ANNUAL REPORT

Willis E. Johnson, President,
South Dakota State College.

Dear Sir:

As director, I have the honor to make the following report of the South Dakota Agricultural Experiment Station for the fiscal year ending June 30, 1921.

Organization

The Experiment Station is organized under the provisions of the Hatch Act of 1887 and the Adams Act of 1906. These acts provide $30,000 annually for the station, and also, indirectly, how the same shall be expended. The legislature of South Dakota accepted the conditions and made the station a part of the South Dakota State College.

The Object

The object of the station is to conduct experiments along agricultural lines for the benefit of the farmers of South Dakota. With its limited funds it is impossible to include all lines of agricultural activities in the state, but there are five divisions of the station, as follows: Animal Husbandry, Agronomy, Chemistry, Dairying, Entomology and Horticulture. These divisions are well equipped and well manned and I believe are doing as much along their respective lines as is being done in any other state in the Union when we consider the funds available. The state appropriates $1,500 for printing popular bulletins, which is of great assistance in printing bulletins not provided by federal funds.

Changes in Personnel

Since my last report there have been few changes in the personnel of the staff. Mr. T. M. Olson succeeded Mr. H. M. Jones in the Department of Dairy Husbandry. Mr. Arthur T. Evans succeeded Mr. Manley Champlin in the Department of Agronomy. Mr. A. T. Bushey succeeded Mr. H. Loomis in the Department of Agronomy. These changes were made because of better paying positions offered these assistants.

Division of Funds

At the beginning of the fiscal year the Hatch and Adams funds are apportioned to the different departments, but the $30,000 furnished by these two acts must be expended in accordance with regulations made by the Secretary of Agriculture, Washington, D. C.
For the year ending June 30, 1921, these funds were apportioned to departments as follows:

**Hatch Fund**

<table>
<thead>
<tr>
<th>Department</th>
<th>Amount</th>
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</thead>
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<tr>
<td>Executive</td>
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<tr>
<td>Agronomy</td>
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<td>Animal Husbandry</td>
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<tr>
<td>Dairy Husbandry</td>
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<tr>
<td>Horticulture</td>
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$15,000.00

**Adams Fund**

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<tr>
<td>Dairy Husbandry</td>
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<td>Entomology</td>
<td>1,692.00</td>
</tr>
<tr>
<td>Horticulture</td>
<td>4,960.00</td>
</tr>
</tbody>
</table>

$15,000.00

Of this amount $18,981.43 was paid for salaries.
Besides the annual report four bulletins were printed.

Bulletin No. 190. The Webspinning Sawfly of Plums and Sand Cherries, by H. C. Severin, Department of Entomology, is summarized as follows:

The plum webspinning sawfly is distributed generally over South Dakota, but it is the eastern half of the state that suffers most severely from the ravages of the larvae of this pest. The larvae are gregarious and live and feed in webs which they spin about the leaves and twigs of their food plants. The foliage of plum trees and sand cherry bushes constitutes the preferred food of the pest and such trees and bushes may be entirely defoliated during June and July.

The adult insects make their appearance during the latter part of May and early June. After mating, each female lays 46 eggs on an average and these, after a period of five to seven days, give rise to larvae or "worms." The "worms" feed for 13 to 23 days and at the end of this period they fall to the ground, enter it to a depth of 1 to 10½ inches and hollow out cells, inside of which they pass the remainder of the summer, and all of the fall, winter and early spring. With the approach of warm weather in the spring, the "worms" change to pupae and these give rise to adults or sawflies in 7 to 10 days. Thus it is seen that there is but one generation of this pest per year.

While there are several very effective parasites and predaceous enemies of this insect, they do not keep down the numbers of the Neurotoma larvae to the point where their presence upon plum trees or sand cherry bushes is negligible. Consequently, spraying or dusting must be resorted to. If spraying is practised, 1 pound of lead arsenate in paste form or ½ pound in the powdered form should be used for each 50 gallons of water, but if dusting is adopted, then 1 pound of powdered lead arsenate should be diluted with 15 pounds of air-slacked lime or powdered sulphur before it is applied to the foliage. The spray or dust should be applied to the fruit trees or bushes while the webs of this pest are still small.

Bulletin No. 191. Water as a Limiting Factor in the Growth of Sweet Clover (Melilotus alba), by A. N. Hume, Howard Loomis and J. G. Hutton, Department of Agronomy, is summarized as follows:

1. Sweet clover (white) will apparently live in the loam soils employed in the present trial with as little moisture as 9 per cent of the dry weight of the soil in which it grows.
On the clay soil employed in this series sweet clover appeared to cease growth when the percentage of water on the basis of the dry soil approached 11 per cent as a minimum. It is thus indicated that even under conditions otherwise identical variations in soil type may produce some variation in the amounts of water necessary for growth of sweet clover. The observation that soil type, regardless of other conditions, may furnish a factor influencing "water requirement" is in substantial agreement with other investigators.

2. When the factor of soil type was equalized, it was observed that as the percentage content of moisture in soil was increased, the total amount of water utilized by the plants increased. With increase of moisture content by degrees, in soil from 9 per cent, to a maximum of 32 per cent, the total water used increased regularly from 6.6 kilos to 79 kilos. Thus, in general, sweet clover plants can make some growth with very limited moisture, but if water is available to them they can adapt themselves to use it.

3. It is also apparent that the average production of dry matter per plant increases with the total amount of water utilized.

4. One chief factor in the increase of dry matter of sweet clover produced with the increase of available water was the increase in height of main stems; the extreme height of plant (main stem) was found to increase, with the increase of water available, up to 22 per cent of the dry weight of soil. When the percentage of available water was still further increased the corresponding increase in dry matter apparently was produced not by increase in extreme height but by increase in number of stems and branches. Such was the means by which sweet clover plants adapted their manner of growth to the increases in water.

5. Also, in regard to the manner of growth of sweet clover plants as affected by increases in amount of water; it appeared that the average weight of the leaves of plants increased, and that the mean area per leaf increased with increase in the amount of moisture available. This statement is based on measurements made in 1918.

6. It appeared that the average actual "water-requirement" (as indicated by the ratio of grams water used to grams of air-dry tops produced) increased with an increase in the amount of the water available, up to 18 per cent of the weight of the soil, possibly beyond. In short, sweet clover will not only utilize more total water within limits when it becomes available, but also will utilize more water per gram of dry matter up to a maximum.
7. The present researches indicate that as an average on all soils the water requirement for sweet clover varies according to the percentage of water available, from 675 to 789.

8. These figures for water requirement as determined agree substantially with those furnished by Briggs and Shantz, for conditions at Akron, Colorado, they having secured a water requirement of 770.

