SOUTH DAKOTA
AGRICULTURAL
EXPERIMENT
STATION

ANNUAL REPORT
OF THE DIRECTOR
For the Fiscal Year Ending
June 30, 1925

SOUTH DAKOTA STATE COLLEGE OF
AGRICULTURE AND MECHANIC ARTS
Brookings, South Dakota
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ANNUAL REPORT

Mr. C. Larsen,
Dean of Agriculture,
South Dakota State College.

Dear Sir:

I have the honor to make the following report of the South Dakota Agricultural Experiment Station for the fiscal year ending June 30, 1925.

After the passage of the Hatch Act in 1887, providing funds for the establishment of an experiment station in each state and territory in the United States, the State Legislature of South Dakota enacted a law making the experiment station a part of the Agricultural College at Brookings. The function of the station is to conduct experiments and make investigations along agricultural lines, the results of which would be of value to the producers of the state.

Organization

This station has eight sub-departments as follows: Agronomy, Animal Husbandry, Chemistry, Dairy Husbandry, Entomology, Horticulture, Poultry, and Veterinary. At the head of each is the professor of the subject in the College. Department heads, assistants and employees are paid in proportion to the time required for teaching and for research. During the year, there were 27 persons who received part of their salaries from experiment station funds, totaling $20,713.23 of the $30,000.00 received from the federal government. In addition to this, hour labor is employed temporarily in nearly all of the departments.

In the spring of 1925, another act of Congress, known as the Purnell Act, was passed to authorize additional agricultural experimental work and to broaden the scope of the work to include investigations in farm economics, marketing, rural sociology and home economics. Added funds from the federal government were made available for this work beginning July 1, 1925.

State Appropriations

The Legislature of 1922-23 made an appropriation of $10,000.00 annually for experiments in horticulture, $10,000.0 for experiments in animal husbandry, $1,500.0 for printing popular bulletins and $2,230.00 for the support of each of the sub-stations located at Highmore, Cottonwood, Eureka and Vivian. In addition, there are local funds at each station created from the sales of products such as livestock, grains, etc. These funds are available for experiments.
There were five bulletins printed during the year as follows:

**No. 211—Weeds and Their Control.** This bulletin was prepared by E. J. Petry, consulting botanist of the station. It includes descriptions, and in many cases illustrations, of the troublesome weeds found in the state. With this bulletin as a reference, one is able to identify nearly all weeds in the state, not only by the common name but scientific name as well. The object of printing this treatise was to furnish a substitute for the extremely popular weed bulletin, No. 150, the edition of which was exhausted soon after publication. Students in the grades and in the high schools of the state made extensive use of this information. Although the distribution of bulletins is confined to residents of South Dakota, this bulletin was used as a text in school in the adjoining states.

**No. 212—Effects of Feeding Extremely Wide Rations to Horses.** This investigation was inaugurated by the late James H. Shepard, chemist of this station. It was conducted in cooperation with the Veterinary Department of this institution. The results were tabulated and prepared for the printer by his successor, B. A. Dunbar. It is summarized as follows:

1. From a survey of the tables having to deal with physical measurements during the several years covered by the experiment, it is noted that at a time which varies somewhat but which occurs usually from thirty to forty days after the opening of each year's feeding season, the animals seem to improve in physical particulars, including in some cases the blood count, during several days. The change that has occurred in their diet, even though such change is toward loss of balance in the ration, appears to result in temporary improvement. After this temporary up-trend in physique, the reaction is rapid and notable to the end of the feeding season.

2. Despite this fact, a steady loss in weight is found to obtain from the first to the last of the season.

3. As might be expected, the unbalanced character of the ration fed in this experiment produces, in a general way at least, and despite some marked exceptions as noted in the tables, a diminution in the number of leucocytes present in the blood. Apparently, as the physical condition of the animal becomes sub-normal, the leucocytes almost automatically increase as a safeguard against the conditions which are threatened by a lack of balanced nourishment.

4. A comparison of the digestion coefficients obtained during the first year of the experiment brings out a striking change during the period of feeding, not only in their general average but in the individual cases. There was a marked fall in these horses' ability to digest all types of food, with the single exception of that type of
nutrient which was to be relied upon most for energy upkeep—the fats. In the case of this one nutrient, the digestive capacity was, in two instances and on the average, more than doubled. This occurred in the face of a heavy decrease in the digestion coefficient of the ration, taken as a whole.

5. The tables covering the chemical examination of voided nutrients, as collected and analyzed in the composite, when compared with the observation made in Table IV show that while the ability of the animals to digest their food became consistently lower during a given experimental period, the feces indicate a fairly constant rate of elimination of the nutrients, with the single exception of the ether extract. Evidently a constantly increasing bulk of food was eaten in order to make possible the retention of sufficient nutrients to maintain normal body condition. This observation is amply substantiated by a glance at the amounts of feeding material eaten during the two digestion coefficient trials of 1912. Such increase in the bulk of food eaten must have carried with it a constantly increasing tax upon the digestive and secretory organs.

6. The data obtained from both physical and chemical work throughout the experiment show a steadily decreasing vitality, despite the long period of recuperation between feeding seasons. This establishes beyond question the fact that the feeding of an extremely wide ration, even for a few months of each year, works permanent damage to the general health and efficiency of the animal. In no one of these periods of feeding does the animal appear to enter upon the feeding period with the measure of well-being that was his at the opening of the work of the preceding season.

7. There is ample evidence to show that, in such circumstances as those produced in this experiment, the animal sacrifices his bone structure to the maintenance of life, tending to become spavined and markedly weakened in his skeletal condition.

The evidence seems to point out the evil effects to be expected from a custom—followed quite extensively in some localities even to this day—of allowing horses to have access to straw only during several months of the year, especially during those months wherein the animals are in comparative idleness. Particularly is this practice to be condemned when these are months of great demand for heat-producing feeding material.

