THE STATE AGRICULTURAL COLLEGE
OF COLORADO

THE TWENTIETH ANNUAL REPORT

OF

The Agricultural Experiment Station

For 1907

State Board of Agriculture.

	Term Expires
HON. P. F. SHARP, *President*,[1] Denver	1907
HON. HARLAN THOMAS,[1] Denver	1907
HON. JAMES L. CHATFIELD, Gypsum	1909
HON. B. U. DYE, Rocky Ford	1909
HON. B. F. ROCKAFELLOW, *President*, Canon City	1911
HON. EUGENE H. GRUBB, Carbondale	1911
HON. A. A. EDWARDS, Fort Collins	1913
HON. R. W. CORWIN, Pueblo	1913
HON. F. E. BROOKS,[2] Colorado Springs	1915
HON. J. L. BRUSH,[2] Greeley	1915

GOVERNOR JESSE F. McDONALD[3]
GOVERNOR HENRY A. BUCHTEL
PRESIDENT BARTON O. AYLESWORTH } *ex-officio.*

EXECUTIVE COMMITTEE IN CHARGE.[4]

P. F. SHARP, *Chairman*

B. F. ROCKAFELLOW. A. A. EDWARDS.

EXECUTIVE COMMITTEE IN CHARGE.[5]

B. F. ROCKAFELLOW, *Chairman.*

A. A. EDWARDS. B. U. DYE.

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[1] Term Expired April 10, 1907.
[2] Term Began April 10, 1907.
[3] Term Expired January 1, 1907
[4] To April 10, 1907.
[5] Since April 10, 1907.

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
W. H. OLIN, M. S., ---------- Agronomist
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

STATE FRUIT INVESTIGATIONS, GRAND JUNCTION.

O. B. WHIPPLE, B. S., ---------- Field Horticulturist
E. P. TAYLOR, B. S.,[1] ---------- Field Entomologist

OFFICERS.

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

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

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[1] Resigned October 15, 1907, to become Entomologist, State Fruit Experiment Station, Mountain Grove, Missouri.

LETTER OF TRANSMITTAL.

To His Excellency, 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 Twentieth Annual Report.

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

L. G. CARPENTER,
Director.

FINANCIAL REPORT OF THE COLORADO AGRICULTURAL EXPERIMENT STATION FOR THE FISCAL YEAR ENDING JUNE 30, 1907.

RECEIPTS.

DR.

From the Treasurer of the United States as per appropriations for the fiscal year ended June 30, 1907, 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	$7,000.00	.....	.....	.....
Balance on hand July 1, 1906	.....	.....	$2,364.52	.....	.....
Miscellaneous	.....	.....	.....	$7,497.68	.....
Total Receipts					$31,862.20

DISBURSEMENTS.

By Salaries	$ 9,111.27	$4,614.81	$ 843.33	$1,069.96	$15,639.37
Labor	1,200.34	701.55	276.02	695.95	2,873.86
Publications	1,914.26	.....	.....	2,266.47	4,180.73
Postage and Stationery	616.07	93.07	17.60	159.16	885.90
Freight and Express	522.23	108.57	12.50	198.38	841.68
Heat, Light, Water and Power	5.90	.....	.....	16.30	22.20
Chemical Supplies	.....	38.05	.....	12.45	50.50
Seeds, Plants and Sundry Supplies	203.12	23.15	53.54	80.54	360.35
Fertilizers	.....	.....	.....	.....	.....
Feeding Stuffs	11.10	.....	.....	431.86	442.96
Library	1.80	655.26	.....	3.00	660.06
Tools, Implements and Machinery	19.50	.....	17.00	11.00	47.50
Furniture and Fixtures	90.29	28.45	42.25	22.95	183.94
Scientific Apparatus	131.59	228.34	5.20	98.64	463.77
Live Stock	.....	.....	.....	533.30	533.30
Traveling Expenses	704.93	508.75	175.90	500.17	1,889.75
Contingent Expenses	21.00	.....	841.24	227.85	1,090.09
Buildings and Land	446.60	.....	79.94	327.37	853.91
Total Expenditure	$15,000.00	$7,000.00	$2,364.52	$6,655.35	$31,020.20
Balance				842.33	842.33
				$7,497.68	$31,862.20

REPORT OF THE DIRECTOR

To The State Board of Agriculture:

Gentlemen—In this report as Director I will discuss more the general problems of the Station, and those which pertain to the work and policy as a whole, and will attempt to give information which bears upon the general work, and to show what the Station is doing.

The variety of work has had a tendency to increase. Funds from State and other sources have served to extend the work so that more topics need to be discussed than usual. The Station, and in fact all of the Stations of the United States, are at a turning point in their history, are hunting for light, and feeling their way toward their proper function. It was a number of years after the Hatch Act was passed before the Stations as a whole grew to their responsibilities and came to a clear understanding of their proper scope.

With the passage of the Adams bill another period in their life comes, which involves not only the interpretation of the law but also a growth of the idea of important scientific research. It will undoubtedly be a number of years before the Stations will have reached a uniformity of sentiment, and have gotten clear light on many of the problems which this Act brings up. The limitations of the Act are at present troublesome, and cause much preplexity to the Stations, and the feeling among many that the interpretation is arbitrary and unnecessary. The provisions of the Act, however, place the control of the funds much more directly in the hands of the general Government than the Hatch fund. This was probably done because some of the Stations at least, did not live up to their duties as institutions for the advancement of scientific investigation along agricultural lines. Some were affected by itching for popular applause, and some had used money in ways that were at least doubtful. While these restrictions are at present the cause of much perplexity, I have no doubt that in the course of a few years it will be generally realized that they have been wise, and that the Stations could not have become so important without them.

The requirements of the bill are such as I have previously pointed out. The additional appropriation is not really an addition to our resources. The requirements are correspondingly great, and in fact such as to make additional demands on our other funds in order to utilize this fund within the requirements of the law. As a consequence it appears that some difference in the relations between the Colleges and Stations will result in the course of a few years. Under the Hatch Act, as commonly interpreted, scientific investigation was secondary, and the fund was often used to supplement the salary of an instructor, when the requirements of investigation gave way to the requirements of the routine work of teaching. The conditions of the

Adams fund, however, are more strenuous, and it would appear that it will be almost inevitable that with those principally engaged in scientific research, the scientific work will be primary and teaching and other work will become secondary. In the past if there was conflict the investigational work had to give way. Under the conditions of the Adams Act, if the two conflict it would look as though the adjustment would need to be on the other side. In other words the requirements are such that the Government is in a position to insist upon conditions favorable to scientific work. While at present most Stations are not so situated, nor as yet enough money from the Adams fund, to justify such conditions, yet it seems to me that the tendency will inevitably be that way. The Government already urges that there be only a few men supported from this fund, and that those men give the large part of their time to this work. This means a force of professional scientists, and the use of the fund to a few men of high type who give the greater part of their energies to such investigation. It must lessen the amount of teaching which they can do, but the final result will be to put such Institutions more of the type of the German Universities. The transition and development is bound to be slow, and possibly painful, but if I forecast the development rightly, the inevitable and final results will show that it is best for the Institutions and for agricultural science. At the start and for a few years there will be misunderstanding and criticism undoubtedly from failure to understand the wisdom of the law, but the situation of the Government is such that it seems to me the result must come.

So much has been done in the name of Experiment Stations that there is not a clear idea among the public as to the scope of the Stations, or their limitations, and this same vagueness of idea is not free from the staff of the Experiment Station. Popular applause is very often, if not generally, given to the work which is not really scientific, and in fact scientists very generally doubt work so heralded. It was the result of wide experience that physicians reached the conclusion that reputable physicians must not advertise.

The Experiment Stations had at the passage of the Hatch Act relatively few trained men to draw from. With the requirements of the Adams Act there are now not sufficient qualified men to meet the demands of the Stations. They should, to some extent, be trained. The requirements are such as to need the most thorough scientific training as a basis, and it should encourage years of preparaiton. Whether we deceive ourselves or not the final standing of the Stations will be fixed by the opinion of scientific men.

A part of the confusion in the consideration of the scope of the Experiment Stations is because of the fact that there are different sources of support, and a Station may have three very different lines of action. It needs to be considered;

(a) As supported from U. S. Government funds
(b) As supported from State Appropriations
(c) As supported by private and other funds

As maintained by the U. S. Funds, that is the Hatch fund and the Adams fund, its powers and its duties are such as are contained in these two acts of Congress. Some things it is prohibited from doing, some things it can do, and some things it is required to do. Under these limitations extension work is not permitted, except as it may be considered as a form of publication, which is permitted under the Hatch Act. This manifestly would be improper, more than to a very moderate degree, for the Act strictly speaking, refers to publication of results. It is to be anticipated that much that has been permitted hitherto under the Hatch Act will be more strictly inspected by the Government in the future.

The Adams fund cannot be used for printing nor for the organization of the Station. None of this fund can be used for the purchase or rental of lands, nor for the operations of farming, nor can they be used directly or indirectly for the salaries of persons whose work is not in connection with the Experiment Station, nor can this fund be used for permanent substations.

Likewise under the State appropriations the Station would be permitted to do whatever may be permitted by the State Act. Thus the appropriation by the Legislature last winter is such that almost anything can be done under the different sections of the Act that may be thought desirable. It is not subject to the limitations of the National Act. Any investigation tending to develop the animal interests of the State, or of the grain and forage interests, or the fruit interests, would be possible. Substations, extension work, the distribution of seeds, and many other things which were not the purpose of the National Act, would be possible under these provisions.

Likewise under the third class such funds as are given by private subscriptions or from other sources, would be subject to their own limitations. Under this may be such as the Delta County subscription of the past year, the Mesa County subscription of the previous year, funds from cooperation with the Government, in each the funds are available for the special purposes provided for. So likewise may be classed the direct support from the State Board of Agriculture. Its powers are so wide that it would legally be possible for them to give funds for almost any purpose.

Inasmuch as the U .S. Department of Agriculture may, and does, do many things which we cannot do under the Hatch and Adams funds, it is sometimes supposed to be inconsistent. This is not so, for its funds are given by Act of Congress, and as these are given annually, and as the conditions are changed from year to year, it is only limited by these conditions, and in that case the funds given to it bear the same relation as the State appropriation does to us. Hence while we may not support a substation from the U. S. funds, the Department of Agriculture may do so, if the conditions of the grant to them are such as to permit it.

Demonstration work, variety testing, the distribution of seeds, etc., and various cooperative work which are perfectly proper under section B are not proper under section A. So publications which may be

proper under either B or C may likewise not be permissible under the Government funds of the Station. Such bulletins are often printed and such work done. Inasmuch as the distinction concerning the source of the revenue, and the conditions is not made confusion often arises as to the work of the Station. The Cornell Experiment Station has had a large appropriation from the State, and thus does much work from these funds that it could not do from Government funds. The Geneva Station also has a large amount from the State, amounting now to nearly $100,000 per annum, and only under conditions made by the Legislature. Hence such stations are not guides as to the limitations of other stations which are largely restricted by Congressional requirements.