9. Sweet clover may be said to have an average water requirement, as compared to plants listed in general; tumbleweed with 277 and millet with 310 are among the lowest, and brome grass, with 1016, highest in respect to water requirement.

10. Previous to beginning the present researches, South Dakota Experiment Station published Bulletin No. 151, "Trials with Sweet Clover as a Field Crop," which indeed may have been the earliest bulletin published giving results with growing, harvesting, and feeding the plant in question as a harvested crop. At the beginning of the present researches it was intended to get quantitative information about the capacity of the sweet clover plant to adapt itself to a wide range of cropping conditions. It becomes more apparent that sweet clover possesses that range of adaptability. In spite of some limitations as a crop plant it may well increase in importance as a farm crop, in South Dakota and throughout the world.

Bulletin No. 192, Rations for Pigs, by James W. Wilson and Arthur H. Kuhlman, Department of Animal Husbandry, is divided into five parts as follows:

1. By-products for pigs in cornfield.
2. Fishmeal vs. tankage as protein supplements for pigs.
3. Shelled corn vs. ground barley for fattening pigs.
5. Value of bluegrass pasture for fattening pigs.

Bulletin No. 193, Soybeans in South Dakota, by Arthur T. Evans and Matthew Fowlds, Department of Agronomy, is summarized as follows:

Hundreds of varieties of soybeans have been introduced into the United States and tested by the United States Department of Agriculture and by the state experiment stations. Many of these are handled by growers and seedsmen. The bulk of the soybean seed on the general market is grown in central and southern states. The varieties which are well adapted to those states are not generally suitable to grow in South Dakota. This state will perhaps not be able to compete with southern states in the production of soybeans for
grain, but sufficient seed of the best varieties should be grown here to supply the local demand for seeding purposes. Only by doing this can a source of good seed, well acclimated to this state, be established.

If the crop is to be grown for seed, it is necessary to choose a variety which will ripen. In an average season, only the early varieties will mature seed. The medium early varieties which do not ripen but which produce well filled pods before the first frost can be grown for hay or silage. The large late maturing varieties are not desirable for any purpose. About 30 varieties have been tested at the station at Brookings for one or more years. Those which failed to mature were discarded after the first year.

Mailing List

A regular mailing list is maintained to which the bulletins are sent when issued. In addition daily requests for bulletins are filled. The demand for these bulletins is not confined to residents of South Dakota, but requests come from residents of other states as well. The bulletins are used as texts in some colleges and the teachers of agriculture in the high schools are also using them. Many requests for bulletins on agricultural subjects not considered by our station are received. We believe if all lines of agricultural activity within the state are to be served properly, an appropriation for this station should be made by the state legislature. The federal money should be at least equalled.
COOPERATIVE WORK

The station cooperated in the following lines during the year:

The Department of Animal Husbandry, from July 1, 1920, to July 1, 1921, distributed 107,285 doses of blackleg vaccine for the Bureau of Animal Industry, United States Department of Agriculture. The county agents have been active along this line and during the year considerable vaccine was distributed to the stockmen by them. Probably every county agent in the state by this service has prevented the loss of enough cattle to pay his salary. They distributed about one-fifth of the total amount. There were 692 requests from North and South Dakota. The livestock raisers appreciate this vaccine, otherwise they would not use it year after year.

The Department of Chemistry cooperated with the Bureau of Chemistry, United States Department of Agriculture, in a study of methods for determining chlorine content of chlorine bleached flours, also to standardize solutions for spraying purposes.

The Department of Dairying cooperated with the Pennsylvania station in nutrition experiments.

The Department of Horticulture cooperated with the farmers in the Northwest, with the South Dakota State Horticultural Society, and with the Section of Seed and Plant Introduction, United States Department of Agriculture.

The Department of Agronomy cooperated with the Bureau of Plant Industry, United States Department of Agriculture.
DEPARTMENT OF ANIMAL HUSBANDRY

Experiments in pig feeding and sheep breeding were conducted. In the experiments in feeding pigs, it was desired to ascertain the value of buttermilk products as compared with the natural buttermilk from the churn. This experiment will be conducted another year before publishing results. Grain rations for the development of breeding gilts and boars while on rape pasture were also considered.

Sheep Breeding

The object of this experiment is to develop a hardier breed of sheep than any we now have, possessing the superior qualities of both the Siberian fat-rumped and the ordinary breeds of sheep. The lambs of this cross have wonderful vitality at birth, a valuable feature for the sheep grower.

The majority of the people who have used the half-blood rams are well pleased with the results. Again, this breed comes from the home of the Siberian camel, where it is dry in summer, and cold in winter. Frequently it is confused with the fat-tailed breeds, but these sheep are tailless.

It is planned also to develop a prepotent strain that possesses the good qualities of the ordinary breeds of sheep, both as to mutton and wool, and also that will eliminate the tail, when crossed with other breeds. There is but a small flock at the station and none are for sale.

I include and make a part of this report the following reports from heads of divisions of the Experiment Station.

Yours truly,

JAMES W. WILSON,
Director of Experiment Station.
Finances

The following is a report of the secretary, R. A. Larson, of receipts and disbursements for the year:

**EXPERIMENT STATION AND SUBSTATIONS**

Receipts 1920-1921

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<tr>
<th></th>
<th>Home Station</th>
<th>Highmore Sub-Station</th>
<th>Eureka Sub-Station</th>
<th>Cottonwood Sub-Station</th>
<th>Vivian Sub-Station</th>
<th>Miscellaneous</th>
<th>Total</th>
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### EXPERIMENT STATION AND SUBSTATIONS

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<th>Otherwood Sub-Station</th>
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**Totals** | $15,000.00 | $15,000.00 | $3,319.76 | $4,406.69 | $4,735.21 | $4,470.76 | $5,076.47 | $52,098.89 |

**Popular Bulletins**
- Popular Bulletins
- Popular Bulletins—Reverted to State Treasury

**Balance on Hand**
- Experiment Sub-Station, July 1, 1921
- Local Fund Home Station, July 1, 1921

**Grand Total** | $61,066.98 |
DEPARTMENT OF AGRONOMY

Director J. W. Wilson,
College.

Dear Sir:

In reply to your recent request, I beg leave to report concerning progress of Hatch and Adams projects for the fiscal year just closed.

Adams Project No. 1

A Project on the Influence of Rotation Upon the Maintenance of Soil Fertility.