No. 213—Growing Flax in South Dakota. This bulletin is by A. N. Hume, E. W. Hardies and Clifford Franzke, all members of the Department of Agronomy. This is a progress bulletin of growing flax in South Dakota. It considers the flax consumption, flax seed prices and the tariff, the world outlook, varieties, date, rate and manner of seeding, with tables showing the annual rainfall at the Brookings, Cottonwood, Eureka, Highmore and Vivian stations for several years. The bulletin contains the following digest:
1. Flax has been a profitable crop during the past three years. This has resulted in a great increase in flax acreage. Consumption of flax in the United States has also increased greatly. But if the present good prices are to continue, a balance between production and consumption of flax in this country must be maintained.

2. Secure flax seed of a disease resistant strain. There are several strains of flax in this and other states that have proven their ability to resist disease and to yield well.

3. Avoid sowing any great area of flax on poorly adapted land. This might at once overdo the market and result in loss to the producer.

4. Seed flax seasonably early, not delaying until summer seeding as has occasionally been practiced. Seed as nearly as possible to April 15.

5. Seed not less than 20 quarts of seed per acre. Experiments to date seem to indicate that this quantity results in the best yield and that lesser amounts are insufficient to give maximum returns from the land.

6. Growers have occasionally favored the practice of seeding flax and wheat in mixture. Experiments at Brookings, under the conditions of eastern South Dakota point to some possible advantages, without assuming that this should become the universal practice.

No. 214—Correlations Between Length of Spike and Culm in Wheat and Certain Characters of Progeny, Including Yield. This bulletin was also by the Department of Agronomy. The following is a digest:

1. No correlation exists between the length of head and the yield in the succeeding generations. The selection of long heads in a field is not a means of increasing the yield of a variety.

2. The length of the culm is correlated with the length of head that it bears but there is no correlation between length of heads and the length of culms produced by these heads in the succeeding generations.

3. Long heads are as a rule borne on long culms but seed from long heads may or may not give rise to plants with long culms.

4. The highest average yield of Marquis wheat, in grams per row, for four years was secured from strains that come from mother heads of 11.5 centimeters length.

5. Inasmuch as no general correlation was found between length of mother heads and yield of progeny, it seems possible that the mother heads indicated represented a separate strain, thus incidentally separated. Some further investigation of this question is being made.

No. 215—Soybeans for Dairy Cows. In this bulletin, written by T. M. Olson of the Department of Dairying, the following conclusions were drawn as a result of an experiment:
1. Ground soy beans when fed with the basal ration were 17.7 per cent more efficient than old process linseed oilmeal for fat production and 19.9 per cent more efficient for milk production.

2. Ground soybeans apparently were as palatable and gave as good physiological results as old process linseed oilmeal.

3. The ground soybean rations were readily eaten even when 100 per cent of the grain ration was composed of soybeans.

4. Ground soybeans, in the first trial, when fed with the same basal ration as oilmeal, had a higher coefficient of digestibility for all nutrients.

5. The data of this experiment indicate that soybean hay is 6 per cent more efficient for milk production and 7.8 per cent more efficient for fat production than good quality alfalfa hay.

6. When oilmeal is selling for $60.00 per ton, ground soybeans are worth $72.00 per ton for dairy cows.

7. Ground soybeans do not noticeably affect the consistency of the butter until the grain ration contains 50 per cent or more of ground soybeans.

8. Ground soybeans seem to influence the per cent of fat in milk with some cows at least temporarily but not its flavor or odor.

9. Soybean hay is not as cheap a legume roughage in South Dakota as alfalfa hay for dairy cows because of the comparatively lower yield, and expense in handling the soybean hay.

10. Soybean hay can be recommended as an emergency legume crop for dairy cows, and as a regular crop in sections where it is difficult to get a stand of clovers.

11. Greater efficiency in milk and fat production can be effected by using home grown feeds, particularly those feeds which are high in protein. Therefore, where soybeans can be grown, their cultivation should be encouraged.
DEPARTMENT OF ANIMAL HUSBANDRY

The following experiments were conducted during the year:

Baby Beef Production

The objects of this experiment were:

a. To determine the feeding value of corn silage, yellow sweet clover hay, soybean hay, one-half ration soybean hay and one-half corn silage, alfalfa hay, and red clover hay with same grain ration.

b. To determine the value of oilmeal, cottonseed meal, gluten meal, ground soybeans and ground flax with same roughage and grain ration for the production of baby beef.

Thirty-six head of Hereford calves were purchased in the Black Hills section, divided into six different lots of six head each and fed for 144 days. These results will be included in a bulletin on this subject soon.

Value of Soft Corn for Beef Production

To furnish information on the value of the so-called "soft corn" for fattening cattle was the object of this experiment. Twenty head of two-year-old grade Hereford steers were purchased in the vicinity of Miller, South Dakota, and divided into four lots of five head each for the experiment. To Lot I was fed closely snapped corn. To Lot II was fed same variety, but husked. To Lot III was fed the soft selection of another variety of corn, and to Lot IV the hard selection or the matured ears. In addition, all lots received alfalfa hay. Pigs were put in each lot to pick up the waste. The corn for different lots was analyzed by the chemist and all results of the one year's findings will be published soon.

Grazing Experiment with Cattle, Sheep and Swine

The object of this experiment was to ascertain the comparative pasture value of white sweet clover, yellow sweet clover, alfalfa, blue grass, and Sudan grass for cattle, sheep, and swine, both at the Cottonwood and at the Brookings stations. The experiment is being conducted with the following objects in view:

a. How many head will an acre supply feed for?

b. What is the comparative value?

c. What is the danger from bloat in the different kinds of livestock while feeding on these different pastures?