It may be desirable to distinguish in the publications, the work done under these different funds, as a means of educating the public and of preventing this misconception which frequently leads to embarrassment and to dissatisfaction which would not arise if the limitations were understood.

It then follows that the conditions and requirements for the workers in the second class of work may be very different. Demonstration work and the work which brings the Station in contact with the public and attempts to put at their disposal the work of the Station and of the College, is exceedingly desirable, but it is not in itself scientific work, nor is it permitted to more than a moderate degree under the terms of the Government grants. These things need to be supported from the State and other funds. The fact that it is not permitted by the Government acts does not show that these officials do not realize its importance and value, but rather that they believe that local support can be obtained for such work much more readily than for the scientific work which should be its foundation, and without which such work would lose its inspiration and its value.

As mentioned before the provisions of the Adams fund do not make the conditions of the Station easier. It was expected that the State appropriations would ease the Station funds, but unfortunately it has not done so, especially during the past year. The general expenses of the Station tend to increase, and must do so inevitably. As more work is done there should be more bulletins published. There is a great increase in the number on the mailing list, and this means a direct increase in the expense of publication.

The Farmers' Institutes and the extension work of Professor Cottrell, have brought a very large addition to our mailing list, so that the cost, with the increase in the cost of printing and of paper, and the great increase in the size of the edition, more than doubles the cost of a bulletin. The envelopes for sending out one edition to the full mailing list, will in the future cost about $50. The work of mailing and addressing these envelopes is very great, and if done by hand would mean several weeks' work. Our present system of addressing the envelopes, which served its purpose with a small list, is now outgrown, and it means an additional expense for another addressing

machine. Hence all of these conditions due to the growth of the Experiment Station mean cost. At the same time our funds available for these purposes are fixed. Further demands likewise occur, and many greater expenses. All of the miscellaneous demands which are in consequence of the Adams fund, come back and are a charge on the Hatch fund, or other funds. All of this means more clerical work, it means more correspondence, and therefore more help throughout the Station as a whole. These miscellaneous expenses must be borne by the Hatch fund, and yet may be a direct consequence of the Adams fund. Hence, as I have stated before, the consequences of the Adams fund are not a relief to the financial situation of the Station, but rather make it more strenuous. To some extent this is also true with regard to other appropriations given to the Experiment Station for other work.

When other funds are given, as for the fruit investigations and from other State appropriations, they have a tendency to cause additional correspondence and therefore additional bulletins. Therefore, it has seemed to me that the only satisfactory way to treat the other funds is to estimate the incidental expenses, like bulletins, postage and stationery, and make them a charge against those funds. This I have endeavored to do, and hence in estimating the expenses of such an investigation as the Delta County fruit investigation, the Mesa County, or the animal investigations, etc., I have included the printing as an essential part of the expense. Otherwise the Hatch fund would become practically nothing but a printing fund, and the Station proper might thus have nothing to do with the line of experimentation.

The last Legislature passed a bill appropriating $45,000, of which $35,000 is essentially for the Experiment Station, as follows:

$6,000 for Animal Industry.
$4,000 for Plant Industry.
$2,000 for Grain House.
$2,000 for Farm Machinery and Building.
$500 for Animal Diseases.
$8,000 for Fruit Investigations.
$7,500 for Purchase of Lands.
$5,000 for Co-operative Horse Breeding Work (Provided the Government will spend $10,000).

One-half of this amount should be available the fiscal year ending December 1st, and the other half during the next fiscal year. It was expected that this money, or a proportionate part of it, would be available immediately after the Legislature adjourned, and it has been expected to be available almost every month since. As a matter of fact it was not available until late in October, this was after the growing season, and therefore it meant that such work had to be continued at the expense of other funds, or else dropped. It therefore has led to an awkward situation We realized the fact that a suspension of the work would mean the destruction of its value, and it has therefore lead to a tendency to use other funds and continue the work. The effect has therefore been to make the Station chronically hard up during the season, and to

rather strain the interpretation to justify the use of other funds. The Government auditing officers have questioned the desirability of doing this.

During the entire season, therefore, the Station has been constantly in the situation where its funds were very low, and has been forced to hold back bulletins, and refrain from other expenditures which were desirable to make This awkward situation has arisen with almost every State appropriation. The appropriation of four years ago has not been received until now. The appropriation of two years ago was not available until late in the fall, and the present appropriation was available November 1st, and there is still doubt as to whether we shall receive the full amount for the coming year. This makes an exceedingly difficult situation to arrange for. If the appropriation be for a building, then the delay in the payment simply means the delay in starting, and no more serious result is apt to arise. In the case of investigation or all work which has to be continuous, then such a delay means either suspension of the work or the depletion of the other funds. It is manifest that such work cannot be suspended for 10 months, or even one month without practical destruction of all value.

This kind of appropriation is exceedingly difficult to manage in connection with the Experiment Station. It is far better to have a less amount, but one which can be depended upon with certainty, and to be paid promptly. Hence it would be far better could we have a mill tax for such purposes, for if the total amount is less than the other appropriation, even then the work like the fruit investigation and plant investigation could be continuous, and avoid the embarrassment and difficulty which affect us throughout the year.

This same shortage likewise affected the appropriation for Grand Junction.

While there has been much objection to a mill tax on the part of the people of the State, yet this kind of appropriation becomes almost impossible to use successfully, unless it be that the Board is in shape to stand the additional draft for the period of delay, and to run the risk of failure to get any money, and thus lose what has been advanced.

THE LOCO INVESTIGATION.

A co-operative investigation of the loco plant and disease has been carried on with the Department of Agriculture. The first work on this was done byMr. Payne, who was given special instruction to collect information concerning the disease and its distribution through the study, and interviewing stockmen. He outlined a course of work but manifestly it required much more funds to take up than we had available. It also seemed as a consequence of the whole inquiry that the most important point to be attacked was to determine absolutely whether the disease was a consequence of the plant or not. The disease occurs in widly separated localities in different states, and the plant recognized as the cause in one locality does not grow in others where the disease is recognized.

An agreement was entered into whereby the department sent an expert and we furnished animals and arranged for land. Dr. Glover was to represent the station and to be consulted concerning autopsies and various other work. The total cost to us has been about $1200, aside from the time and some traveling expenses. Dr. Marsh has represented the Government. The previous investigations had failed to find any poisonous element in the plant. As a basis for final remedy of the disease, the cause must be absolutely known, and while the popular belief of cattlemen was that the plant was the cause, yet that might be as wrong as the supposition that has existed for thousands of years that the miasma of swamps was the cause of malaria, or contagion was the cause of yellow fever. Hence we urged in the investigation the determination of the cause.

Dr. Marsh took up the question in a different way. Instead of attempting to determine the poisonous principles, he used the plant or extracts and studied their physiological effects upon small animals. He thinks he has determined the cause. We are not conversant with the details of the work as performed by them, for this, as in most cases of so-called co-operation, consists of our putting up the funds for work by the Government men.

A summary of some of the conclusions was given in the report of 1905. We hope that a report may be made upon this soon.

THE PLAINS SITUATION.

At a meeting of the Board in April, a petition was presented, asking for a substation at Akron, and giving a subscription of $3,000. The Government representative, Mr Chilcott, was present at the Board meeting in June The subscription given by the people at Akron seems to have been based upon the statement that committed us, in popular impression, to the establishment of a Station, but such statement was without authorization and tended to cause some friction and embarrasment. I think, however, that the matter now is practically straightened out. The Government has taken over the land which the people of Akron had provided and with the funds subscribed, have started a station at that point, which they can do under Congressional appropriation, though we cannot under the Government funds at our disposal. Were we to continue such work on the Plains, the plant which we already have at Cheyenne Wells could be used to best advantage. Its location, however, did not prove to be so desirable for the Government inasmuch as they already had a station in Kansas not very far from Cheyenne Wells, and therefore they desired to go farther away. There may be some echoes still as a result of this action, but I think that little more is to be expected.

The last Congress passed a bill, giving to the College, for forestry experimental purposes, a tract of 160 acres near Akron. The land which the Government has is adjacent to this tract. Up to the present time, we have not received a deed for the land. The last correspondence had with the Commissioner of the Land Office stated that he

would look up and see whether there were any adverse claims to this land, but since I have not heard from him, it was supposed that it would come in the ordinary course of proceedure of that office. Any title which we obtain, however, is conditional on the use for five years for such purpose. No funds have been available. The opportunity seemed to be good and rather than lose a year of time, it was thought best to spend the amount that would be necessary for plowing a part of the ground. Accordingly a total expense of about $50. was spent in the plowing. The Government asked us to build a fence on the south side between this tract and the Government tract on the south. The condition of our funds did not seem to permit this, and in addition to that, until we had some evidence of title it seemed undesirable to do. A plan has been discussed with Prof. Paddock and also with a representative of the Forestry Bureau at Washington, to whom plans were referred some time in the summer and their help invited. A man from the Bureau recently invited us, and Professor Paddock accompanied him to Akron to look over the ground and to reach some conclusion as to what was best to do. The negotiations with them has not gone further as yet, and to what extent they will be willing to aid in this work is as yet unknown. We hope that they may meet most of the expense, but while we so hope, it is unusual for them to aid financially to any extent. The total cost of carrying on this work is not, therefore, definitely ascertained. It would seem to require about $150 for 1908. In 1909, the tract would need to be fenced and some planting done so that apparently about $300 in 1909, besides fencing the tract on three sides, or a total of about $800 would be needed. Of this amount, in case the government aids, they might give one-half of the maintenance, but probably would pay nothing toward the fencing, so that the expense upon us would be from $700 to $900 in 1909. In 1910 probably $300

These figures are given not as estimates, but as a rough idea of the amount that would probably be required to continue the work. There is a possibility that the Forestry Bureau may act on the idea of forestry plantation there and plant trees on a portion of the land which has been turned over to the department and in that case it is a question whether it would be necessary or desirable to meet this expenditure and continue the work.

For the coming year, this would require then about $150, and this it would seem necessary for the Board to authorize. It is rather of a demonstrative character, does not fit in with the previous work of the Station, and is a doubtful charge on the Hatch fund.

I called attention to the general Plains situation in one of the previous reports. For a number of years we had a man at Cheyenne Wells. The result was negative. When the Government notified us that the Government funds could not be used for such purposes, we assigned Mr. Payne to work as general Field Agent and to note the conditions in a general way. This resulted in a number of bulletins and some were very valuable studies. They showed that there were possibilities

in the Plains as a whole and for individuals on the Plains. The work and the conclusions together with some recent favorable years have been made the basis of booming by some land speculators, and with the result that they have brought in many settlers on the Plains. The problem is there before us in that respect. They do not need investigations whose results are in the future so much as immediate advice as to how to meet the situation that is now before them. The most beneficial way of meeting the whole Plains is very largely, to meet people, to advise them, to learn the experience of those who have been there, and to make it available for those who have settled upon the Plains.