The plots chiefly concerned in this project consist of two tenth-acre series on East Farm, Brookings. Each series is confined to a definite rotation. As previously reported, these plots were sampled in 1908 and analyses are on record showing the complete content of nitrogen, phosphorous, potassium, of total carbon and of inorganic carbon. With present progress, it is believed that a similar series of analyses can be completed during the present summer season, for the series of samples taken in 1915.

Acidity determinations have been made on this last series of samples and it may be noted briefly that whereas no acidity was recorded in the case of the earlier samples, acidity is now present. This is an example of a definite effect which has occurred in soil under a known system of rotation, whether or not directly caused by the rotation.

Under this same Project No. 1, studies of the nitrogen content of continuous legume plots on the West Farm have been conducted. The general trend of analyses may be said to indicate that the total nitrogen in the soil of these plots has tended to diminish.

The crop yields from the rotations indicated are of course preserved and these will be tabulated in connection with whatever deductions can be made and tabulated in bulletin form.

Adams Project No. 2

A Study of Correlations Between Certain Physical Characters of Plants and Their Capacity for Yield.

The nature of this project may be learned in detail from our Experiment Station Bulletin No. 187, which is already published, entitled, "The Influence of Length of Wheat Heads on Resulting Crops."
The state of the project at present is that "Mother plants" of Marquis wheat were produced in 1919. Head rows from these "Mother plants" were in turn planted in 1920. These, however, were so completely rusted that the yields from them are not to be depended upon for making computations. The head rows in question, however, were harvested in order that the strains represented by them might be continued. Said strains are now growing in head rows and are about ready for harvest at the present time. The present season, although not perfect for crops, has been such as to permit growth and it is hoped that the head row yields will give sufficient data for computation.

The chief question which will be asked from these head row yields is whether the progeny from "mother plants" bearing long heads will yield higher than the progeny from similar plants bearing short heads. Theoretically, providing Marquis wheat is a pure line, our head row yields for this season should show only negative correlation between these two types of wheat plants. Is Marquis a pure line?

Adams Project No. 3
A Project to Determine Definitely the Extent to Which Water Is a Limiting Factor in the Growth of Sweet Clover (Melilotus alba).

This project is published in Bulletin No. 191, which was in press at our last report. The printing is now complete and the bulletin is available. The project is discontinued.

Adams Project No. 4
A Project to Determine Definitely the Effect of Phosphorus in Different Forms on the Growth of Plants and the Effect of Sulphur in Combination with Calcium (gypsum calcium sulphate) and as Pure Sulphur on the Growth of Plants and Its Effect on the Availability of Phosphorous in Different Forms.

No positive results are completed on this project. It has been necessary to assemble material which in fact has been somewhat slow and difficult, due to transportation. However, special plots have been secured and soil collected and homogenized. Also apparatus for colorometric determination of phosphorus has been secured and all necessary equipment is now at hand. Preliminary work in methods has been carried through.

Hatch Projects
One of our continuous plot experiments on West Farm, Brookings, is a three-year rotation of corn, oats, clover, com-
prising a comparison of a "livestock system" and a "grain system" of farming. Three separate acres each divided into one-tenth acre plots are involved in this experiment. On certain of the plots, crop residues consisting of corn stalks, straw and clover haulm are turned back as such into the soil. On the comparative plots these are removed from the soil on which they are produced and an equivalent weight of stall manure is returned. Crop yields were higher from the livestock system in the early part of the experiment. Later the yields are higher from the grain system. This fact may result from the avoidance of fertility losses, when crop residues are returned immediately instead of being hauled away from soil and hauled back, or partially hauled back later in the form of stall manure after feeding.

Not only will crop yields be recorded from this system of plots, but the ultimate effect of the two modes of farming upon the soil itself will be investigated.

Cereal breeding and "variety testing" are conducted with the use of Hatch funds. One of the objects of "variety testing" is that of finding, introducing and testing the kinds of field crops that may be most productive in South Dakota. Since making last report Ruby wheat and Kitchener and Monald have been introduced from Canada and North Dakota, and Minhardi from Minnesota. Kanred is being tried out in comparison with Turkey and other winter wheats.

Other varieties of corn and small grain are tested in a similar way. Potato variety tests include Early Ohio, Sixty Day, Burbank, Rural New Yorker, King, Raleigh, Carmen, Blue Victor, Irish Cobbler, Early Rose, Late Rose, White Harvest and Bugless.

It is appreciated that mere "variety testing" is not an ultimate scientific principle. An attempt is made by us to accomplish such work in accord with such principles. What is a variety and where is it?

More important in this connection, Mr. Evans and Mr. Fowlds and others constantly make "selections" of crops from fields in the state wherever promising selections appear. Recently the former discovered some wheat plants bearing smooth heads in a field of Turkey winter wheat. These smooth headed plants will be "head rowed." They may or may not be more valuable for South Dakota conditions than varieties already common. Such is one illustration of a constant effort to discover valuable strains of cereals and forage crops.

Hybridization of cereals is resorted to as a possible means for securing combinations of characters that are practically valuable but for securing material for fundamental studies
of inheritance, which may be practical in breeding field crops. Crosses of oats may combine the earliness of such a variety as Sixty Day with taller growing habit of Swedish Select and the high yielding capacity of both. Crosses of wheat may secure the rust resistant quality of red durum, with the quality of Acme, or even of a "bread wheat."

Among the most important problems in cereal breeding is that of securing varieties that are resistant to or immune from rust, especially Puccinia graminis. Mr. Evans with Mr. Fowlds and Mr. Janssen are making the most careful observations to learn if possible how to circumvent rust.

In the line of crop breeding, Mr. Fowlds is conducting a nursery of seedling potatoes, seed of which was furnished us two years ago by the South Carolina Experiment Station. These new varieties are some of them promising.

Corn breeding studies are continued. We are studying the correlation between protein content in corn and yield of protein per acre. Also Mr. Bushey plans to make some researches into forms of protein in several strains of corn.

The writer is continuing a system of corn breeding devised by himself, wherein we hope to secure (1) continuous selection, (2) hybridization, and (3) introduction of new strains or the closest approximation that can be arrived at with a wind-pollinated monoecious plant. Perhaps the same system of breeding may prove serviceable in breeding gregarious animals. We are studying the system as such.

In regard to personnel, our principal changes within the past year are the addition of Dr. Arthur T. Evans and Mr. George Janssen and Mr. W. H. Pierre. Dr. Evans has been engaged with us since July 1, 1920, and is in direct charge of crops, including crop diseases. Mr. Janssen is a graduate of State College who throughout his eight years in the School of Agriculture, and later in college had long experience on experiment station plots, including rotation experiments and crop breeding, as student assistant in crops. It is correct to say that Dr. Evans with present help is able to inaugurate some lines of work, especially crop pathology, not previously provided for. Mr. W. H. Pierre comes to us from the University of Wisconsin as assistant in soils. He will engage mainly in research projects and soil survey.