Good progress was made at both of these places and some interesting data were secured.
Sheep Breeding

To develop a sheep with a valuable pelt for fur purposes by the use of the Karakul and fat-rumped breeds. The question is, is it profitable to market lambs at an early age before the curl and lustre have left the fleece? If so, what per cent of Karakul blood is necessary and also what kind of ewes are the best? Some progress was made in this line.

Sheep Breeding to Eliminate the Tail

The fat-rumped breed of sheep presented to the Department of Animal Husbandry by Dr. N. E. Hansen has been used to ascertain whether the tailless feature can be fixed in a strain without the fat rump or the hair in the fleece, both being objectionable in the market. As a result of using a five months old ram lamb on ewes that had a per cent of fat-rump blood, eighteen out of twenty-one lambs were short tailed. The majority of these lambs have good fleeces and only a few have any evidence of a fat rump.

The above lambs were sired by the yearling ram standing in the door. None of the tails were cut off.

Alkali Disease Project

This investigation was conducted in cooperation with the departments of Botany, Agronomy and Veterinary of this institution. Cattle, hogs and rats were furnished by this department. Several tests were made but to date we are not in a position to make a report.

A Cross-breeding Experiment

This project is being carried on in cooperation with the Dairy Husbandry Department. The object is to ascertain whether, by cross-
ing two breeds of dairy cattle, the Holstein-Friesians and the Jerseys, the per cent of fat and quantity of milk are inherited separately; to what extent each of these is influenced by cross-breeding, line breeding and inbreeding; to ascertain inheritance of conformation, size, quality and color; also whether hardiness and fertility are affected.

**Summer Feeding of Market Pigs**

A study of the value of corn, barley and oats supplemented with tankage for developing feeder pigs on alfalfa pasture was continued. The results of the first two years work indicate that, when limited grain rations were fed to young pigs in connection with alfalfa pasture, 115 and 118 pounds of barley and 143 and 146 pounds of whole oats produced the same gains as 100 pounds of yellow corn.

During the past year, each of the seven lots, consisting of 10 pigs each, was finished on a ration of yellow corn and tankage in a dry lot after the close of the grazing season. The results obtained indicate that the ration fed during the summer months greatly influences subsequent gains. The experiment also includes a comparison of the value of limited vs. full feeding of a corn and tankage ration on alfalfa pasture and under dry lot conditions. In addition to yielding about one and one-half tons of hay during the season, one acre of alfalfa pasture saved over 25 bushels of corn and 579 pounds of tankage. The value of alfalfa hay is also shown by the faster gain, greater uniformity, and superior finish of the pigs on pasture as compared with those fed the same ration in dry lot. The results of the first two years indicate that a limited corn and tankage ration fed in dry lot does not produce satisfactory returns, for gains are slow, a large percentage of the pigs become runty, and losses are greater than in the pasture lots, even though pigs are kept free from worms.

**Tankage Requirements of Pigs Fed Barley on Pasture**

Work on the experiment has been in progress for several years. Results obtained thus far show that mixtures of ground barley and tankage produce very satisfactory gains. The problem in this project is to determine the lowest percentage of tankage which, when fed with barley, will produce rapid gains and desirable finish with a low feed cost. The average of results of four lots, two on alfalfa pasture and two on rape, during the summer of 1924 show that 100 pounds of gain were secured for each 378 pounds of ground barley and 11 pounds of tankage fed to pigs with an initial weight of 42 pounds and carried to an average final weight of 200 pounds.

When allowance is made for the saving of tankage in this ration as compared to the amount needed in a corn and tankage ration, it is evident that barley, when fed under the conditions of this experiment, is a very good substitute for corn. Since barley can be grown successfully in many parts of the state, farmers should plan to use it more extensively in pork production.
Winter Rations for Pigs

Work was continued on the study of efficient rations for fall pigs. The results of some phases of the work have been published and are now available in Bulletin 216, "Improving Winter Rations for Pigs."

For a more detailed report, I include and make a part of this report the report of each division of the Experiment Station.

Yours truly,

JAMES W. WILSON,
Director of Experiment Station and Professor of Animal Husbandry.
DEPARTMENT OF AGRONOMY

Director J. W. Wilson,
Experiment Station.

Dear Sir:

I beg to submit the following outline as a report of the experiment station projects for the fiscal year 1924-25.

ADAMS PROJECT NO. 1

This project is entitled "A Project on the Influence of Crop Rotations upon the Maintenance of Soil Fertility." The manner of conducting this project includes the operation of more than two acres of land laid out into continuous rotation of crops from which the yields are taken and recorded. Samples of soil from these several plots are taken by prescribed method at intervals of seven years; these samples to be analyzed by laboratory methods to discover what fundamental soil changes may have occurred due to different rotations over considerable periods of time. This project is in charge of J. G. Hutton and Alfred Bushey.

ADAMS PROJECT NO. 2

"A Study of Correlations Between Certain Physical Characters of Plants and Their Capacity for Yield." This project included the selection and propagation of headrows of Marquis wheat, which were the progeny of original mother plants bearing either (1) long, or (2) short central spikes. The headrows for comparison were planted alternately with long and short heads in the first year and similarly planted from progeny of these original mother heads in the second and third years of the experiment. Thus the project covered a total of four growing seasons. The project has been closed and the results reported. They are available in Bulletin No. 214. The final results indicated that correlation between length of head of mother plant in Marquis wheat and yield of progeny either in the first year after selection or in later generations was not mathematically measurable, although the coefficient of correlation between length of spike on mother plants and yield in the first year immediately after selection was slightly greater than the probable error. Certain correlations other than length of spike and yield were computed and all results are put down in the bulletin indicated. The nursery work for the foregoing project was carried out by Fowlds, and computations and preparation of the bulletin completed by Hume, Hardies, and Franzke.
ADAMS PROJECT NO. 4

"A Project to Determine Definitely the Effects 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—the Availability of Phosphorus in Different Forms." Investigations during the past two years have been pursued according to the plan outlined in the project. One new series of pot cultures, designated as series 3, was added during the year. These pots contain sand like series 2, and receive nutrient solution. The growth of crops on this series was more consistent than on series 2.