Many have gone upon the Plains with the hope of making farms and of using eastern crops, and eastern methods, and in some cases have risked their all. Many are bound to fail, even under the most favorable conditions. It is therefore a question whether it be possible to provide money which would permit the assignment of a man for that special work. Mr. Payne who has been an excellent man for such purposes, is now in the employment of the United States. Some arrangement might possibly be made, by which he could give some time to such work. In that case it might cost us from $700 to $1000, possibly less. Another course might be to provide a larger number of Institutes for the Plains. This, however, would involve the idea that we are prepared with the information and the experience necessary to give to those people, so that it will direct them right. This is ony partially true and the people who go on the Plains to advise the settlers as to the most hopeful way of meeting the situation, should have an extensive acquaintance, and therefore I think that it would be very desirable to have a man for that special purpose if it could be done. Mr. Payne has already acquired the experience through his connection with us. Since the time he was active, some conditions have changed on the Plains, and especially the situation in regard to the number of settlers. At that time there were relatively few, and a very few settlers coming in. Since then the number has greatly increased, and the need for work is very much greater.

THE FRUIT INVESTIGATIONS.

The Legislature made an appropriation for fruit investigations. This work was started on the solicitation of the people of Mesa County who provided $1,500. The State Board of Agriculture provided for an additional amount and put in last year, 1906, a total of about $4,000. The Legislature appropriated $8,000 for the biennial period. This is at a less rate than was expended last season. Hence we have had to practice economy. Some expenses necessary last year have not been necessary this year. The $4,000 per annum is scarcely enough as the pay of the two men amounts to $3,000. The appropriation for this purpose is treated differently from the appropriation for other purposes inasmuch as the salaries of the two men are taken from this appropriation. In

the case of the appropriation for Animal Industry, for Farm Machinery, and for Plant Industry, and for Farmers' Institutes the salaries of the men are not charged against the appropriation.

The position of Field Agent is one requiring good sense, and tact, as well as a desire to be of service. The work at Grand Junction has been especially satisfactory in this respect under the charge of Mr. Whipple and Mr. Taylor. Mr. Taylor resigned to take effect October 15, he having been appointed to take charge of the Fruit Experiment Station in Missouri. As his successor we have arranged to appoint Mr. George P. Weldon, As the margin is so small he will not begin until the first of February or the first of March. Under the conditions of the State appropriation and the financial limitations, it will doubtless be necessary to modify the plan for next year. Practically all of the work under this appropriation was performed in Mesa County. The bill, however, is general, and related to the fruit industry over the whole State. It will probably seem necessary to do more work during the coming year in some of the other counties, and probably therefore to leave one man at Grand Junction, the other to be placed at Delta. This seems the most feasible arrangement. From the standpoint of most effective work, it is desirable to concentrate the efforts in a limited area. In this case it is a question partly of expediency. I have already discussed the matter with Mr. Hoyt of Grand Junction who was particularly instrumental in the action of the Legislature, and with Mr. Moore, both active leaders. Mr. Hoyt thinks that we will have to do more in order to hold the support of the other fruit centers. Mr. Whipple now stationed at Grand Junction could also give more attention to Garfield and Eagle Counties. A horse and buggy have been provided. This has been the cause of considerable expense and has not been entirely satisfactory. It costs about $17 per month for keep, besides the repairs of the buggy and depreciation. The experience here and at Delta suggests that it may be better to allow an extra sum and have the men furnish their own transportation. A motor bicycle could probably be had for less than a horse and would do a greater amount of work. It would be desirable for the horse or equipment to be kept by the parties.

DELTA FRUIT INVESTIGATIONS.

A Committee from Delta appeared before the Board asking that some work be done in that county, and pledged $700 for that purpose. It was afterwards found that for some reason, some other centers had not been asked to contribute, and therefore there was some feeling of resentment. We have tried to reduce this and think we have succeeded. The total amount paid was $700. This was in addition to the salary for the time being, of Mr. Paull who was paid from the College funds. The work has had some other difficulties of its own. The fund still remaining will pay for the printing that may be necessary.

The general State appropriation also covers Delta County, and in

all probability the people of that County will not feel like subscribing for another season. We, however, ought to do what we can to help that community as above stated. The plan which would seem to be desirable would be to assign one of these two men to Delta as a headquarters, and make Delta and Montrose Counties his counties for work.

The establishing of these outlying centers of work is a matter of some delicacy. It requires men of scientific training who also are tactful and prudent, otherwise unless we could keep very closely in touch there is danger of great difficulties arising. The work has been appreciated but has also given rise to some difficulties and troubles that have been hard to allay. So far as the work consists in teaching the fruit men how to handle their fruit and insects, it would probably be of relatively short duration. The work ought, however, to be continued at one of those centers for a period of at least ten years. After the first few years, I am inclined to think that a change in plan might be desirable, but that will be a matter for future development.

THE POTATO WORK.

Last year there were some funds available for experimental work on potatoes This was put in charge of Mr. Bennett as potato specialist. His salary was taken care of by the Station funds, amounting to $1,500. There is no doubt that this work is of considerable use, something in the way the work of the fruit investigations is of value to Western Colorado.

A field was rented near Greeley, on the farm of one of the best known growers, Mr. Bliss. There will be about revenue enough from potatoes to pay for the cost of the land. The total expense otherwise involved has been about $600, including the cost of the printing. There was no money set aside for this last year, and we have crippled along allowing some from the special fund. For the coming year, I would recommend an appropriation of $750.

HORSE BREEDING WORK.

The cooperative work with the Government on horse breeding has been continued through the year. The outlay on the part of the College and Station in connection with it has been the barn, a considerable land, and other expenses. There is nothing in this office to show what the Government has put into the work. The Board is under obligation to expend the receipt in the work.

Other matters concerning the work of the various departments are mentioned to some extent in their reports. Most of the work of the Experiment Station is a kind of work that does not lend itself to any startling proceeding and is a quiet steady work, hence while there has been considerable important work, and there is now considerable going ahead, most of it comes under the ordinary procedure of the Station and along ordinary plans so that it does not make any particular comment necessary.

There have been printed during the calendar year so far, nine bulletins, besides eighteen press bulletins. The editions now will need to be increased from 8,000 to at least 12,000 to 15,000, doubling the cost. With the increase it may be necessary, or at least desirable for us to do as some other stations have done, and that is to issue a popular or printed edition which will give a summary of results of the bulletin and then send the larger bulletin on request. One of the most important and laborious studies is Bulletin 124, on Colorado Fodders, giving the results of a number of years' work. Such a one will not have any immediate effect, but represents much work directed along a particular line, and its value becomes more apparent as a foundation of subsequent practice. A number of other bulletins are soon to be ready to issue. The state of the funds has made it necessary to hold back bulletins or not to hasten them and hence it is probable that a number will be issued in the near future.

Our printing bill the last fiscal year was larger than usual, but in the years to come, it will probably be nearly as large. The size was partly due to the payment of some of the expenses of Bulletin 100. In some states, the expense of printing is paid out of other funds and is not put in as a charge on the Hatch fund. The work may be done by the State printer and the laws are such that it is paid for by the State. The fact that we have to meet these bills lowers the efficiency of the Hatch fund On the other hand, considerable help is given from College funds in that heating and janitor service is almost entirely at College expense. The other funds make it possible to divide the proportions more easily and during the present fiscal year, several of the men who give a large part of their time to the Station receive one-half or more of their pay from the Government funds.

The financial statement and reports of the various sections form a part of this report.

L. G. CARPENTER.
Director.

Dec. 1907.

BULLETINS ISSUED DURING YEAR OF 1907.

No. 117. The Colorado Potato Industry, by E. R. Bennett.

No. 118. Western Slope Fruit Investigation, 1906. Report of Field Horticulturist, by O. B. Whipple.

No. 119. Western Slope Fruit Investigation, 1906. Report of Field Entomologist, by E. P. Taylor.

No. 120. The Howard Scale, by E. P. Taylor.

No. 121. Alfalfa, Sugar Beets, Cantaloupes, Notes 1906, by P. K. Blinn.

No. 122. Fruit Growers' Associations, by W. Paddock.

No. 123. Some Press Bulletins on the Plains.

No. 124. Colorado Fodders, An Examination into their composition and Comparative Values, by W. P. Headden.

No. 125. Colorado Fodders, A Study of Comparative Values based on Bulletin 124, by W. P. Headden.

PRESS BULLETINS.

No. 29. Cost of Colorado Roads, by E. B. House.

No. 30. The Howard Scale, by E. P. Taylor.

No. 31. The Green Aphis and the Woolly Aphis of the Apple, by C. P. Gillette.

No. 32. The Locust Borer, by C. P. Gillette.

No. 33. Dairy Work for Plains Settlers, by H. M. Cottrell.

No. 34. Acclimated Seeds, Hints for New Settlers in Eastern Colorado, by W. H. Olin.

No. 35. Wind-Breaks and Shelter Belts for the Plains, by B. D. Longyear.

No. 36. Preparation of Seed Bed, Hints for the Plains, by W. H. Olin.

No. 37. Potatoes on the Plains, Suggestions to New Settlers, by E. R. Bennett.

No. 38. Grasshoppers Upon The Plains, by C. P. Gillette.

No. 39. Summer Culture to Conserve Moisture, Hints for Plains Settlers, by W. H. Olin.

No. 40. Seeding Field Peas, by W. H. Olin.

No. 41. Pruning Locust and Catalpa Trees for Timber, by B. D. Longyear.

No. 42. Western Slope Fruit Investigation, Condensed Report of Field Entomologist, Season of 1906, by E. P. Taylor.

No. 43 Western Slope Fruit Investigation. Report of Field Horticulturist, by O. B. Whipple.

No. 44 Spraying for Codling Moth, Some Important Points to be considered, by C. P. Gillette.

No. 45. The Spring Grain-Louse, by C. P. Gillette.

No. 46. Advice to Plains Settlers, by J. E. Payne.

REPORT OF CHEMIST

To the Director:

I herewith present a statement of the work of the Chemical Section during the period elapsing since my last annual report.

The work on our Colorado fodders has been completed and our results presented in Bulletin No. 124, issued in July last.

The work on the Australian saltbush, *Atriplex semibaccata*, and Russian Thistle mentioned in my last annual report, as nearly completed, was prosecuted to the extent of completing the chemical work on the samples of these plants which I had up to that time collected and I gathered my notes for the preparation of a small bulletin on their composition and value. I, at that time, thought that this Australian saltbush had been studied and its coefficients of digestion determined by the California Experiment Station, and probably also under the direction of the Australian authorities, but I was unable to find such data. Inquiry addressed to the Office of Experiment Stations at Washington, D. C., resulted in obtaining the information that no determination of the coefficients of digestion of this plant was known to that office. It, therefore, seemed to me desirable that these data should be definitely established before we presented this plant to the consideration of our people as a forage plant. But to make a single series of digestion experiments meant, in this case, to grow fodder to be fed and to postpone the preparation of the manuscript practically a year or rather more.