Professor J. Gladden Hutton continues in charge of soils and soil survey. Agronomy analytical laboratory is in direct charge of Assistant Professor Alfred Bushey. At present Theodore Kurtz and Oliver Overseth are working with him as student assistants. Joseph Machlis assisted Professor Bushey in the laboratory previous to the opening of field
work in soil survey. He is now surveying in McCook county. Clerical work, including transfer of records, is accomplished by Miss Selma Ronning and Miss Elva Feuerhelm.

It is attempted to provide definite projects of work for each individual, without interfering greatly with initiative. It is our hope and belief that results contribute to the sum of knowledge of soil and crop conditions in South Dakota.

During the year the department has published and printed the following:

Bulletin 193—Soybeans in South Dakota, by Dr. Arthur T. Evans and Mr. Matthew Fowlds.


Very respectfully,

A. N. HUME,
Agronomist and Superintendent of Substations.
Dear Sir:

The work of the Division of Chemistry of the Experiment Station, during the fiscal year just closing has covered the following items:

Cooperative with Department of Agriculture. During the year we have cooperated with the Department of Agriculture of the federal government in the matter of assistance in their issue of standardizing of methods of analysis in connection with the determination of the chlorine content of chlorine bleached flour, and in standardizing of methods of analysis of insecticides and fungicides. In this work we are selected as cooperative assistants for the Association of Official Agricultural Chemists.

As our station chemical analyst is partially paid from state funds, he has been obliged to do a large number of miscellaneous analyses, sent in by private parties, but we have been careful to replace all materials and apparatus used for such purposes from the stock carried by the college department, so that no federal funds have been used for such work.

I would strongly urge, as future station work in our department, projects having to do with the fixing of isochlor lines over this region, a project which, as much as any that we might undertake, would make for the convenience and commercial profit of the agricultural interests of the Northwest. Such work should receive cooperative aid from state funds, if possible. I would also urge some extended chemical investigation into the possibilities, commercially speaking, of the sweet clover plant.

Sincerely yours,

B. A. DUNBAR,
Station Chemist.
In compliance with your request, I am glad to give you herewith a report of this department for the year ending June 30, 1921.

Changes in Staff: Mr. Horace Jones resigned July 31, to enter county agent work, and Mr. Thomas M. Olson succeeded him on August 1. This was the only change in the staff of this department.

Adams Fund: The only project carried on under the Adams fund was the one outlined by Dr. H. P. Armsby. The object of this project was to determine the protein requirements for the growth of cattle. Four grade Holstein heifer calves were chosen. The calves were as comparable in all respects as it was possible to get them. They were divided into pairs. One calf of each pair was fed on a low protein ration, the other one on a high protein ration. The net energy was the same for all the calves.

The low protein ration supplied little more than the minimum amount theoretically required, while the high protein ration supplied about the amount demanded by current feeding standards. The calves were weighed and measured bi-weekly, and rations computed making allowance for the expected increase in weight for the following two weeks.

The ration consisted of the following feeds: Chopped alfalfa hay, chopped oat straw, oilmeal, peanut meal, corn-meal, starch and salt. Both pairs of calves received the same feeds, but in amount so as to meet the requirements for high and low protein intakes. The bulk of the ration was furnished by increasing or decreasing the amount of oat straw. The net energy supply was regulated by the use of commercial starch.

Any changes in the condition of the calves were noted. One calf developed scours, but when she was moved from the end stall which was next to the outside of the barn, she immediately got over it. It was presumed that the sudden change of temperature caused scours. No other conditions or differences were noted that would warrant one in assuming that the high protein ration was producing greater growth or better physical condition than the low protein ration.

The chemical work done in connection with this problem has consisted chiefly in the analysis of the feeds fed during the experiment and also the determination of the composition of the feces and urine obtained during the digestive trials.
The usual determinations such as the content of nitrogen, ether extract, crude fiber, ash, etc., were made. With this data as a foundation, tables giving the daily amount of nutrients consumed by the experiment animals, and also the customary balances of nutrients and digestibility of the ration will be presented in publication form later.

As noted previously these animals were given the specified rations commencing November 1, 1920, and continued until July 1, 1921. The calves were subjected to five digestion trials during this time as compared to two the year previous. It was thought advisable to have the length of each trial five days rather than ten because of the high price of labor. Also the amount by which the ration increased from week to week was so small that the irregularities in composition and passage of the feces would be insignificant when we consider the value which the data from five trials would have as compared to that from only two or three. During the trials the animals were attended at all times by two men who made the necessary collections of excrement. The digestion trials began on the dates following:

Digestion Trial No. I. Nov. 30, 1920.
II. Jan. 7, 1921.
III. Feb. 18, 1921.
IV. April 17, 1921.
V. June 5, 1921.

At the end of every 24 hours of each trial aliquot portions of the excrement were taken. When the trial was over those aliquot portions were thoroughly mixed and analyzed to insure that the excrement collected corresponded closely to the excrement which should result from the ration fed during the trial, the animals were given the specified ration at least a week in advance of the trial. To further insure the accuracy of the digestion data, enough of each feed to last half a month was cut or ground, mixed, sampled and sub-sampled for analysis. It was noted in this connection that the feeds varied in moisture and crude protein content, sometimes several per cent.

We hope to have the analytical work for this problem completed during the next few months.

The allotment on the Adams fund was $1,519.
It was expended as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
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<tr>
<td>Feed</td>
<td>267.61</td>
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<tr>
<td>Supplies</td>
<td>146.87</td>
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<tr>
<td>Equipment</td>
<td>42.75</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,519.00</strong></td>
</tr>
</tbody>
</table>

Hatch Fund: The experimental work with milking machines has been continued. Under the new series of experiments begun in March, 1920, the following points have been studied: (1) the relative economy of machine and hand milking, (2) the efficiency of the various types and makes of mechanical milkers, and (3) the bacterial count of machine drawn milk. Two different machines were used for a period of 90 days. The number of cows being milked by each machine was about the same, and the same cows were milked for 45 days by each machine, when the machines were interchanged. Thus each machine milked the cows in two groups.

The following machines were used during the year: Universal, Pine Tree, Empire, National, Sharples, B. L. K.

Records were made of time required to milk a given number of cows, time required in washing, cleaning pipe lines, tubes, and care of machine. The time required by the hand milkers to milk a given number of cows was also recorded from time to time. The strippings from each cow were weighed and recorded separately.

A detailed and comprehensive tabulation of results and conclusions will be prepared for publication.