ADAMS PROJECT NO. 5

"A Project to Discover the Occurrence of Corn Ear Rots in Given Areas and to Determine the Effect Which Ear Rots May Have upon the Constituents of Affected Ears, and upon the Progeny Therefrom." This project was started early in 1924; in fact preparation was made for starting it so that it would be as well under way as possible as soon as its approval was assured. Numerous ears of seed corn from various sources in South Dakota were selected on the basis of appearance of disease on the kernels and ears. A study of these seed ears has been made from several standpoints with a view to characterizing the diseases affecting South Dakota corn, assuming that such diseases exist, and likewise to discover means for combating and avoiding them. As a result of the original inspection of these ears and of further records taken during individual ear germination tests, the presence of several apparently distinct diseases has been discovered. Several correlation tables have been computed. One reveals the positive correlation between percentage of germination and yield in nursery rows of several seed ears, a correlation of the per cent germinated on the germinator to the final stand in the field was found to be $R = +.4194 + .0488$. A correlation was also computed of the final stand of corn in the field with relation to yield per acre. This was found to be $R = +.1874 + .0571$. This latter correlation is obviously not high. The purpose in mentioning here is to indicate progress and not to discuss the significance of the result. Still lower numerical correlation was computed between the percentage of germination of ears on the germinator with yield per acre and also of correlation of the final stand of corn in the field to the yield of corn per plant. As a result of observations made on plants grown last season and this season, a number of most interesting characters of corn plants have made themselves evident. These have been carefully recorded. Plant characters appearing last season are being followed up this season in the progeny of last year's plants.

A number of plants last year were selfed; likewise a number of crosses were made and the progeny of these several fertilizations are
proving of great interest this season. Different phases of the project have been carried through by Hume, Franzke, and Bushey.

A special piece of work in line with this corn disease project was submitted in detail to be carried out by Percy Danielson, student assistant. The phase of the work undertaken by Mr. Danielson was entitled "Quantitative Determination of the Elements in the Nodes and Internodes of Normal and Abnormal Corn Plants." A detailed study of 25 separate corn plants was carried through. These plants were first selected and grouped on a basis of their characteristics, whether normal or specifically diseased. All nodes and internodes of these plants were analyzed separately for total ash, nitrogen, phosphorus, potassium, calcium, iron, aluminum, and silica. A summary constructed by Mr. Danielson on the basis of these analyses is as follows:

"Normal corn plants have different selective powers for the various ash constituents. No two plants seem to have any correlation in the distribution of elements absorbed.

"Abnormal corn plants which were selected for similar characters also show a marked difference in their selective powers.

"Abnormal corn plants contain a much higher average percentage of ash than do the normal plants.

"Abnormal corn plants contain a much higher average percentage of iron, aluminum and potassium than do the normals.

"Normal corn plants contain a higher average percentage of phosphorus, calcium and silica than do the normals.

"When grouping all abnormal plants, no large accumulations of iron or aluminum or other elements were found in any particular portion of the plants. However, when observing individual abnormal plants, large accumulations are found in certain nodes and internodes which do not seem to be correlated with any particular character found in the plant.

"Discolored nodes and internodes in plants apparently affected with rots do not seem to be correlated in any way with a higher percentage of iron or aluminum."

HATCH PROJECTS

Included under Hatch projects are experiments in cereal breeding. The following statement is made by Mr. Fowlds with regard to progress.

"Third generation selections of hulless oats from crosses with the Richland and White Russian varieties were grown. A number of these selections show a considerable degree of resistance to stem rust.

"The Kilby hulless oat and several of the hulless selections were inoculated with loose smut and planted in rod rows. The results indicate that all of these are susceptible to the loose smut, although one selection was infected to a lesser extent than the others."
Variety Testing

Varieties of flax as well as alfalfa, soybeans, and special forage crops are continuously under test for yield and quality. In the present season at Brookings, the testing of varieties of rye, wheat, barley, oats, and emmer was continued with the introduction also of a number of varieties and strains of commercial and scientific interest. Accordingly, the results of these tests will not only furnish a practical guide for telling the varieties that are likely to produce highest yields but will serve to complete a number of scientific tests, some of which are being carried on in cooperation with other institutions. One variety of oats was introduced from Denmark. Rust nursery of wheat has been continued in cooperation with the Office of Cereal Investigations with the object of discovering which varieties and strains may be most resistant to rust. One of the incidental bits of information in connection with varieties developed due to the low freezing temperature which occurred especially on the date May 25. After this freezing occurred, notes were taken which indicated a striking degree of difference in susceptibility of various varieties to freezing.

Corn Breeding

Yield.—Projects with corn breeding under the Hatch fund are continued. Two systems of ear-to-row selection combined with hybridization are continuously compared not only with each other but also with the use of mass-selected seed.

Chemical Composition.—Breeding corn for high protein and low protein is continued. In connection with this project there seems to be no longer any question about the fact that separate strains of corn can be developed from a common origin possessing widely different percentages of total protein (N x 6.25). Further studies are being conducted which throw further light upon the chemical constituents of these strains of corn. Contrary to previous indications, the comparative productiveness of the two strains according to their development seems to be affected by the kind of selection they are undergoing continuously. These indications serve as a basis for further investigations which are being undertaken as facilities will permit.