The crop has been grown, but owing to a number of untoward happenings, I fear that we may be necessitated to grow still another crop before we can complete the work but I sincerely hope that such may not prove to be the case. In this connection I wish to acknowledge the willing and interested assistance rendered by Mr. Knorr and his student assistant, Mr. Aicher, to whom is due the credit of our having any crop at all.

The reasons for undertaking this study were given in my last report. Originally, I began growing the plant in order to make a study of it, but as I, at that time, about nine years ago, judged it doubtful whether it would ever become a plant of sufficient importance to any section of this State to justify its cultivation as a fodder plant, I permitted other work to take precedence. But I fear as the eastern portion of our State fills up with settlers, occasion may arise when this plant, owing to its tenacity of life and ability to make a fair growth under adverse soil conditions might be a great boon to them. I propose now to return to my original plan of presenting a short study of

the plant which will be of more general interest than a mere presentation of its manner of growth, cultural needs, etc.

There have been times in the eastern portions of our State when any kind of fodder would have been of great service in tiding stock over a period of severe weather but fodder was very scarce and stock perished from lack of it. Perhaps our increased knowledge and improved methods of cultivation may have removed this danger, still I believe that if it can be shown that the Australian saltbush has a reasonable amount of merit, it will commend itself as a forage for this large section greatly to be preferred to the sand grass, Russian thistle or hay made from the silvery saltbush hays which I know that they have had recourse to in order to keep their stock.

I shall include a short study of the Russian thistle but no digestion experiments. This hay is used to some extent in some parts of the State. Its value is doubtful, though some claim that it is good.

I began the collection of alkalies from this State shortly after I became connected with this Station, thinking at that time that there was probably a big basis of fact underlying the then current public notion that it was an important factor and a growing one which promised to become more deleterious to their lands and crops than it was then. I soon became convinced that the evil effects attriubted to these salts and the impending danger due to their apparent increase was greatly overestimated, and as but little satisfactory information was being accumulated, I have not prosecuted the study of the subject except as opportune occasions have presented themselves until within the last year. There are some questions of interest and prossibly of importance in connection with this question, particularly as it relates to drainage, and the use of water carrying considerable quantities of these salts for the purpose of irrigating crops. Again, some lands in our irrigated sections are becoming seeped and pari passu alkalized and it is a question whether the latter effect intensifies the former or not, and further whether the correction of the former will of itself remove the effects of the latter.

During the present season, I have turned my attention quite exclusively to the study of this subject—to some extent in the neighborhood of Fort Collins and Greeley, but to a greater extent in the San Luis Valley, and in the neighborhood of Delta and Grand Junction. Some of the results of this study will have some scientific interest, others will have quite an important economic bearing.

I proposed to take up the study of the water of the Rio Grande del Norte with the intention of studying the changes in its mineral content and their variation in composition as effected by the irrigation of the surrounding lands. I proceeded to the town of Creede with my assistant, Mr. Douglass, intending to begin the study of the water above the point where the Willow Creek joins the Rio Grande. We found the river unusually high and devoted ourselves to the study of the questions pertaining to the seepage and alkali, hoping that the

river in the meantime would fall to its usual stage at this season of the year. Our work consumed over three weeks but the river had not fallen, due to the succession of showers in the mountains and also in the valley. Determinations of the mineral matters in the river water near Creede and three weeks later at Alamosa showed a difference of only abuot two grains per gallon. This result showed that it would be futile for us to prosecute this work under these conditions with any hope of obtaining results which would certainly represent normal conditions. Data which I have already collected relative to the changes in the Rio Grande waters indicate that they are much less than in our northern streams, but I believe them to be normally much greater than indicated by the determinations alluded to and I therefore did not venture to prosecute the work.

I have, up to the present, found no opportunity to approach the subject of mountain or meadow irrigation and a study of the composition of the fodders produced. I furthermore, do not see how I can possibly begin this work for some time to come as the already accumulated analytical work is very considerable.

Mr. Alford has revised the manuscript presenting the results of his experiments with beeswax.

The work on the loss and deterioration of barnyard manure under our conditions came to an abrupt end by the interference of Mr. Montgomery, who needing a load of manure, appropriated ours, utterly spoiling the lot for our further use. Mr. Douglass is preparing an account of the work done. The record covers a period of four years, but only the weights for three years can be used. This interference is very much to be regretted as it rendered our fourth year's work of little value. In the beginning it was intended to study the bacteriology of the pile, but this feature has had to be dispensed with, so our results will present only the loss and changes in its chemical composition. Mr. Douglass will not be able to work consecutivaly upon his manuscript and its preparation will necessarily be slow. It will not be ready before the late summer or more probably the fall of 1908.

It now seems probable that the next bulletin which I will present will be on the Australian saltbush, *A. semibaccata,* and the Russian Thistle, followed by one on the alkalies of Colorado which will include a study relative to use of seepage water for purposes of irrigation.

The analytical work still to be done on these subjects will not permit me to even suggest how soon or how long it may be before I can present them for publication.

So far as our present work is concerned, we need nothing of sufficient importance to deserve mention in an annual report.

The requests for analytical work of a miscellaneous sort, largely waters and soils, continue to be numerous. It is clearly out of the question, with our present force, to do any of this kind of work especially in cases where the request is made by an individual, and where the work can in no reasonable way be made to serve any purpose for the Station. This Section is always ready and willing to give such

information as may be at its command but I have accepted very little of this class of work. I may add further that I would be unable to give the specific information requested in almost all of the cases even if I should have the soils or water analyzed, and in no case which I now recall would any scientific purpose be served.

Respectfully submitted,

WM. P. HEADDEN,

Chemist.

Fort Collins, Colo., Dec. 1, 1907.

REPORT OF ENTOMOLOGIST

To the Director:

I have the honor to present the following report of progress in entomological work supported by the Hatch fund for the year 1907.

During the year bulletins 119, "Report of Field Entomologist of Western Slope Fruit Investigations" and 120, "The Howard Scale," both by E. P. Taylor, and press bulletins, 31, "Green Aphis and Woolly Aphis of the Apple;" 32, "The Locust Borer;" 44, "Spraying for the Codling Moth;" and 45, "The Spring Grain Louse" have been published A technical paper upon plant lice entitled "Chermes of Colorado Conifers" has been published in the Philadelphia Academy of Sciences, a similar paper describing a new louse upon cottonwood is about to appear in Entomological News, and descriptions of several new species of plant lice (Aphididae) that have been discovered in the prosecution of our work with this group of insects have been sent to the Canadian Entomologist for publication along with life history notes of the species. While the more technical papers have been sent to technical journals, the economic deductions from these studies will be given to the farmers and fruit growers from time to time in Station bulletins.

SOME OF THE MORE IMPORTANT INSECTS OF THE YEAR.

The very mild winter of 1906-7 permitted many plant lice to survive the cold and start their spring broods in unusually large numbers. As a consequence the spring Grain Louse, *Toxoptera graminum*, was destructively abundant in many grain fields in eastern Colorado, and the wolly aphis of the apple trees was extremely abundant early in the season and, where it was not destroyed by sprays or overcome by its natural enemies it remained a serious pest throughout the season. In regard to the latter pest I am glad to say that our experiments carried on chiefly on the Western Slope, as well as the experience of many orchardists, has proven that kerosene emulsions or tobacco preparations can be used very effectively to destroy this louse upon the trees. The plant lice have become such serious pests in the State that it has been thought best to give them special attention and many species have been collected and observations recorded upon life habits and food plants during the year. This work will be a valuable supplement to the plant louse investigations carried on under the Adams fund.

The Spotted lister Beetle, *Epicauta maculata*, was sent to the

station this past summer from the eastern part of Arapahoe county as a serious pest in potato fields. Arsenical poisons were recommended and Mr. E. G. Sanderson reported very good results from the use of Paris green as a spray.

The Western Wheat Stem Maggot, *Pegomvia cerealis,* which the writer reported in 1904 (Bulletin 94, Colo. Experiment Station) as destructive to a field of wheat near Fort Collins was sent to the station from Littleton and from Cortez as a wheat enemy the past spring during the month of April. This is doubtless a native insect as it seems not to be known outside the state.

The Onion Thrips, *Thrips tabaci,* occasioned considerable loss to onion growers, especially in the vicinity of Greeley, during the latter part of the summer and an effort was made to assist them in finding a practical remedy, Mr. S. A. Johnson making two trips to the district for that purpose.

Mr. D. B. Thurston, horticultural inspector for Boulder county, sent the station specimens of the peach borer, *Sannanoidea exitiosa,* which he reported very destructive to plum, apricot and cherry trees in the vicinity of Boulder. Mr. L. C. Bragg was sent to investigate the conditions and he found this borer quite abundant and actually killing many small cherry trees.

An experimental orchard of nearly 1,000 trees was set in the spring for plant louse experiments chiefly. The entomological garden has been in charge of Mr. Johnson who has found it a very favorable place to study garden pests., his chief attention having been given to the spotted bean beetle, *Epilachna corrupta,* and the potato Flea beetle, *Epitrix cucumeris.*

The black peach aphis, *Aphis persicae-niger,* has been known to exist upon very few trees only upon the Western Slope for two or three years, but during last spring and the early summer Mr. E. P. Taylor of the Western Slope Fruit Investigations found this louse in many orchards in the Grand Valley and in a few in Delta county. While for a time the lice became quite abundant early in the season they soon dissapeared and did not seem to do much serious harm.

WESTERN SLOPE WORK.

Mr. E. P. Taylor of the Western Slope Fruit Investigations has devoted his attention especially to the control of the wooly aphis, (*Schizoneura lanigera*) and the green apple aphis, (*Aphis mali*) but he has also sent in much important information concerning other insect pests in Western Colorado. His very complete and detailed repot is appended hereto.*

There were two general heads under which research work was taken up, one a biological and taxinomic study of Colorado Aphididae (plant lice), and the other a biological and economic study of the potato flea beetle, (*Epitrix cucumeris* Harr.) The latter study has

* The report of Mr. Taylor details observations made during the year. Being too long to print, it is put on file in the records of the Experiment Station.

been entirely in charge of Mr. S. Arthur Johnson while the former has been in charge of the writer with the assistance of Mr. L. C. Bragg and the department artist, Miss M. A. Palmer. Mr. E. P. Taylor, Field Entomologist for the Western Slope Fruit Investigations, has also collected and made field notes upon numerous species for me.

The three species selected for special study are the Wolly Aphis of the Apple (*Schizoneura lanigera*), the Green Aphis of the Apple (*Aphis mali*), and the Melon Louse (*Aphis Gossypii*).