The milk drawn from the first cow milked by a machine contains many more bacteria than that obtained from the subsequent milking of other cows at the same milking period by the same machine. The average count of the first cows milked in 22 instances was 23,478, while that of the second cows milked was only 14,087. Sometimes a double unit machine is used and both sets of teat cups are not used continuously during the milking period. When one set of teat cups hangs idle from the machine while the other set is being used for milking we find that when this idle set is used the bacterial count of the milk is increased. In our work, where a double unit machine was used, the first cow being milked with one set of teat cups, and the second cow with the other set, we got an average count for the first cows of 8,500 as compared with a count of 27,082 for the second cows. This would indicate contamination of the teat cups and tubes while standing idle.
When the tubes were kept in a saturated solution of lime hydrate from one milking to another the average count was 16,832 as compared with a count of 14,926 where a commercial preparation was used. This would not indicate much preference as far as count was concerned.

Our allotment of the Hatch Fund was $860, which was expended as follows:

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</tr>
<tr>
<td>Equipment</td>
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</tr>
</tbody>
</table>

$860.00

Local Station: During the year a glass enameled vat was purchased and has been used as a combined heater, holder and cooler for the pasteurization of market milk. It heats and holds satisfactorily, but is slow in cooling. It does not seem to impart any heated flavor to the milk although low pressure steam is used for heating. We expect to continue our work with this vat and study its effects on the cream line and bacterial count of the milk.

The “Grading Up Experiment” which was started in 1907 is still in progress. The purpose of this work is to ascertain the value of mating a purebred sire with grade dams. We have offspring from Holstein, Guernsey, Jersey and Ayrshire purebred bulls mated with grade Shorthorns and grade Hereford cows. Careful records of milk production and feed consumption are kept so that the total production and cost of production of the grade cows can be compared with their respective dams. We are contemplating a bulletin including all the data up to date, therefore we are not giving any data in this brief report. No experimental funds have been used in carrying on this work.

The heifers which were on the Adams project the year previous were continued on the Local Station fund. The plan is to keep these heifers until they calve, to note the results if any of the high and low protein rations on the further development of the heifers, and the effect on the fetus. One heifer has calved, giving birth to a 75-pound calf, normal in every respect so far as physical appearances show. The calf was active, and the weight at birth would indicate that it was fully grown and normal in size. The other heifers have been bred a number of times, their oestrual periods appearing at regular intervals. The two high protein heifers appear to be safe in calf, but the remaining low protein heifer shows no indication as yet of being in calf. Whether the failure to conceive at first was due to the rations being fed, or other
causes, cannot be ascertained. These heifers will be continued on the present rations until calving, at which time a more complete report giving all the data will be issued. The balance of the Local Station fund carried forward from last year was $1,078.24, which, with additional credits of $135.25, made a total of $1,213.49. Of this sum $1,211.28 was expended as follows:

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<table>
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<tbody>
<tr>
<td>Equipment</td>
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<tr>
<td>Supplies (including feed)</td>
<td>296.93</td>
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<tr>
<td>Labor</td>
<td>246.60</td>
</tr>
</tbody>
</table>

$1,211.28

Respectfully submitted,

T. H. WRIGHT, Jr.,
Dairyman.
My Dear Sir:

In reply to your request, I submit herewith a brief report of the Experiment Station work conducted by the Entomology Department during the fiscal year ending July 1, 1921. The three projects which were investigated were financed through Adams funds. Projects 2 and 3 were carried on under the leadership of H. C. Severin, while Project 4 was conducted under the supervision of George Gilbertson.

**Adams Project 2**

Title: The Webspinning Sawfly of Plum and Sand Cherry (Neurotoma inconspicua (Norton) MacGillivray), its distribution, food plants, economic importance, life history, habits, natural enemies and control.

This project was completed during the fiscal year ending June 30, 1919, but the data and conclusions were not published until September, 1920. Following is a summary of this bulletin:

The plum webspinning sawfly is distributed generally over South Dakota, but it is the eastern half of the state that suffers most severely from the ravages of the larvae of this pest. The larvae are gregarious and live and feed in webs which they spin about the leaves and twigs of their food plants. The foliage of plum trees and sand cherry bushes constitutes the preferred food of the pest and such trees and bushes may be entirely defoliated during June and July.

The adults make their appearance during the latter part of May or early June. After mating, each female lays 46 eggs on an average and these, after a period of 5 to 7 days, give rise to larvae or "worms." The "worms" feed for 13 to 23 days and at the end of this period they fall to the ground, enter it to a depth of 1 to 10½ inches and hollow out cells, inside of which they pass the remainder of the summer, and all of the fall, winter and early spring. With the approach of warm weather in the spring, the "worms" change to pupae and these give rise to adults or sawflies in 7 to 10 days. Thus it is seen that there is but one generation of this pest per year.

While there are several very effective parasites and predaceous enemies of this insect, they do not keep down the numbers of the Neurotoma larvae to the point where their
presence upon plum trees or sand cherry bushes is negligible. Consequently, spraying or dusting must be resorted to. If spraying is practiced, 1 pound of lead arsenate in paste form or ½ pound in the powdered form should be used for each 50 gallons of water, but if dusting is adopted, then 1 pound of powdered lead arsenate should be diluted with 15 pounds of air-slacked lime or powdered sulphur before it is applied to the foliage. The spray or dust should be applied to the fruit trees or bushes while the webs of this pest are still small.

**Adams Project 3**

Title: Distribution, life history, economic importance, natural enemies and control of the common field cricket, *(Gryllus assimilis* Fab.)*.

Much of our time during the past year was spent in studying the life history of the field crickets of the genus, Gryllus. This study was rendered especially difficult because of the taxonomic uncertainty of this group of insects. While we are satisfied that all of our crickets of the genus, Gryllus, belong to the species *assimilis*, we still have the question confronting us: “Do they all belong to the same variety or race?” There are such marked variations in the sizes and colorations of our field crickets and also in the proportions of body parts that one is tempted to group these crickets into varieties, but when one has a large series of the insects before him, all intergrading forms are found and then it becomes an impossible task to so classify them.

Considerable variation also exists in the life histories of our field crickets. While some pass the winter in the egg stage, others do so as nymphs. We have been able to carry the insects that show these variations, through their entire life cycle and to accurately describe all the stages. This data will be published in detail as a station bulletin. We have planned to cross such field crickets as show the variations mentioned with the hope that this may help solve our taxonomic difficulties.

Considerable time was also devoted to the study of the behavior of the field crickets. This study was concerned chiefly with the tropisms, feeding habits, mating and egg laying activities.