High and Low Ears.—The breeding of corn for (1) high, and (2) low ears is continued. There is no longer question but that wide differences in height of ear and height of plant can be secured merely by selecting seed annually from strains bearing ears in the relative heights indicated. Numerous correlative characters developed which merit further study. The low-eared strains mature relatively very early although the yield of grain is reduced almost to a minimum. The high-eared strain grows exceedingly tall and matures so late as to be frequently frosted. It appears that some prac-
tical use may be made of the low growing strain as a dent corn for hogging down purposes. One or two inquiries have been made for seed of this strain for drill. The low-eared strain is also interesting for the purpose of making various crosses with other strains and some crosses were tried during the previous season and are being continued the present year.

**Soft Corn.**—Since the last report, the printing of Bulletin No. 210, "Some Chemical Characteristics of Soft Corn," has been completed. Mention of this work was made last year, and these conclusions are now put down in the bulletin indicated along with the data supporting them. The investigation of the quality of corn from the standpoint of maturity is being continued to the extent of resources. It is believed that in addition to other contributions, it will be possible to arrive at a more accurate definition than is generally given for what is termed "soft corn."

**Rotation Experiments**

A number of crop rotations are continued on an experimental basis. It is implied that not only will data be secured in the form of crop yields but underlying causes of the differences in yield due to differences in rotation will be investigated. Among the obvious differences resulting from variations in rotation systems is the prevalence of weeds coming into different kinds of crops. Moreover, it becomes increasingly evident that these weeds consist of definite species which are largely determined by the special environment furnished to them due to the rotations into which they gain access. Investigations properly termed "scientific" may be conducted with a view to controlling these species of weeds. The crop rotations which have been conducted on experiment plots at Brookings for many years furnish a fine opportunity for conducting such projects in eradication and control of weed species. The Agronomy Department is giving increased attention to this phase of crop rotation studies.

Results expressed in terms of crop yield from livestock and grain systems of farming are interesting and important. Decidedly the lowest yields of corn, oats, and sweet clover are secured in a definite rotation system indicated where all crops including residues of straw and corn stalks are removed from the soil. In comparison, the highest yields of said crops in the entire series is secured from plots on which the crop residues indicated are returned as such and the element phosphorus also applied.

**Additional Projects**

In addition to the projects conducted with Adams and Hatch funds, the Agronomy Department pursues other investigational work specifically provided for by state appropriation. These investigations include experimental substations, Highmore, Eureka, Cottonwood, Vivian; South Dakota soil survey; potato experiments.
Soil and crop trial fields are carried on at the following separately equipped substations, each of which is conducted on the basis of specific legislation by the state; at Highmore in Hyde County; at Eureka in McPherson County, at Cottonwood in Jackson County, and Vivian in Lyman County. These field experiments are designed to furnish information regarding problems affected by soil and climatic conditions in these localities. At all places, definite areas of land are laid off either in acre units divided into tenths, or into larger fields accurately measured and marked. Not only rotation experiments but especially crop adaptations of varieties of rust resistant cereals; of hardy alfalfas and other forage crops; of special and less commonly grown forage crops such as Sudan and sunflowers are conducted.

Cereal Breeding

At Highmore as well as at Brookings, cereal breeding nurseries are conducted. These include numerous headrow selections from standard and newer varieties of wheat, oats, barley, rye, and emmer. Numerous hybrids within species and between species are also made and tested out. The practical object of this headrow cereal breeding is to secure, if possible, varieties and strains of the grains indicated that produced increased yields over the varieties now commonly grown. This practical end, however, involves numerous investigations leading to studies, not only of hybridization methods, but also studies of genetic applications involved. The recent session of the South Dakota legislature appropriated certain funds designated in part for investigation of rust resistant cereals. The application of these funds is being made to rust studies at these cereal nurseries at Brookings and Highmore with a view of actually securing rust resistant varieties for increase and with a further object of acquiring knowledge about the nature and causes of rust as related to these strains and how to combat it. It is possible to make somewhat more definite progress with cereal breeding at present due to the continued efforts of Mr. Fowlds at Brookings and Mr. Hardies and Mr. Franzke at Highmore.

State Soil Survey

The state of South Dakota, through its legislature, makes appropriations for a state soil survey which is conducted as a project of the Agronomy Department. The general plan is to conduct this survey in such a way as to secure information of practical value in outlining methods for better soil management than is now commonly practiced. The work may be divided into three general parts: (1) the surveying and mapping of areas proper, (2) sampling of soil types and analysis of samples, and (3) soil field experiments. The following seven counties have been surveyed and mapped: Beadle,
McCook, Douglas, Union, Walworth, Grant, and Brown (not quite complete). In addition, a detailed survey has been completed of six townships in Lyman, Jones, and Stanley counties. Surveying is now proceeding in Brown and Hyde counties. Soil survey is conducted cooperatively with the U. S. Bureau of Soils, with the general arrangement that an equal amount of necessary field assistants shall be furnished by the state and federal government. The cooperation has been thoroughly satisfactory and the survey work has proceeded efficiently. At the beginning of the survey, two soil trial fields of four acres were established; one eight miles northeast of Vermillion, and one four miles west of Groton on the bed of old Lake Dakota. Results from these farms indicate elements of soil fertility which may be limiting in the soil areas upon which the fields are located as well as supplying other information indicating the value not only of commercial plant food but also of applications of green manure and stall manure.

During the seasons of the year when field surveying is not practicable, Messrs. Machlis and Larson have been occupied all or part time with making analysis of the samples secured in the field with a result that numerous analyses have been made of plant food content in South Dakota soil types.

Potato Experiments

The Agronomy Department expends a small appropriation consisting of $1,000 per annum appropriated specifically for potato experiments. This has been mainly employed during the past three seasons for the purpose of making growers' strain tests. They involve a study not only of comparative yields from certain tubers furnished by different growers but also correlation coefficients have been computed between yields of the first year from given growers' strains and the same strains the second year. This correlation was so small as to be negligible. In addition to the work just mentioned, spring experiments have been conducted the present season comparing ordinary sprinkling with high pressure spraying done with a new high pressure spraying machine.