As a necessary basis for this work we have endeavored the past year to determine as fully as possible, the food plants of all our common species, and the time of the year when the different species may be found upon their various food plants, and to make careful descriptions of the living lice in their various stages of development. This has required a large amount of field and breeding cage as well as taxonomic work. In connection with the descriptive work the department artist has made careful detailed drawings in color of the lice in their different forms and stages of development.

A few technical papers resulting from the above studies have been sent to scientific journals for publication and others are in preparation. The economic deductions will appear in station bulletins.

The assistance rendered Mr L. C. Bragg and Miss M. A. Palmer in the plant louse work has been most important and efficient.

The work of Mr. Johnson upon the potato flea-beetle will be written up for publication as a station bulletin soon.

The new insectary just being completed will be a great assistance in carrying on future work with these insects.

I am appending an invoice of the property held by this Section that has been purchased by money from the Adams fund.

All of which is very respectfully submitted.

C. P. GILLETTE,
Entomologist.

REPORT OF THE HORTICULTURIST AND BOTANIST

To the Director:

The report of the horticultural section will consist mainly of the sub-reports from the men who have had charge of special lines of work.

The schedule submitted to you at the beginning of the year has been adhered to closely though but little has been acomplished with some of the lines of work; namely, those with which I personally had to do. The reason for this is that the growth of the section both in the college and station requires a great deal of attention as to details. This is particularly true in the extension work which the college is now carrying on.

The experiments with alfalfa blight have not progressed except that we succeeded in securing about thirty strains of seed from the Department of Agriculture and planted them in an infected field. The seeds came up promptly and the plants have made an excellent growth.

The work with tomato blight has been carried far enough to show pretty conclusively that instead of being a new disease, the trouble is due to attacks of a species of Fusarium. This is probably the same species which has been common for several years in various portions of the United States.

The root disease of raspberries has not been worked upon because of lack of time.

The field work in horticulture on the Western Slope continues to be one of our most practical lines. This feature was broadened this year by stationing Professor Paull in Delta county for the season. That there is an increasing demand for this class of help and that much good may be accomplished by it is clearly shown in his report. We hope that this experience may result in placing a man permenantly in that locality.

The potato investigations are now well under way and the problems are developing to such an extent that one man can scarcely keep abreast of them. The experiments now being carried on give promise of valuable results.

Our experiments in forestry have been confined to the tree plantations which have been noted in former reports. The subject of forestry is one of such vital importance that means should be provided so that a man could devote his entire time to these problems.

Respectfully submitted,

W. PADDOCK,

Horticulturist and Botanist.

Fort Collins, Colorado,
December 1, 1907.

REPORT OF ASSISTANT BOTANIST.

During the summer just past my time has been chiefly devoted to the inspection of the cooperative tree planting experiments in my charge, which were inaugurated during the spring of 1906. These experiments consisted in supplying farmers and land owners in various localities with two species of trees to be planted and cared for under the direction of the experiment station. Black locust and the hardy or Western catalpa were selected on account of their general utility qualities, and so far as possible, 300 trees of each kind were sent to one person.

The data secured from these experiments should enable us to make recommendations concerning these trees for planting under most of the conditions occurring in our state. And while it is yet too early to estimate the reliability of the trees under all circumstances still the prospect is in most cases encouraging.

Out of the twenty localities visited fifteen were favorable for the growing of the black locust. The catalpa was not sent to all of these places but made a fair comparative showing in most localities where planted.

In the majority of cases the black locust made the stronger growth and showed somewhat greater hardiness than the catalpa.

Remarkably strong growths of the former were noted in some places where the trees had been given good soil and care.

In a number of cases due to lack of care or poor location the trees failed when the climatic conditions were evidently not unfavorable to their growth. And it was often a source of surprise to see how tenaceous these trees were under the trying conditions in which they were sometimes found.

It may be safely stated from the observations made, that with reasonable care in planting and watering these two species of trees should succeed in situations similar to those in the region of Denver while the black locust is doing well at elevations considerably higher.

Nearly three weeks were spent in the study of our native forest trees in the Long's Peak region. Photographs and data were secured toward the publication of a bulletin on the cone bearing trees which constitute the native timber supply and the forest trees of our forest reserves in this state.

Respectfully submitted,

B. O. LONGYEAR,

Fort Collins, Colo.
Dec. 1, 1907.

REPORT OF POTATO INVESTIGATIONS.

The potato investigation work is being carried on along practically the same lines as last year. The aim of the work is as follows:

First; to improve the industry by a study of the best methods of culture of potatoes for this state. Second, to improve the quality and yield of the present varieties by selection. Third, a test of the standard varieties to find if possible a variety that will be resistant to the soil diseases that cause the losses of the potato crop of this state. Fourth, to study systematically the diseases of potatoes of this region. Fifth, to bring this knowledge to the growers by means of publications and lectures or talks with individuals.

Owing to the nature of the work all these objective points are taken up together.

NEED OF THE WORK.

The yield of potatoes of Colorado is from six to eight million bushels per year as against three hundred million for the United States.

The markets for the Colorado potatoes extend over more than half of the United States. The soil and climatic conditions of a large part of Colorado are such that when no disease prevails no part of the United States, except possibly Northern Maine, can produce potatoes of such quality or a better yield. Some localities in the state produce from four to six hundred bushels per acre, yet there are so many failures or partial failures in the crop that the average yield per acre for the state (Bureau of Statistics, U. S. Department of Agriculture) is less than one hundred bushels, or fifty sacks. A general survey of the state shows that there is available land that is adapted to the best potato growing to produce five or six times as many potatoes as it now produces.

The work of selection is being carried on by this writer in several parts of the state and also in cooperation with some of the best growers in several districts.

One and fifty-five hundredths acres of land were rented on the E. R. Bliss ranch at Greeley on which were planted seventy-six varieties and a quantity of seedlings. Among the varieties were some of the standard French, German, Russian and Scotch market varieties, also some alcohol potatoes from Germany. A large number of these varieties made good yields and crates of each have been selected for use next season. Almost no disease appeared in these plots so no data could be taken as to the disease resistance of the different varieties.

A plot of about one acre of potatoes was planted on the college farm for the purpose of studying diseases and the effects of different methods of cultivation and seed treatment.

Only one variety was used on this plot. The seed was divided and part cut while the remainder was planted whole. The cut seed was divided and treated respectively with dry sulphur, air slaked lime, dry Bordeaux, and a part left untreated.

DISEASES OF POTATOES.

Potatoes have been less troubled by the fungus diseases this past season than the year previous.

Fusarium:—Soon after planting this season a rot developed in the pieces of seed potatoes. The rot started on the cut surface of the seed and worked through to the skin. Some rotted so quickly that the sprouts did not start at all. Others rotted more slowly so that the sprouts emerged from the ground but soon died because of the rot following up the stem from the seed. An examination of these stems and rotting tubers showed the presence of a fungus which is supposed to be Fusarium solani.

A poor stand resulted from this disease, especially on land that had been in potatoes the previous year. Microscopical examination of plants were made at intervals all summer but while the fungus could be found during the whole season, little damage was done by it during the latter part of the season except in a few localities.

Comparatively little is known of this disease at present. Work on it is being done and will be continued during the winter in the greenhouse and laboratory.

Rhizoctonia:—The Rhizoctonia, or stem and root rust disease, did much less damage in the state than in previous years. Places where the soil was hard and compact or basins where water settled were the only places troubled seriously by this fungus.

Work with this disease is going on in the laboratory and greenhouse. Potatoes grown in the greenhouse under sterile conditions and inoculated with Rhizoctonia produced scabby potatoes as well as the Sclerocia or resting stage of the fungus.

The subject of scab from other sources is being also studied. German botanists claim that scab on potatoes may be caused by several different fungi. Cultures of the fungus that is supposed to cause the scab of the eastern states have been obtained and will be used to inoculate growing potatoes in the greenhouse this winter.

EXTENSION WORK.

Considerable time has been spent during the past season in investigating the conditions and talking at institutes in different parts of the State. In the opinion of the writer this work is desirable, especially in the newer parts of the State, where the knowledge of cultural methods and varieties best adapted to the conditions is limited.

Respectfully submitted,

E. R. BENNETT.

Fort Collins, Colo.,
Dec. 1, 1907.

WESTERN SLOPE FRUIT INVESTIGATIONS.

Report of Field Horticulturist.

The work of the field horticulturist during the past year has been along the lines suggested in my report for 1906. Practically all of my time has been devoted to Mesa County. Investigations of plant diseases, cultural methods, handling irrigation water, pruning and the collection of data on the fruit industry in Mesa County has largely occupied my time.

In the work we still have the hearty cooperation of the fruit growers. Requests for information have been more numerous and orchards and vineyards have been freely placed at our disposal for experimental purposes. The work is beginning to show more definite results as time passes.

The orchard survey work has progressed during the year as time would permit. The county has not been covered by any means, but other work of more immediate importance seems to require the time that should be devoted to this work.

The plant diseases under observation have been largely those mentioned in my last report. Very few new troubles have appeared although some of the diseases found last year have apparently assumed more importance.

The loss of grapes from the attacks of powdery mildew called for experimental work in the control of this disease. Experiments were outlined in the use of Bordeaux mixture and powdered sulfur in this fungus. Results of these experiments and observations in other vineyards show that the fungus is most easily controlled by the use of sulfur. Two dustings, one just as growth is starting and one after the fruit has set, seem to be sufficient.

Peach mildew again appeared in a few orchards and presented the opportunity for demonstration work in the control of this fungus. Experiments undertaken in a badly infected orchard only go to prove more conclusively that such an orchard can be thoroughly cleaned up with one careful spraying with half strength Bordeaux mixture.

Pear blight has caused some serious loss and many neglected orchards are practically gone. It has also caused much anxiety by attacking some apparently well cared for orchards.

The root rots are seemingly gaining some headway in the destruction of some varieties of apples. An effort was made to show the effectiveness of treating affected trees by cutting away the diseased bark, and washing the wound with a disinfectant. The results of

this work were very discouraging, and in fact almost demonstrated that such a practice means only failure. The use of lime about the base of the tree, as a preventative measure, was also tried and seems worthy of a more thorough test.

Some other plant diseases of minor importance found during the year are powdery mildew of the apple, powdery mildew of the squash and cantaloupe and the Fusarium wilt of the cantaloupe.

Some experiments were undertaken in cross pollenation of apples but on account of many of the blossoms being lost by the frost this work will hardly give any reliable results.

It is gratifying to note that the growers are heeding the instructions of the Experiment Station staff in the more careful use of water and the handling of various types of orchard soils.

Respectfully submitted,

O. B. WHIPPLE.

Grand Junction, Colo.,
Nov. 1, 1907.

REPORT OF THE DELTA COUNTY FRUIT INVESTIGATION.

April 24 to September 5, 1907.

At the request of a committee of fruit growers from Delta County, was assigned to this work which was prosecuted between the above ates.