Some time was also devoted to studying the natural enemies of the crickets. The following parasites were discovered obtaining their livelihood by feeding upon or within the eggs, nymphs or adult crickets:
Ceratoteleia marlatti Ashmead. Hymenopterous egg parasite.

Paradris n sp. Hymenopterous egg parasite.

Exoristoides johnsoni coq. Dipterous parasite of nymph and adults.

Euthrombidium sp? Mite parasitic upon adult crickets.

Gamasidae sp? Unidentified mite parasitic within or upon adult crickets.

Paragordius varius. Thread worm, parasitic within nymphs and adults.

The following predaceous animals were found feeding upon the nymphs or adults:

Chlorion cyanium Dahlborn—wasp enemy.

Spiders, several unidentified species.

Of the enemies enumerated, the egg parasites were the most important. In certain fields, these destroyed as high as 50 per cent of the eggs.

No new methods of control can be recommended outside of those discussed in my annual report of last year. We have planned to conduct further experiments with poisoned baits and to vary the ingredients of these. Further, the baits will be used in attempts to kill crickets of various ages.

Adams Project 4

Title: The Wheat Stem Maggot (Meromyza americana Fitch), its distribution, food plants, economic importance, life history, habits, natural enemies, and control.

During the last fiscal year the literature dealing with this pest was further searched.

The past year also increased our knowledge as to the distribution of the wheat stem maggot over the state of South Dakota. This was accomplished through the personal collecting of H. C. Severin and George Gilbertson, through nursery inspectors in our employ and through county agents and others who sent us material.

A number of food plants of this insect were added to our list during the year. These plants now include the following:

Wheat—

Marquis.

Preston.

Kubanka.

Acme.
Turkey.
Minbard.
Mintork.
Prelude.
Kola.
Pioneer.
Castilione.
Barley (two and six rowed).
Oats (sparingly, less than 1 per cent).
Rye (both spring and winter).
Emmer.
Timothy.
Quack grass—Agropyrum repens L.
Slender wheat grass—Agropyrum tenerum Vasey.
Western wheat grass—Agropyrum smithii Rydb.
Wild barley—Hordeum jubatam L.
Brome grass—Bromus secalinus L.
Wild rye grass—Elymus sp.
Green foxtail grass—Setaria vindis L.
Yellow foxtail grass—Setaria glauca L.

Further work was done relative to ascertaining the percentage of injury done to various crops by the wheat stem maggot. During the last year the following average injury was done: To wheat, 1 to 15 per cent; to barley, 2 to 4 per cent or more; to oats, less than 1 per cent; to spring rye, 10 to 15 per cent.

The following points in the life history of the fly have been further studied and elaborated upon:

A. Adults: Description, emergence, longevity of life, mating, preoviposition and egg-laying activities.

B. Egg: Description, numbers laid, incubation period, hatching.

C. Larvae: Description, feeding activities, length of life, access to stem.

D. Pupa: Description, position within host plant, length of life, issuance of adults.

Work has also been done during the year to ascertain the number of broods that are produced during the year, the time when these occur and the food plants that are infested by these broods. Curves have been plotted showing the decline and increase of flies with reference to the broods. Field and laboratory experiments in conjunction with this, have augmented our knowledge of the brood cycle considerably.

Tropic responses to the flies have been investigated during the year.
The following parasites have been reared from *Meromyza americana* larvae:

- **Microbracon meromyza** Gah.
- **Coelinidea meromyza** Forbes.

During the past year we have observed a mite (*Pediculoides ventricosus*) feeding upon a larva and a *Trombidium* sp. feeding upon a fly. The importance of each of these enemies is still to be determined.

Further experiments were conducted during the year with control measures. The use of oils as attractive agents for the flies were all negative. We have not yet given up hope, however, of obtaining a poisoned bait that will be a successful and practical control measure.

Cultural methods of control are still under observation. Such farm practises as hand picking of infested plants, rotation of crops, destruction of volunteer plants, weeds and grasses are to be worked up more thoroughly.

Very truly yours,

H. C. SEVERIN,
Entomologist.
My Dear Sir:

South Dakota is a state of such immense area that the climatic conditions vary widely; hence the list of fruits and ornamentals suitable for the northeastern and northwestern districts will necessarily be different in many respects from the list suitable to the southeastern and southwestern districts. This fact is recognized in the recommended plant list of the South Dakota State Horticultural Society.

This history of horticulture in our northwest prairie states shows that we must allow for the occasional crucial test winters when the severe cold comes without snow on the ground, following a dry fall. In order to have a permanent horticulture in the Northwest, including South Dakota, it is necessary to originate varieties adapted to open prairie conditions. My standard of hardiness is 40 degrees below zero with the ground bare of snow and without protection of any kind. The busy prairie farmer will not take time to protect plants. The protection of plants over winter is horticulture on crutches, and we should do as little of it as possible. The originating of new and hardy varieties of fruits and ornamentals has been the main work of this department since I took charge in the fall of 1895. This creative work in horticulture has necessitated the growing of many hundreds of thousands of seedlings, and the grubbing up and burning of the discarded seedlings. The best have been saved for further work.

In addition, much new material has been brought home as a result of my five trips to Russia, and the best of this material has been propagated for distribution. As much native material as possible has been selected and used in the work. The work then may be classified as follows:

1. Importation of plants.
2. Hybridization of cultivated plants.
3. Selection of native wild plants.
ADAMS FUND PROJECT—Fruit Breeding

Trees of the following varieties were sent out in the spring of 1921:

The Hansen Hybrid Plums

Originated in this department, they are now represented by far more than a million trees in western orchards and nurseries. They are rapidly finding favor in many other states. My sand cherry hybrids, such as Opata, Sapa, Sansoto, Cheresoto, and Wachampa, should be kept in bush form with many stems close to the ground. As they bear heavily on 1-year-old wood, try to have an abundance of this wood coming on by pruning back the shoots that has borne several years. The sand cherry hybrids should not be trimmed up with a high stem as some practice with ordinary plums.

Waneta

This is the largest of all the Hansen hybrid plums. It is a 2-inch, 2-ounce plum, and of a very strong growth in nursery. An early, heavy and persistent annual bearer of delicious plums of immense size. It is a cross of the America, a large Japanese plum, with pollen of the Terry, the largest native plum. The Waneta combines in large measure the most desirable points of the native and the Japanese plums. In a visit to the 1920 Iowa State Fair at Des Moines, I noticed that Waneta and the sister variety, Kahinta, were by far the largest plums on exhibition.

Of my other new plums, a few trees, 1 year old on native plum roots, of Opata, Sapa, Hanska, Kaw and Kiowa were distributed.