Very respectfully,

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

The following is submitted as a brief report of the work of this department of the Experiment Station, for the year ended June 30, 1925.

This department has continued its work of cooperation with the Animal Husbandry department in the compilation of the necessary analytical data having to do with its special problems in silage feeding and other nutritional work as mentioned and described elsewhere in this report.

We have also continued our cooperative work with the Dairy Husbandry department in the form of analysis of cereals, other feeding materials and excreta, used and obtained in connection with their projects dealing with the feeding of dairy animals.

A special project to ascertain the minima of plant food materials necessary to normal fruition in the case of certain field crops and to investigate the accuracy of present methods of ash analysis as used in the determination of such minima up to this time is still in its control period. Delays are due to lack of proper growing facilities in the building and to unusual climatic variations outside.

In the work mentioned, more than one hundred separate samples for analysis have been handled, involving approximately five hundred separate analyses.

Respectfully submitted,

B. A. DUNBAR, Chemist.
DEPARTMENT OF DAIRY HUSBANDRY

Director J. W. Wilson,
Experiment Station.

Dear Sir:

I beg leave to submit the following report of the experimental work of the Dairy Husbandry department for the fiscal year ending June 30, 1925.

Self Feeders for Calves

Five calves were used. Each calf had a separate pen and an individual feeder with six compartments. The feeds used were whole and ground oats, white and yellow corn, oilmeal and bran.

The feed was weighed in as needed and weighed out every 15 days. The calves were weighed and measured bi-weekly. This concludes the third trial. All the data have not been compiled but daily observations indicate:

1. That self feeders are not economical for dairy calves. The calves eat too much of the high protein grains and not enough roughage.

2. The calves were in too high condition of flesh necessary for good growth.

3. All the trials indicate the need of sunshine for calves. Mineral assimilation is interfered with when calves do not have access to direct sunshine.

4. Rachitic conditions developed in calves which were not allowed direct sunshine, even when inorganic minerals were furnished.

Bacterial Flora of Normal Cows' Udders

The trial was reported a year ago in uncompleted form. Studies were made on the udder flora of cows over a period of two years. The data indicate that individual animals vary widely in respect to numbers of organisms contained in milk. Different quarters of the same udder also show wide differences, and these differences appear to be permanent. However, the stage of lactation seems to exert no influence on the number contained in the milk of individual cows. Udders apparently normal, show counts varying from none in exceptional cases to as high as over 300,000 per cc.

Cell counts from each quarter of the udders of forty cows indicate some correlation to bacterial counts. The exact correlation remains to be determined. The correlation appears to be greater when the bacterial count is high. The germicidal activity of milk from different cows varies widely.
Investigation of the importance of udder types in milk fermentations shows relatively low both total and volatile acid production. Curdling may occur with very objectionable flavors and odors. The casein of milk is also changed.

**Influence of Starter on Quality of Fresh and Storage Butter**

The use of a starter, and its effect on fresh and storage butter, has received attention the past year. Authorities are not agreed on its use or its efficacy, particularly for storage butter.

Cream was obtained from several sources, comprising the grades ordinarily handled in the state. The cream was divided into three lots. One lot was churned without the use of starter. The second lot was ripened in starter. In the third lots, the butter was washed in starter. Twenty-pound tubs of each lot were put in storage and scored every 30 days.

The starter butter had a somewhat higher score when fresh, and also after six months' storage. The variation was slight, and inasmuch as the period of storage was rather short, it was felt that another trial should be conducted before publishing the results. The data indicated, however, that the use of good starter is a commendable practice and one which should be encouraged.

**Effect of Frozen Cream on Quality of Butter**

Inasmuch as considerable of the cream in South Dakota is shipped long distances, it is frequently received at the processing point in a frozen condition. It was deemed worth while to gather data on how frozen cream should be handled, and also what effect freezing had on the quality of the butter.

Frozen cream when thawed developed a flakiness resembling the appearance of sour cream. No difference in length of time of churning was observed. The butter showed, however, a short grain as soon as massed from the granular condition and when the working was completed. At each scoring, the same short grained body defect was noted. The short grain condition prevailed in storage butter also.

**Ground Soybeans vs. Old Process Linseed Oilmeal**

This concludes the second trial in which ground soybeans have been compared with oilmeal for milk and fat production. The data has been compiled and published in bulletin form.

The data of both trials indicated that ground soybeans were about 20 per cent more valuable for milk and fat production than old process linseed meal. So far as could be observed, the soybeans were as palatable and had as good physiological effects on the cows as old process oilmeal.

No deleterious effects on the butter were noted until at least 50 per cent or more of the grain ration was made up of soybeans. Even
then, no effects could be noted upon physical inspection. Chemical analysis indicated a somewhat softer butter following the feeding of soybeans when fed in large quantities.

The soybean hay is about equal in feeding value to alfalfa hay when cut and cured in good condition. However, it is recommended as an emergency legume crop and not to replace alfalfa as a dry roughage for dairy cows.

Effect of Silage on Vitamin C Potency of Milk

This concludes the third trial in which an effort has been made to ascertain whether silage fed cows have more of the vitamin C in their milk than cows receiving no green feed.

The trials indicate that there is a difference of vitamin C in milk, and this is in favor of milk from silage fed cows. The amount of this vitamin seems to be influenced by the quality of the silage. Corn which is ensiled before frosted and in green condition seems to contain more of the vitamin C than silage made from frozen corn, or corn too ripe and dry when ensiled.

Breeding Up Experiment

This work has been in progress since 1907. Cows of the fourth cross are now in the herd. The data of this experiment prove conclusively that good dairy herds can be built up by means of purebred sires, and that the purebred sire route is in most instances the one which should be adopted by most farmers who contemplate entering the dairy business. If good purebred sires are chosen, high producing cows will be assured, and with them economical production.