The nature of the work was primarily two-fold; first, so far as ossible, to give advice and aid to the fruit growers upon any line n connection with their work; second, to collect information on all natters pertaining to horticultural interests.

To the people of the County the success of the investigation is easured entirely by the results obtained under the first class; because f its fundamental and lasting character, forms the superior basis for dging of the value of such work. However, in this class the obser-ations of one season are of but slight value of and by themselves, ut must be repeated through successive seasons to test their accuracy nd finality. It is because the practical fruit grower or farmer judges ings mainly by immediate results, whereas the horticulturist foresees hat the basis of correct practices lie in the slow and laborious collec-on of data from observation and experiment, that both of these lines f work are essential in such an investigation.

The work naturally divided itself into several lines in each of ese classes, in fact, in most cases being common to both.

A discussion of a few of the problems attacked follows:

ENTOMOLOGICAL WORK.

The most of my efforts along this line were directed to the carry-g out of a series of spraying experiments against the Green and the Woolly Aphis of the apple, by far the most serious insect pests of the ear. One large grower offered to place at my disposal his orchard nd to furnish labor and materials if I would direct the experiments. omparative tests of many different sprays and combinations resulted n determining that a strong tobacco extract, applied with or without oap, at a high pressure, in proportions from 1 to 80 to 1 to 65 was y far the most efficient summer spray for these pests and that they ay be very well controlled by this method.

SMUDGING AS A MEANS OF FROST PROTECTION.

Here, as elsewhere in the State, there occurred great losses to the uit crop by successive freezes in April and early May. Following e example of the Grand Valley some attempts were made to smudge, sing baled hay. Believing this to be too expensive a material for the

amount of smoke obtained, I set about finding a material which should combine ease of handling and storage, maximum smoke-producing power and low cost. This was secured in a compound of sawdust, gas-tar and crude oil, in which the sawdust forms the base, the gas-tar a binding material, and both gas-tar and oil throw thick black smoke. It is believed that this can be made at about one-half the cost of the hay, and moulded into blocks by hydraulic pressure for ease in handling and storing. In an actual orchard test upon one acre the temperature was raised from 5 to 7 degrees in different parts of the area. This would have saved the crop in the spring. There is a likelihood of a company being formed to manufacture this material in the County.

SOIL AND DRAINAGE PROBLEMS.

These problems are unique in this County and little understood. The few drainage systems thus far installed are not very satisfactory. Believing that great value would result from a soil survey, I placed in circulation a petition to the U. S. Bureau of Soils and secured more than 200 signers among the property owners in various parts of the County. This is on the way to Washington, and it is hoped will result in a thorough survey at an early date. I also succeeded in interesting the Division of Drainage and Irrigation Investigations of the Office of Experiment Stations, U. S. Department of Agriculture, in the problem of drainage, and they sent an engineer who spent about a week looking over the ground. As a result they will later on locate an engineer in the County to conduct cooperative drainage experiments with the farmers and fruit growers there.

Considerable advice was given concerning methods of control of plant diseases, the use of water in the orchard, cover crops, etc., which seemed to meet with general approval. Altogether it appears that the work of the season was valuable far beyond its cost and if possible should be continued.

Respectfully submitted,

L. F. PAULL,

Dec. 1, 1907.

REPORT OF AGRICULTURIST

To the Director:

I take pleasure in submitting herewith brief reports from the animal husbandry, farm mechanics, agronomy and horse breeding divisions of the Agricultural Department of the Experiment Station.

I regret very much that the work that we have been enabled to accomplish for the past season has been so unsatisfactory and so limited in extent in this Department. The reason for this condition may be found, however, in the fact that the funds provided for research work in this Department are practically all obtained from special state appropriations. These appropriations as made by the last legislature were liberal and had they been made available early in the year when we expected they would be, we should have had a very much different report to make. As it was, however, we had no funds other than those that were advanced by you from other funds from time to time to carry on absolutely necessary work until the month of October of this year, when the state appropriation funds were turned over. Consequently no experiment work whatever was undertaken in the animal husbandry division other than to carry over some steers on pasturage. The work in the agronomy division was curtailed and limited owing to the uncertainty of our funds being adequate to carry on any extended lines.

In the farm mechanics division we were also compelled to lie perfectly idle during the summer months because of no funds being available.

We earnestly hope that some provision may be made in some way for the future whereby we can have some funds set aside definitely for these different divisions, that may be made available early in the year. Our appropriations as now made, are for the biennial period and as I understand it, cannot be used after the close of the said period except in small amounts. Consequently, all or nearly all of the state appropriations must be utilized in one year of the biennial period. Nearly all of our research work, in order to be of real merit, must be continued from year to year without interruption.

I understand that eighty per cent of the first part of the appropriations made for the biennial period is now available. It will be useful for the feeding experiments in animal husbandry work this winter, but comes too late, however, to be of any especial service for the agronomy and farm mechanics divisions.

The accompanying report of the animal husbandry division outlines the feeding experiments proposed and now under way for the coming winter.

The work carried on last winter was not sufficiently conclusive to warrant us in publishing the results. Consequently they have been witheld for further verification during the coming winter. I take this opportunity, however, to present a summary of the data obtained from the hog feeding experiment conducted last winter. This will be fully elaborated and published early in the coming year together with that from the experiment along similar lines that is now under way.

EXPERIMENT WITH 100 PIGS IN 10 LOTS OF 10 PIGS EACH FOR 102 DAYS, FEBRUARY 2 TO MAY 15, 1907. ALL GRAIN ESTIMATED AT 80 CENTS PER CWT. ALFALFA AND BEETS AT $5.00 PER TON. TANKAGE $30 PER TON.

Lot	Kind of Feed	Total Amount of Feed	Total Gain, 10 Pigs	Average Daily Feed	Ave. Gain per Pig per Day	Amt. Feed for 100 lbs Gain	Total Cost of Feed	Cost, 100 lbs Gain	Profit, 10 Pigs
1	Barley	6083		5.96	1.23	4.86			
	Alfalfa	918	1251	.9		.73	$50.95	$4.07	$30.36
2	Corn	6557		6.42		4.62			
	Alfalfa	998	1358	.97	1.33	.73	54.95	4.04	33.32
3	Barley	3347							
	Corn	3347		6.36		4.28			
	Alfalfa	998	1514	.97	1.49	.65	54.45	3.59	43.96
4	Barley	3110							
	Wheat	3110	1378	6.09	1.35	4.51	49.76	3.61	39.81
5	Barley	3133							
	Peas	3133	1382	6.15	1.36	4.52	50.02	3.61	39.90
6	Barley	3129	1399						
	Shorts	3129		6.13	1.37	4.47	50.06	3.56	40.87
7	Barley	6065							
	Tankage	718	1552	6.65	1.52	4.37	59.29	3.82	41.59
8	Corn	6345							
	Tankage	718	1686	6.92	1.65	4.18	61.35	3.65	48.06
9	Barley	5199				4.61			
	Beets	5348	1127	5.09	1.1	4.75	54.95	4.87	18.31
10	Corn	5354		5.24		5.42			
	Beets	5348	987	5.24	.97	5.42	56.20	5.7	7.95

The report from the agronomy division herewith submitted, outlines a very extensive series of investigations that we have undertaken in a tentative sort of a way, though they have never been definitely approved, nor has any portion of the Adams fund been set aside, so far as I know, for their conduct. We have been very loath to undertake

some of these lines while basing our hope for future support entirely upon the state legislature. If these lines of research are undertaken we should have the assurance that they are to be carried through for a period of years without interruption. Otherwise, there would be no use in beginning them.

The work undertaken has been very carefully followed out by Professor Olin and his assistant, Mr. Knorr. Their report very briefly outlines the work accomplished.

HORSE BREEDING.

In the horse breeding division, there has been a steady progress made in the investigations and demonstration work. A number of valuable animals have been contributed to the breeding stud by friends interested in the work. One of the most valuable of these has been received from Ex-Governor Alva Adams. The terms on which this animal was received from Mr. Adams were that the first foal from this mare by Carmon is to be returned to Mr. Adams at weaning time without expense to him. After that, the ownership of the mare is to be ours unconditionally as well as all future produce. Another valuable animal has been donated by Mr. John Kuykendall, of Denver. This mare had a young colt at foot when received, in which Mr. Kuykendall wishes to retain one-half interest. This mare was bred to the stallion Emigrant, owned by Mr. G. W. Rainsford, of Diamond, Wyoming. We were very fortunate in having her bred to this stallion, as he is now 24 years old, and, as he has sired several of our best brood mares, we are hoping that we may succeed in receiving a good foal from him by the mare donated to us by Mr. Kuykendall.

During the year, two additional mares have been added to the stud by the Department of Agriculture through purchase. One of them is a particularly good one and the other fair, though exceptionally well bred. A number of mares did not prove in foal and several of them were very late in dropping their foals. Consequently, we have but 17 foals for the year 1907. With one or two exceptions, these are all very promising.

The foals from the year 1906 have developed into exceptionally promising yearlings. Of the six stallion foals, of last year, four were castrated early in the spring, as they were not deemed of sufficient promise to preserve for breeding purposes. The two remaining ones are very promising indeed as future stallions for breeding purposes. The eight mares with two or three exceptions are good individuals and will be a great addition to our stock of brood mares in the experiment. I feel very confident that the results of our work in fixing the type of an American carriage horse is going to fully equal our expectations. One of the greatest problems in this work is now in a fair way of being successfully solved, viz., that the type we have selected may be perpetuated in the offspring. This seems to have been fairly effectually demonstrated in the two crops of colts now on the College farm.

THE NEEDS FOR THE FUTURE DEVELOPMENT OF THE HORSE BREEDING WORK.

The last state legislature made an appropriation of $5,000 for the conduct of this experiment. Of this amount, $1,000 has been utilized in the purchase of additional pasture land. It will require $2,000 of the remaining portion for the construction of shelter for the brood mares and the young stock. Also in the construction of suitable fences about the small fields and corrals that are very much needed at the present time. We are planning to locate one of these sheds out in the foothills pasture where the mares will have abundance of exercise during the winter months and where they can be fed a certain amount of hay in this shed when it is desired. The other shed will be constructed on the farm adjacent to the present horse stables and will be utilized for the shelter of the young stock and possibly some of the brood mares when it is necessary to keep them where they can be more closely supervised than when in the foothills pasture.

It is hoped that the Agricultural Department will soon add a few choice mares and an additional stallion to the stud. These are very much desired, particularly the stallion, as a number of Carmen's female colts will soon have to be bred and a suitable horse should be obtained with which to breed them. Three or four of the present stock of brood mares have not proven to possess any great merit as breeders and they should be disposed of while it can be done to advantage. It is our plan at present to take the young stock that we do not believe is desirable to keep in the experiment and thoroughly train them and then dispose of them to the best advantage, financially and otherwise. As the funds from the sale of this stock reverts to the experiment fund, this money may be used in financing the work of the future.