Plums on Sand Cherry Roots

Plums budded on the native sand cherry roots bear very early, dwarf the tree but not the fruit, and hence are best to grow in tubs for crossing work, or for amateur dwarf orchards.

One year old buds on sand cherry stocks, of Waneta, Opata, Sapa, Hanska, Wachampa, Kaw, Winnipeg, Assiniboin and Yuteca were distributed.
Can Plums Be Bred True to Seed?
The following is from our 1916 spring list:

Plums True to Seed Series

“The first step in my project of breeding plums true to seed to avoid the necessity of budding and grafting. T. T. Seed No. 1 is a seedling of Opata. T. T. Seed No. 2 is a seedling of Ezaptan which is of the same pedigree as Sapa. I am not sure this plan will be desirable, as the trees would need to be isolated when in bloom, either by tenting the trees or by planting them far from other trees. Some of them will no doubt revert, others will come true. To complete this work, seedlings should be raised and only those saved that come true.”

We have not sent out trees of this series since, but last spring distributed more trees of True to Seed No. 2. I have watched this seedling closely the past five years. It is practically a Sapa in fruit, but the plant is a low bush, having much the same habit as its granddam, the native sand cherry. Bears freely on one year shoots in nursery, from the ground up, and annually thereafter. But probably the plant should be propagated by layers to save the expense of budding. What has been done in this seedling is really to reduce the choice black-purple flesh plum-sand cherry hybrid to the stature of a small fruit. They can be planted close together like currant bushes. What more can be done, the future must disclose.

Wild Gooseberries

Offered for the first time. The native gooseberry of this region (Ribes gracile) has been carried through seven plant generations. The eighth generation is now coming on. Many thousands of seedlings have been discarded. Some interesting hybrids with the immense gooseberries of western Europe have been obtained, but these are not yet ready for distribution.

The pure native seedlings are very vigorous and productive; thorny; fruit large, up to or even exceeding one-half inch in diameter; black; smooth; makes an excellent red sauce.

Crabs, Plums, Sand Cherries, Hazelnuts

Plants were distributed of the following varieties described in former reports: Ivan, Olga, Dolgo, Cathay and Red Tip crabs; Winnipeg and Assiniboine plums; our select South Dakota sand cherry seedlings; Manitoba hazelnuts.
Apples on Crab Roots

Root-killing of the common apple stocks is now one great source of failure in apple culture in the prairie northwest. It is time that definite experiments were conducted over a wide area with standard varieties of apples grown on Siberian crab roots. Such trees will be free from root-killing, will attain less size and bear earlier. This season we had no standard apples to distribute; but have some choice crab apples. The trees of Ivan, Olga, Dolgo, and Cathay crabs were on Red Siberian crab stocks, and Red Tip was on mixed Pyrus baccata stocks.

In Bulletin No. 65 of this station I urged the trial of Siberian roots to prevent root-killing which is often disastrous at the north. The experiments are still in progress. The seedlings sent out in the spring of 1921 were from Yellow Siberian, Red Siberian and mixed Pyrus baccata.

Breeding Pears Immune to Blight—The Greatest Enemy to the Pear

The experiment in breeding pears immune or resistant to blight is described in Bulletin No. 159 of this station. Most of these new hybrid Siberian pears have not fruited, but the fruit cannot be expected to be smaller than that of Pyrus ovoidea itself, which, although only one and five-eighths inches in diameter, is sweet, juicy, and of fair quality.

In the spring of 1919 I visited some of the best collections of cultivated pears in Arkansas, Missouri, Iowa and Illinois, to obtain pollen for use in this great enterprise of originating hardy, blight-proof pears of large size and good quality by mating the choicest pears of Europe, the largest pears in the world, with the small-fruited but hardy and blight-proof pears of Siberia.

For spring planting I imported 15 pounds of seed from Pyrus Ussuriensis. During this season I learn that this seed came not from Korea, but from southern Manchuria. The germination was good and the seedlings have made a very vigorous growth.

Progress with Grapes

My choice hybrid seedling of the wild grape of Bismarck, North Dakota, bore again and a lot more seedlings of similar parentage fruited this year for the first time. Many more wild grape seedlings are coming on. The plan of this work is to originate varieties of grapes that will be hardy without winter protection.
Progress with American Wild Crabs

Last fall encouraging progress was evident in my project of taming the American wild crab apple. Many of the hybrids with cultivated apples fruited for the first time and the best were placed in propagation for distribution.

HATCH FUND PROJECTS

The testing of varieties of trees, shrubs and perennials is giving us year by year valuable data on relative hardiness. The rose-breeding project is receiving special attention as there is great need for everblooming roses that will be hardy without winter protection. Several thousand flowers of various native roses were pollinated the past season and much seed ripened.

Of plants described in previous reports, the following were distributed last spring: Siberian almond; Siberian Buckthorn; Tetonkaha rose; Siberian form of Rosa rugosa; also seed of Lavatera Thuringiaca. Cuttings of new varieties were distributed.

A New Siberian Basket Willow

Offered for the first time. In the fall of 1913 in the dry steppe region of Semipalatinsk, Siberia, I walked along a small creek which had almost dried up. Stumbling, I seized hold of a willow and found that the branches simply would not break. So I brought home a few cuttings. You may tie bow knots in these pliable shoots, but it appears practically impossible to break them. They ought to be good as a tie willow for nursery work or for basketry.

Russian Silver-leaved Willow

Offered for the first time. Some years ago I brought from Russia a silver-leaved willow under the name Salix regalis. The botanical status of this tree, according to Bailey, appears to be Salix alba, var. splendens, or Salix alba, var. Argentea, hence a form of the white willow. These trees have made a strong growth, are perfectly hardy, and are noteworthy for the silvery foliage. A rich silver satin on both sides.

Work with Vegetables

The shortage of land and lack of funds have prevented much work I had planned with vegetables in recent years. Some of the giant winter muskmelons I brought from Turkestan in my 1897-9 and 1908-9 tours now appear to be in
cultivation on the Pacific coast region under new names. There is much valuable material in this type of melons for further development. Last spring I distributed more seed of the Hansen Siberian Muskemelon No. 3 and Hansen Siberian Watermelon No. 3, found in cultivation in the Semipalatinsk region of Siberia in 1913. The Hansen Turkestan radish which I brought from Semipalatinsk, Siberia, in 1913, attains very large size and finds favor with many as an all season radish. More work along these lines awaits the allotment of more land and more money for labor.

