigation Engineer.

REPORT OF THE VETERINARIAN

To the Director:

During the past year, the veterinary section has concerned itself with the following projects:

NECROBACILLOSIS IN PIGS

Our efforts in this line have been directed toward the production of a vaccine which might prove of service to those interested. Progress has been satisfactory, but no definite conclusions have been reached as yet concerning its value.

CONTAGIOUS ABORTION

Our efforts have been confined to the determination of the prevalence of the disease within the State by means of agglutination tests. The work must necessarily continue for some time before any definite results can be had.

SHEEP LOSSES IN THE FEED LOTS

A small band of sheep was fed at the station during last winter with a view to determining whether lambs could be killed by an over feed of grain, and if so the amount which would be necessary. While the results were interesting, the experiment must be repeated before any conclusions can be had. Many visits were made to the feed lots where animals were dying, and while the loss undoubtedly was due to several different factors, we seem to have definitely proven that hemorrhagic septicemia is one of the prominent causes of loss in this business. Our efforts are now

directed toward determination of the value of vaccines for the prevention and control of this disease.

CHICKEN DISEASE

A disease of small chickens in which there are vesicles present on the feet and head has been investigated only slightly as the season was well advanced before this work began. We have nothing as yet for publication. We have, however, some definite work planned for the following year.

BRISKET DISEASE

Owing to the demand for bulletin No. 204, the supply became exhausted, and it was necessary to revise and reduce it, which work appeared as station bulletin No. 229. Some of the more technical studies which were done in previous years will shortly appear as a separate bulletin. No investigational work has been done on this disease during the current year.

Respectfully submitted,

GEO. H. GLOVER,

Veterinarian.

REPORT OF THE EDITOR OF PUBLICATIONS

To the Director:

I respectfully submit herewith the annual report of the Editor of Publications for the fiscal year ending November 30, 1917:

The past year has been an exceedingly busy one in the Office of Publications. Bulletins to the number of 15, totalling 421 pages, and a combined edition of 102,000 copies, have been published. Eleven of these have been practical, well illustrated bulletins upon agricultural subjects of interest to the farmers, fruit growers, and stockmen of the State, carrying usable information ready to be applied to their problems. Four of them were of a more technical nature, treating of the results of scientific research, but at the same time conveying some very valuable information which is available to the better posted owner or worker in the industries with which they deal.

Following is a list of the bulletins published during the year just closed, together with the number of pages in each, and the number of copies printed:

Bulletin No.	Title and Author	No. Pages	Number Published
220	Potato Growing in Colorado, by E. P. Sandsten	30	10,000
221	Hotbeds and Cold Frames, by T. F. Limbocker	8	10,000
222	The Forcing of Strawberries, by Florence Kinnison	8	3,000

Bulletin No.	Title and Author	No. Pages	Number Published
223	A Fruit Survey of Mesa County, by E. P. Sandsten, T. F. Limbocker, and R. A. Ginty	52	5,000
226	Beans In Colorado And Their Diseases, by Alvin Kezer and Walter G Sackett	32	10,000
227	Dry Farming In Colorado, by Alvin Kezer	40	10,000
229	Brisket Disease, by Geo. H. Glover and I. E. Newsom	8	3,500
231	Black Alkali In The San Luis Valley, by Wm. P. Headden	15	5,000
232	Harvesting and Storing Vegetables for Home Use, by J. J. Gardner	7	10,000
233	Grasshopper Control, by Chas. R. Jones	29	10,000
235	Reclaiming Nitre Soil in the Grand Valley, by E. P. Sandsten	8	8,000
224	Native Vegetation And Climate of Colorado in Their Relation to Agriculture, by Wilfred W. Robbins	56	5,000
225	A Comparative Bacteriological Study of the Water Supply of the City and County of Denver, Colorado, by Walter G. Sackett	14	4,000
228	Divisors (For the Measurement of Irrigation Water), by V. M. Cone	52	6,000
230	The Waters of the Rio Grande, by Wm. P. Headden	62	3,000
Totals		421	102,000

The work of this office, which is closing its second year, is now well established. The most cordial relations exist between this office and the workers in the station and it is earnestly hoped that the station specialists will avail themselves of the editor's services more and more in planning and illustrating their bulletins to the end that our publications may be kept at the very highest standard of practical effectiveness.

Very respectfully,

RALPH L. CROSMAN,
Editor of Publications.