The farmer who enters upon the dairy business by this route learns what is necessary to success in dairying while the herd is in the process of building.

Respectfully submitted,

THOMAS M. OLSON,
Dairy Husbandman.
Dear Sir:

In reply to your request of recent date, I beg leave to submit the following report of the experiment station work conducted by the entomologists of the Zoology-Entomology department during the fiscal year ending June 30, 1925. Two Adams projects were conducted during the year, project three being carried on under the leadership of H. C. Severin, and project four under the direction of George Gilbertson.

Distribution, Life History, Economic Importance, Natural Enemies and Control of the Common Field Cricket (Gryllus assimilis Fab.)

Further information was obtained during the past year regarding the distribution of the common field cricket. It was found that the insect has a state-wide distribution and that no area in South Dakota is free from it. However, the pest is much more abundant in the alfalfa fields of the western half of South Dakota than it is in the eastern half.

The life history and habits of this species of cricket were studied at Newell and at Brookings. Through a comparative study made of these two phases of the project in these two widely separated areas, any difference in life history and habits would be readily noticed. Much information of value was obtained through this study.

The injury which the common field cricket is responsible for is ordinarily done to alfalfa, grain, corn, flax, truck crops, small fruits and binder twine. However, wherever the crickets become abundant, they may invade homes and cause much damage to wearing apparel. During the past year, additional studies were made of the injury done by crickets both in the field and in homes.

The natural enemies, including predaceous enemies and parasites, of the common field cricket were again studied during the past year, in order to discover, if possible, any enemy that had not been discovered in previous years. In this study, much valuable data was obtained relating to the role that each of these parasites or predaceous enemies play in holding the crickets in check.

During the past year it was learned through a series of experiments that the number of eggs laid by a cricket is dependent upon the number of times that the cricket mates with an active virile male.
An attempt to destroy the common field cricket in alfalfa fields was made through a series of experiments in which calcium cyanide in the granular form was used as the killing agent. The cyanide was applied to the fields at the rate of 15 pounds per acre. The experiments were conducted near Newell, South Dakota on fields where irrigation is practiced. Before the cyanide was applied, a cutting of hay was removed and the fields irrigated. The fields were then allowed to dry for 24 hours and then the cyanide was applied. Calm, warm days were chosen on which to apply the cyanide, and because the crickets begin to become active at four o'clock in the afternoon, the cyanide was put out from 4:00 to 8:00 p.m. No injury to the results of the experiments, but in no case were the results of our experiments satisfactory from the standpoint of killing crickets.

At the present writing, the most satisfactory measures of control found for the common field cricket are those discussed in the annual report of the Director of the South Dakota Agricultural Experiment Station for the fiscal year ending June 30, 1924.

The Wheat-stem Maggot (Meromyza americana Fitch)

This project was completed during the year and Bulletin 217, "The Wheat-stem Maggot," has been published. In this bulletin the wheat-stem maggot has been discussed from the following aspects: synonymy; common name; nature of injury; food plants; distribution; description of stages—the eggs, maggots, puparia and flies; life history and habits; the appearance, longevity, mating, preoviposition and oviposition of the flies, and the number of eggs laid; the duration of the egg stage and hatching of the eggs; the duration of the maggot period and feeding by maggots; the duration of the puparial stage; the seasonal cycle; the natural enemies of the wheat-stem maggot; and control.

Control of the wheat-stem maggot by means of poisoned baits is discussed but not recommended. The cultural measures which are recommended are a rotation of crops, the use of trap crops, a destruction of volunteer grains, a destruction of grasses that serve the fly as host plants and a late planting of fall grain.

Very truly yours,

H. C. SEVERIN, Entomologist.
DEPARTMENT OF HORTICULTURE

Director James W. Wilson,
South Dakota Experiment Station.

Dear Sir:

In reply to your inquiry, I have the honor to submit the following report for the fiscal year ending June 30, 1925.

Breeding of Hardy Fruits

The horticulture project on the Adams Fund is the breeding of hardy fruits. As far as possible, free use is made of entirely new material. The cumulative evidence so far, after thirty years’ work, is that no progress in obtaining hardy varieties is possible by selection from tender material, but winter hardiness and desirability may be combined in the same plant by hybridization.

In the fall of 1924 the following fruits were introduced: one apple, one cherry, one plum, and one chokecherry.

In the spring of 1925 the following fruits were introduced: thirty-two varieties of grapes, ten gooseberries, and four wild black currants.

Breeding of Hardy Roses

One project on the Hatch Fund is the breeding of hardy roses to obtain varieties hardy without winter protection. Many new hardy seedling roses have already appeared in the seedling plantations and are now in propagation for introduction. Ten thousand plants were planted in the State Rose Garden at Sioux Falls in the spring of 1924, and about eight thousand in the spring of 1925.

In addition to the need for hardy varieties comes the need of hardy rose stocks. The Federal Horticultural Board has indicated that America should grow all the rose stock necessary and that importations will soon be prohibited. To aid in the solution of this important problem, four bushels of wild rose hips were collected in this department last fall. The standard commercial stocks are of no value in South Dakota, so there is much work to be done in solving this problem to meet the requirements of the Federal Horticultural Board.

State Orchards

During the past two years, the annual appropriation of ten thousand dollars for experimental work in horticulture has been granted by the legislature. The same appropriation has been continued for the biennium beginning July 1, 1925.
State orchards have been established at the following places: Sioux Falls, Aberdeen, Watertown, Pierre, Philip, and Eureka. Experimental trees were also sent to Plankinton and Hot Springs.