Agricultural Exploration

Many varieties of forage plants and cereals were brought back from my five tours to Russia. Four of these tours included Siberia. In order to insure a more rapid introduction I have propagated some of these for several years and sent them out for trial in many states. Last spring the following varieties were distributed in a small way, the main introduction having taken place in former years: Cossack alfalfa, Semipalatinsk alfalfa, Hansen’s Hybrid alfalfa No. 1, Hansen’s White Flowered alfalfa, Siberian Esparsette.

Hansen White Siberian Proso

More seed was sent out of this variety, which I am endeavoring to develop by selection as a table cereal, as well as a grain for stock. The past season, 1920, this variety surely surprised us. Circumstances prevented the seeding until July 23, in a dry spell; no rain until about August first, and still it got ripe and made a good crop, although shortened in straw. I found this large white-seeded grain millet among the Kirghiz Tartars near Semipalatinsk, Siberia, in 1913, who grew it extensively as a grain for themselves and their stock. It is the cornerstone of their agriculture in this 8-inch climate, a sure crop in the driest years. For table recipes, see Bulletin No. 158 of this station.

Hansen Siberian White Sweet Clover

More seed was distributed of Melilotus alba raised from seed which I found growing wild on the dry steppes of Semipalatinsk, Siberia, in 1913. Melilotus alba is the common white sweet clover which is native in Europe, North Africa and middle Asia. In Europe it is found as far north as latitude 15 degrees, 16 seconds, in Norway. As found under cultivation, the exact origin of common sweet clover is not
known. It will be of interest to ascertain the comparative value of this strain of the plant from an 8-inch rainfall climate.

At the University of Saskatchewan, Saskatoon, Saskatchewan, Canada, this Siberian sweet clover has been found to be of great promise as the hardiest, earliest and best of all the strains of white sweet clover. It may have a great bearing on the problem of adding humus to summer fallowed land. The name Arctic sweet clover has been suggested for this strain, but the name Hansen Siberian White sweet clover should be retained as it has priority and the plant is not really arctic in its range.

Field Collecting

During the summer and fall of 1918 and 1919 I made six tours to the prairie provinces of Canada, especially Manitoba and Saskatchewan, to collect native plants for use in the experimental work as described in former reports.

In 1920 this work was continued in a seven weeks' tour to Canada, including Manitoba, Saskatchewan, Alberta, and British Columbia. The main selecting was done at Prince Albert, Saskatchewan; Athabaska Landing, Jasper, and Medicine Hat, Alberta; Prince Rupert and Sicamous, British Columbia; Dropmore, Manitoba.

A great deal of study of plants in the field was undertaken, as I believe much can be done by getting the right start. I acknowledge the courtesies extended by the Manitoba Horticultural Society and the Manitoba Agricultural College at Winnipeg, and the University of Saskatchewan at Saskatoon.

It is not possible to get all the material desired in any one tour, as the seeds are not ripe at the same time, and the fruit should be collected while it is at its best.

Hybridization

The unfavorable spring compelled the postponement of much work that had been planned; however, I collected apple pollen at Yankton, South Dakota, and Hamburg, in southwestern Iowa. In the outdoor work this year special emphasis was placed on the rose and the wild crab apple.

Plant Importations

Three importations from Europe were made last fall with the aid of the Division of Seed and Plant Introduction of the United States Department of Agriculture. They arrived in
good condition. These have done well the past season, and represent some of the latest work by European plant breeders. The Division of Seed and Plant Industry also furnished some very interesting material from their own importations. My aim in all this is to get material from anywhere in the world that will help in the development of plants adapted to South Dakota. No one country has all the plants necessary for our needs.

**State Fair Exhibit**

In order to get something new for our exhibit at the state fair we enlarged our work with the dahlia and gladiolus. Many varieties of dahlias and 150 varieties of gladioli were shown at the college flower show, and later at the state fair at Huron, where over 2,000 spikes were on display.

**More Land Needed**

The following is from my spring plant list:

"A few years ago the South Dakota legislature furnished for my experiments the largest fruit-breeding greenhouse in the world. This made possible the Hansen Hybrid plums, and a long list of other fruits. But now I need more land to keep up the good work.

"I need a section of high western upland, say near Pierre, where the legislature can inspect the work at intervals. Here we could raise fruit seedlings of all kinds.

"In addition to the section of upland, we need a quarter of select, extra good nursery land further south, say at Yankton; and a quarter of land as far north as possible, say at Mobridge.

"This would afford you an opportunity to continue on an adequate scale the work you are doing with the Siberian fat-rumped sheep, which I brought home from Siberia in 1913, and which will be worth many millions of dollars to South Dakota.

"It would also give me the needed opportunity to finish up some special selection work with the Siberian alfalfas. With the backing of the state and under my supervision, a section of two of South Dakota public land now could be utilized with great profit to the agriculture of South Dakota.

"But this is only an iridescent dream because, while South Dakota is at the head of all the states in the Union in per capita production of wealth, South Dakota stands at the very foot of the list of all the states in the Union in her appropriations for experimental agriculture."
“But next time I believe conditions will be more favorable. Let us help to make farming more certain on all the uplands of the West.

“In 1919, as the first president of the Association of Official Horticulturists of the Great Plains Region, I recommended the adoption of the policy of each state and province growing over a million fruit seedlings. I have about 200,000 ready for spring—‘all dressed up and nowhere to go’—no suitable land to plant them in, so they must be jammed into nursery rows like sardines in a can. Will you help to get more land for this needed experimental work?”

I am pleased to note that temporary relief was granted by the Regents of Education in allotting five acres of land on the college farm for 1921, and ten acres more beginning next year. This helps greatly in taking care of the young seedlings.

Some Deductions from the Fruit Breeding Projects on the Adams Fund

My experience with hundreds of thousands of fruit seedlings leads me to make some positive deductions as a guide for further experimental work. Some of these are:

1. Winter hardiness cannot be obtained from tender species by selection alone, because selection is only a sieve; hence selection work is mostly sieve-shaking, nothing new coming into the sieve. For practical purposes the possibility of hardy mutations appearing is so remote that it may be disregarded.

2. Hardiness against winter cold may be obtained by hybridization with varieties already made hardy by natural selection extending through many thousands of years. Nature can do work that man cannot.

3. A totally new rearrangement of unit characters forming valuable new fruits combining winter hardiness, large size, and choice quality of fruit, is quite possible.

4. Our cultivated fruits are largely complex or derivative hybrids combining several species. There are some indications that it will be best to make a lot of crosses of pure species; but whether they will be better than the complex or derivative hybrids is not yet clear.

To make sure, I am endeavoring to work along both lines in order to get further evidence.

Yours truly,

NIELS E. HANSEN,
Horticulturist.