Much interest is being manifested not only in the West but throughout the United States in the outcome of this experiment. The correspondence coming to my office making inquiries concerning the success of the undertaking exhibits a very lively interest indeed. Already have there been a number of breeding establishments started along similar lines to the one undertaken here and an organization has been perfected in the East among the American Trotting horse breeders for the encouragement of the American carriage horse. At a number of the large state fairs of the Middle West, classes were established this year for this type of horses and liberal premiums were offered. I feel very safe in saying that no work that we have ever undertaken could have redounded more to our credit as an institution of research and demonstration than this one of developing an American type of horses. Plans have been perfected by the Government cooperating with other Experiment Stations in developing and encouraging them to take up similar lines of work with other breeds of live stock. In Minnesota the Department is cooperating with the Experiment Station in developing milking types of Shorthorn cattle,

while in Wyoming plans have been matured for the development of a type of sheep suitable for the range conditions. In Iowa the work of developing a draft horse suited to our conditions has been undertaken. All of these efforts have been the outgrowth of the work started at this Station. The success of the work here has made it possible to undertake the new lines at other stations.

APPROPRIATIONS.

The last state legislature were very liberal in appropriations to the Experiment Station. $6,000 was set aside for investigations along animal husbandry lines. An equal amount was given to the work in agronomy. Besides this, $2,000 was given for the erection of a much needed grain and storage building and a like amount for research work in farm mechanics and road building.

As before stated, these funds were not available for the Department until the month of October of the present year. Consequently, their use has been very much curtailed.

The additional land secured for experiment work through the purchase of 80 acres adjoining the experiment farm secured two years ago, has been of great service, but some portions of it are very foul with wild oats and other noxious weeds and these must be thoroughly eradicated before it can be of very great service to us.

With the special appropriations being available for the coming year, it should be a specially noteworthy one. If there is no unforseen setbacks, we feel that the next year will give us something to report that will be especially creditable to this Station.

Respectfully submitted,

W. L. CARLYLE,
Agriculturist.

Fort Collins, Colo.,
Dec. 1, 1907.

REPORT OF AGRONOMIST.

I hereby hand you a summary report of the work attempted and now under way in the Agronomy sub-Section of the Agricultural work of the Colorado Experiment Station.

This spring the Board purchased the Taylor addition to the Experimental Farm—80 acres. This the Agronomy Section used to grow the increase plots—several acres in each—of experimental grains and forage. The general rotation plan for the experimental plat section of the experimental farm is being carried out whereby we hope to carry on plat experimental work and, at the same time, demonstrate a practical rotation for an irrigated farm in this crop zone. Through distribution of definite types of small grains, forage and root crops, followed by crop investigation trips to study these types in their field environment we are seeking to place the most desirable types in their best environment. To help us in our work we have arbitrarily divided the state into three crop zones as follows:

A. Lands below 6,000 feet elevation under the ditch.
B. Agricultural lands in Eastern and Western Colorado without irrigation—above the ditch.
C. Lands above 6,000 feet elevation under the ditch.

Through an organization known as the Colorado Grain and Seed Growers' Association we now have the earnest support of some of Colorado's best farmers in this effort to improve the quality and yield per acre of our agricultural crops through Seed Selection.

The Colorado Seed Grain Competition, made possible through the Premium Fund donated by Hon. T. M. Patterson, of Denver, and the San Luis Valley Pea Prize Competition, made possible by philanthropic citizens of the San Luis Valley, are helping very greatly by showing what seed selection makes possible in crops in wheat, oats, barley and field peas. Through experiments now under way we seek to obtain helpful facts for Colorado farmers as follows:

1. Best varieties of wheat, oats, and barley for High Altitudes, for lower altitudes under the ditch and for non-irrigated Agricultural lands.
2. The best types of stock roots for Colorado conditions.
3. A Colorado type of alfalfa.
4. Relative value of animal and mineral fertilizers in sugar beet culture on Colorado soils.
5. Cultural methods for best results in growing sugar beets.
6. Rotations for different farm conditions in Colorado.
7. Cultural methods for alfalfa and small grain.
8. A desirable Colorado type of Dent corn.

9. Effect of irrigation on gluten contents of milling wheat
10. Forage crops for the non-irrigated lands of the state.
11. Best crop methods for each crop zone of the state.

Mr. F. Knorr, my assistant in the Agronomy work, has been very efficient and thorough in his work and though he has received many offers from other states his interest in our field experiments now under way have influenced him to continue with us.

We hope these Agronomy Experiments when worked out may aid our farmers in obtaining better gains without loss in soil fertility.

Respectfully submitted,

W. H. OLIN,

Dec. 1, 1907.

REPORT OF ANIMAL HUSBANDMAN.

The experimental work with live stock during the summer period has consisted principally in carrying over upon range pastures, twenty head of steers used in the three-year continuous experiment for determining the value of winter feeding of range calves, yearlings and two year olds. The plan of this work has been given in detail in previous reports.

The live stock feeding experiments to be conducted during the coming year are as follows:

THE STEER FEEDING EXPERIMENT.

The conclusion of the three-year experiment by winter feeding of two-year old steers, ending with their sale in the spring.

THE LAMB FEEDING EXPERIMENT.

A ration experiment with range lambs. The lambs have been divided into three lots and are being fed as follows:

Lot 1. Alfalfa hay and corn.
Lot 2. Alfalfa hay and barley.
Lot 3. Chopped alfalfa hay and corn.

The object of the experiment is to determine the comparative values of corn and barley when fed with alfalfa hay; and the comparative value of alfalfa hay whole and alfalfa hay chopped when fed with corn. The experiment will continue for a period of from three to five months.

THE HOG FEEDING EXPERIMENT.

A ration experiment with shotes.

Lot 1. Barley and corn, equal parts; alfalfa hay ad libitum.
Lot 2. Barley and corn, equal parts.
Lot 3. Corn.
Lot 4. Barley and durum wheat equal parts.
Lot 5. Barley six parts, tankage 1 part.

Respectfully submitted.

G. E. MORTON,

Fort Collins, Colo.,
Nov. 1, 1907.

REPORT OF THE VETERINARIAN

To the Director:

The launching of Veterinary College as a department in this institution combined with the extensive farmers' institute work over the state, has prevented, in a large measure, the consummation of plans laid out for work in my last report.

As veterinarian to the Experiment Station, I am constantly in receipts of appeals to investigate outbreaks of supposedly contagious diseases among all species of domesticated animals, and from every section of the state. My duties at the College under the present regime, prevent me from complying with most of these requests, as well as precluding the possibility of any extended research work.

LOCO WEEDS.

The investigation of loco weeds, cooperative with the Department of Agriculture, has been carried on to the present time, with headquarters at Hugo. There are at the present time, seven horses and seventeen head of cattle that survived the summers experiments, in a pasture near Hugo, awaiting the decision of the Washington authorities as to the expediency of continuing the experiments one more year. According to the term of an agreement with the federal authorities, we are obligated not to publish any results of the investigation until the work is completed, and the time of publication as well as the substance of report is to be by mutual consent. The entire experiment has been largely appropriated by the government experts in charge. The results obtained have been highly satisfactory from a scientific standpoint. Their economic value is conjectural.

NECROTIC STOMATITIS.

There is no other disease in the state at the present time that is causing as much apprehension as the so-called sore mouth disease of hogs. It has become widely spread and has decimated many large herds. It is found on almost every farm in several sections of the state. The disease has been known for a long time in the eastern states, but has not been reported as assuming any where near the degree of virulency as it has here. It is caused by a specific germ, the necrosis bacillus, and where as in most instances it has been confined to pigs under three months old, here it is fatal to swine of all ages. Ordinarily the disease is confined to necrotic areus in the mouth, and appears to be purely a local affection. In some instances within the last year, herds have been seen where hogs weighing over

200 pounds were near death, showing large necrotic sores and numerous abscesses on different parts of the body.

Source of Contamination.—The litter, feed troughs and every thing that has been in contact with diseased animals, is a source of contamination. One diseased pig will soon infect the others by nursing and infecting the teats of the mother.

The germ does not develop on a healthy mucous membrane. It seems to develop in the mouths of small pigs when the germs are inflamed from the eruption of the teeth. It soon causes a large inflamed area which becomes necrotic and sloughs leaving large cavernous depressions which continue to grow deeper, until often there are holes clear through the snout, or the tongue is largely eaten away. The system soon becomes intoxicated with the secreted products of the germ which produces nervous depression and stupor. In this condition the pigs become careless of the teat and refuse to nurse, soon becoming greatly emanciated.

Treatment.—Prophylatic measures are effective if wisely and persistantly practiced until the infection is completely exterminated. The theropeutical value of drugs internally administered is questionable.

There is no other one thing concerning farm management and its relation to live stock, about which the average farmer appears to be so lacking in information as in the matter of preventing and effectively eradicating infectious diseases among farm animals.

Lethargy combined with not knowing how, has resulted in most cases of simply allowing the disease to continue until the loss is complete.

Four steps are necessary in the mastery of this disease.

(1) Destroy badly infected animals and burn the carcasses.

(2) Clean up the manure, litter and filth and destroy it by fire. Use disinfectants freely, such as 3% solution of zenolium or any one of several coal tar products, chloride of lime in proportion of four ounces to a gallon of water. White wash the buildings, fences, and everything that may have become contaminated. Burn sulfur in the buildings after closing up the windows and doors.

(3) Remove all animals that appear to be healthy to new quarters.

(4) Dip the little pigs when one week old in a bath composed of potassium permanganate, one ounce to a gallon of water.

The dipping may be repeated at intervals of two or three weeks. The mouths should be examined frequently and any necrotic sores burned out with lunar caustic, being careful not to burn the tongue.

HORSE TYPHOID.

Aside from a few autopsies in the vicinity of Colorado Springs nothing further has been done respecting this disease.

The etiological factor has not been determined and is a subject for the laboratory. The disease is not so widely spread or formidable as to warrant serious apprehension. The aggragate loss is not large but the mortality of animals affected is nearly 100 per cent.

The state of Nebraska has made a special appropriation for the purpose of investigating this disease.

HOG CHOLERA.

Hog cholera appears to have become a fixture in the vicinity of Denver.

The claim made by some that the disease in swill fed hogs adjacent to the larger cities was some disease other than hog cholera, has not been substantiated.

Susceptible hogs were exposed to the disease, by placing them in pens adjoining the sick ones. The usual number contracted the disease, and the symptoms and postmortem lesions revealed the identity of swill sickness and hog cholera. This fact was further substantiated by laboratory experiment and blood serum inoculations.

TUBERCULOSIS.

In reality we have no disease among the lower animals in the West that is commonly classed among the animal scourges. The nearest approach to it is tuberculosis. The disease is not as prevalent here as in the lower altitudes of the eastern states, but every state is being constantly infected by the importation of diseased animals. Aside from the probable menace to the human family it has become an economic problem of such vast proportions as to warrant stringent state and federal regulations.

Tuberculosis affecting several species of domesticated animals has become so general and its complete eradication by the usual methods adopted in exterminating contagiums, is such a stupendous undertaking that the authorities everywhere are overwhelmed by its magnitude and, comparatively speaking, are doing nothing.

Cattle and hogs are the most susceptible and in the latter disease is greatly on the increase.

A few spasmodic efforts have been made on the part of various cities to control the sale of tuberculous animal products for human consumption, (a few states have statutes perporting to regulate the traffic of tuberculous cattle).

The federal government is effectively controlling the sale of the flesh of such animals, for interstate and foreign trade. But until there is a united effort on the part of state and federal authorities to control diseased animals and all the products of the same, there will be very little accomplished.

GEO. H. GLOVER,
Veterinarian.

REPORT OF THE METEOROLOGIST AND IRRIGATION ENGINEER

Such lines of observations as are contained in the work of the meteorologist are the steady, persistant continuation of the series of observations planned and continued for the past twenty years. The value of such is in the length of the series, in the continuation under the same conditions and by similar methods. It is recognized that conclusions cannot be drawn short of a number of years, even concerning some of the simplest facts of climate.

A period shorter than 20 years does not give conclusive data regarding rainfall, temperature or agricultural meteorology. The observations have been directed, not to study the weather—that is done by the U. S. Weather Bureau—but the continuous record of those elements of importance in the growth of plants, temperature, moisture, evaporation, sunshine, and the amount of radiation received from the sun. But very little reduction has been made of the observations hitherto, but now with the completion of twenty years in most lines, it is time to do it. The work of reduction, of putting into shape, means toil far more than does the taking of the observations. The solar radiation, our measurements show, amounts to about 1 horse power per square yard.

The irrigation records of the year have been less with the idea likewise of working up the records available. The lack of room, the dangerous condition of our stores have been serious drawbacks. Records have been continued on streams, on seepage, and on the amount of water used in irrigation. Bulletins on three of these subjects are nearly ready for publication.

THE KANSAS-COLORADO CASE.

The year has seen the final ending of the attempt of Kansas to prevent the use of water in Colorado for irrigation. The final decision was given in May. Afterwards Kansas applied for a new hearing, but within a few weeks, the Supreme Court has again, and finally, declined. This case was largely, if not entirely, fought out on the lines which the investigations of this section had shown to be true; with the additional facilities on a larger scale, and with added wealth of fact and illustration. Immense amounts of records were made, hundreds of miles of levels, and the study of the underground waters for hundreds of miles. The original work has been done with the support of the Board, and therefore, as the credit is distributed, the policy and support of the Board in permitting and encouraging the records

which finally resulted in the victory, is to be recognized. It is a great satisfaction in the final result, for while I have believed that this should be the final result there has been considerable cause for fear, for the doctrine which we urged was contrary to precedent, and the accepted traditions of the east. I have felt and urged that the only way was to show facts and that the equity from the facts would force our case. It has not generally been realized how serious was the contention to the prosperity, not only of the Arkansas Valley, but of the whole of Colorado and of the West. The essential points were: First, a denial of the right to irrigate; and Second, by the U. S., as intervenor, that the United States should control the interstate streams. This last, was after all perhaps the most fraught with danger. It represented the continuation of the policy started in the attempt in the Elephant Butte case, which was not so much to prevent the construction of the dam, as it was to put the control of the streams in the United States. What dangers exist in the United States' control are already seen in the refusal of the general Government to grant land for reservoirs or ditches on the Rio Grande and the Grand River water sheds, on the claim that they might interfere in the one case with proposed schemes in Southern California, and in the other in Southern New Mexico and Texas. An assumption of the power to determine where water may be used, what regions may be developed, and the holding back of communities already well settled in Colorado, in favor of others as yet in the desert.

We have felt that while the investigations leading to these results were aside from those originally planned, that they were fundamental in the Colorado agriculture, and that nothing could be of more importance than establishing the right of the use of water.

For the next year, I now feel that it will be timely and better to bring up our observations than to enter upon much new work, unless there are additional facilities. The many plans elaborately prepared some 15 or 16 years ago, have been followed and all the varied work has been along a general plan and joining in a common end. Many of the plans then made were abandoned for lack of means, until better means were available, and the lines of work taken up were caused by the necessity of incurring small expense.

Respectfully submitted,

L. G. CARPENTER,
Irrigation Engineer.

Fort Collins, Colo.,
Dec. 1, 1907.

REPORT OF THE ARKANSAS VALLEY FIELD AGENT

To the Director:

I desire to submit the following report of the work in the Arkansas Valley.

As outlined, the work during the past season has been principally in line of plant breeding, to improve the three important crops of this part of the state, beets, alfalfa, and cantaloupes.

ALFALFA.

A new enlarged alfalfa nursery was established on a more suitable piece of land, than was first used; the old nursery having become infested with pocket gophers, and the area of uniform soil was limited. The new nursery was sown with seed from choice selected individual plants that had evidence of superior hay and seed producing qualities, and fifty varieties or strains of alfalfa from different states and from foreign countries, that was furnished through Mr. J. M. Westgate of the Department of Agriculture. In all the new nursery comprises sixty-four plats of two hundred hills of individual plants each.

The season was cold and rather unfavorable, yet a very satisfactory stand of plants was secured in most of the plats. A very marked contrast was revealed in some of the foreign strains, some of the plats had tall coarse stems with few leaves, others had thick fine stems very dense set with leaves. The variations in regard to the attack of leaf spot and the tendency to shed the leaves was very pronounced. The contrast in seed production if any thing was more marked than all. One plat sown with seed from Ecuador, South America, produced a remarkable yield of seed on nearly all of its plants, while many plats did not furnish enough seed to make a selection. Notes and photographs, and selections of seed have been made to carry on the work.

Observations have been made during the season on the cultural methods of growing alfalfa hay and seed, with a view of systematic study of the question.

BEETS.

Field observations on the beet crop have been made. The beet crop seems to have been quite generally affected with a leaf spot in this part of the state. Dr. C. O. Townsend pronounced it Cercospora Beticola, commonly called eastern leaf blight. It has seriously reduced the tonnage in this part of the State. Land in fine state of fertility has not been so badly injured as worn out land .

The small plat of mother beets for seed that were being grown to

test the different types of beets, failed to mature seed on account of the false chinch bugs, and other unfavorable conditions.

A test of about forty pounds of the "curly top" resistant beet seed that was produced last year was made with a farmer. The seed was sown at the same time with other seed and had the same care and yet it failed to grow seemingly weak in vitality. The general results in growing beet seed in this portion of the state have not been encouraging.

CANTALOUPES.

Of the rust-resistant cantaloupes, seed of ten that scored the highest in all points of quality were selected for the work the past season. The seed were planted in the same plat, which now for five years has been growing cantaloupes, enough to insure a failure of any ordinary strain of seed, but since the beginning of the resistant selection the plat has revealed a decrease in the presence of the disease, while in adjacent fields the rust has been prevalant as ever, and even more destructive. Except for a few individual plants the plat has been free from the disease. Several practical tests of the rust-resistant strain were made with the commercial growers in the vicinity of Rocky Ford, and in Indiana and Illinois, similar tests were conducted with growers of these states, through the cooperation of Professors C. G. Woobury and J. W. Lloyd of the Experiment Stations. Without exception the reports have all been to the effect that the rust-resistant seed had exceeded the highest expectations, remaining green and producing fine flavored melons after other varieties in adjacent fields were dead with the disease.

A comparative test was made of some varieties secured from W. W. Tracy to determine if there was any other variety that was more resistant to the disease, or that possessed better qualities for market or table, than the strain of seed that we were using. The result was that there was none that was considered better except one from Syrmna that seemed to have a better texture of flesh. An effort to combine this quality by hybridization will be attempted another year.

Also a test of eighty individual melons on alfalfa sod was tried to test the variations and to determine the laws of heredity in cantaloupes. The result of this research can better be given in a more extended report.

Respectfully,

PHILO K. BLINN,
Field Agent.

Rocky Ford, Colo.,
Dec. 1, 1907.

REPORT OF THE WORK AT THE PLAINS SUB STATION

To the Director:

It has been an exceptional year for Eastern Colorado, the worst in the history of the Station, the rainfall at the Station has been less than nine inches from October 1, 1906 to October 1, 1907, and nearly one-third of that at one time, on the 26th of June.

The lowest in any other year according to the Station records being the year 1903, when there were 13.26 inches.

On October 2nd, there were 10 acres of Turkey red fall wheat sown on ground that had been in spring wheat. After the spring wheat had been cut, the ground was well disked and the fall wheat was sown with a disk drill. The wheat was harrowed twice in the spring, but being so short, it was thought best not to cut with binder, so it was mowed, stacked and threshed, making a yield of three bushels to the acre.

On February 28th, there were 7 acres of Macaroni wheat sown, but being so dry, it came up very unevenly and was harrowed twice, was mowed and threshed, yielding 2 bushels to the acre, but of very good quality.

There was also one acre of wheat and two acres of oats sown, ground was disked and sown with disk drill, harrowed twice, for cultivation, but was thin, fairly well filled, and was cut for oat hay.

March 26th, there was planted one-half acre of early Ohio potatoes but during the heavy rain of the 26th of June, they were flooded all night and badly washed out. Will about get the seed back again.

On May 8th and 9th, there were eight acres of corn planted with the lister, but got very poor stand and badly taken by gophers, was cut and shocked but is now in the stack. Yield, one ton to the acre.

May 15th, there was one acre of Turkestan alfalfa sown, seed furnished by the College, but being so dry did not germinate until after the heavy rain of June 26th, and then was so badly washed that it was almost a failure. The other grasses which I sowed last year, such as bromis inermis, western wheat grass and slender wheat grass, have about held their own.

The fruit was an entire failure, owing to the late freezes last spring, but was much better for the trees to rest during the dry season. The growth has been but light, they have held their own but by good cultivation.

The land is in fine condition to go into winter. While dry, I

have all double disked twice, so if there is any moisture whatever it will take it in.

I also took up twenty acres adjoining the Station last June, 1906, plowed and packed it, resting the same till September. Twelve acres were sown to wheat, one bushel to the acre, Turkey red. The other eight acres were sown on September 29th, three-quarters of a bushel to the acre. The entire piece was harrowed three times in April and May, as cultivation. From the day it was sown till the 26th day of June, we had received but two and eleven hundredths inches of rain, this being the night of the big rain of the season. The wheat was cut within the next ten days. Where one bushel was sown the yield per acre was 17 bushels, while that where three pecks were sown, the yield was 21 bushels per acre. The same was all sold at the Station for $1.00 per bushel and sown, as dry as it continues.

Respectfully submitted,

J. B. ROBERTSON,
In Charge.

Cheyenne Wells, Colo.,
Dec. 1, 1907.

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