The object of the work is:
1. To test all the standard varieties.
2. To demonstrate the best systems of orchard management.
3. To test out many thousands of new seedlings being originated at this station every year.
4. To establish stock orchards, especially for the Siberian wild blight-proof pears and wild apples, to grow hardy seedlings upon which to bud the new hybrids coming on. Many of these nursery stock seedlings can be sold to propagators, which would make the work partly self-sustaining.
5. To collect new plant material for fruit breeding.

DESCRIPTIONS OF NEW FRUITS

From the many thousands of seedling fruits now coming on in this department, individual plants are selected from time to time for propagation and introduction. The following varieties were introduced during the past fiscal year:

Hardy Grapes for South Dakota

The Concord grape first fruited in 1849 and was grown from seed of the wild Fox grape, Vitis Labrusca, by E. W. Bull of Concord, Massachusetts. Seventy-five per cent of all the grapes raised in eastern America come from this famous Concord vine and its pure breds and cross-breds. But the Concord grape and its offspring, great as they are, will not help South Dakota and the prairie Northwest since, even with careful winter protection, they are not sufficiently hardy.

For many years past, this problem has been worked on and a lot of seedlings of the wild grape of the Dakotas have been grown but this was very slow work as this wild grape is not equal to the wild Fox grape of Massachusetts in size in its original condition. So crosses of the wild grape of the Dakotas with some of the choice tame grapes were made. This was done in the fruit-breeding greenhouse of South Dakota State College. The work was a success. Thirty-two of these seedlings, all hardy at Brookings without winter protection of any kind, are now available. This marks the beginning of a new era in grape culture for the prairie Northwest. These original vines were planted first on land that was too low and wet and had to be moved on to higher land. Otherwise, these grapes would have come out several years ago.

A display of these varieties has been shown the past three years at the South Dakota State Fair and has been greatly admired.

In the following list, the pistillate or seed parent is named first and the pollen parent second. By S. D. wild is meant the wild grape
collected at Fort Pierre, South Dakota. By N. D. wild is meant the wild grape collected at Bismarck, North Dakota. The names of these grapes are all taken from the Sioux Indian language.

Arikara Grape—Pedigree: Lady x N. D. wild. A fine white, sweet, very productive grape with large berries in long bunches. Berries, five-eighths inch in diameter; seeds separate easily from the pulp.

Atkan Grape—Pedigree: Lady x N. D. wild. Sweet, medium size, white with pink tinge. Long bunch.

Azita Grape—Pedigree: Beta x Lindley. Large black fruit; five-eighths inch in diameter; flavor rather wild; strong grower, fair crop.

Caddo Grape—Pedigree: Beta x Agawam. Large, black, sweet grape of good flavor; size nine-sixteenths inch in diameter. Seeds separate easily from the rather firm flesh.

Chonkee Grape—Pedigree: Lady x N. D. wild. A yellow white grape of good size and quality. Vine, a strong grower and productive.

Chontay Grape—Pedigree: Massasoit x Beta. Strong grower; fruit very large, bluish purple; very good flavor. Seeds separate readily from the flesh. Cuttings only.

Edapa Grape—Pedigree: Merrimac x Beta. Large, black, good quality. Seeds separate easily.

Emana Grape—Pedigree: Beta x Agawam. Our largest grape in 1924. Rich, purple, black, fully as large as Concord, borne in close compact clusters, about three-fourths inch in diameter. Flavor good, intermediate between the wild flavor of Beta and the high class rich, sweet, aromatic flavor of Agawam.

Eonia Grape—Pedigree: Lady Washington x Beta. A fine white, sweet, very productive grape. Berries about one-half inch in diameter. The ripest berries have a tinge of pink.

Lachala Grape—Pedigree: Lady x N. D. wild. A white grape of good size and quality; strong grower and very productive.

Luza Grape—Pedigree: Merrimac x Beta. A fine sweet, meaty, red grape, somewhat larger than Beta.

Mandan Grape—Pedigree: Wilder x N. D. wild. An early and very heavy bearer, the first of all of these hybrids to bear. Fruit black, one-half inch in diameter; good flavor. Seeds separate very readily from the flesh.

Manota Grape—Pedigree: Merrimac x Beta. Our largest grape in 1922. Fruit as large as Concord, being three-fourths inch in diameter; color, black with bloom. The quality is between the fancy quality of Merrimac, its seed parent, and the sprightly wild flavor of Beta, the pollen parent. Seeds separate easily from the pulp. The flavor is very good.
Napka Grape—Pedigree: Salem x Beta. A strong grower and very heavy bearer; fruit black, small, about Beta size; good flavor; bunches compact.

Nompha Grape—Pedigree: Lindley x S. D. wild. A large black grape; good flavor; size, eleven-sixteenths inch in diameter.

Oglala Grape—Pedigree: Merrimac x Beta. Vine productive, fruit large, five-eighths inch in diameter. Fruit black, of good flavor; seeds separate very readily from the flesh.

Onaka Grape—Pedigree: Beta x Salem. A fine, productive, large, sweet, white grape, turning to pink as it ripens. Berry about nine-sixteenths inch in diameter. Seeds separate easily.

Osbu Grape—Pedigree: Beta x Agawam. Fruit black, a trifle larger than Beta and of Agawam flavor.

Pontigo Grape—Pedigree: Lady x N. D. wild. Fruit very large, five-eighths inch in diameter; color, white turning to light red with white bloom; seeds separate readily from the sweet flesh.

Ree Grape—Pedigree: Lady x N. D. wild. A very heavy bearer; fruit of large size, three-fourths inch in diameter; green with white bloom. Seeds come out easily. Season late.

Santee Grape—Pedigree: Merrimac x Beta. Vine a very heavy bearer of large black grapes borne in large bunches. The largest of all the seedlings in 1922, the berry being three-fourths inch in diameter, nearly Concord size. The fruit is meaty, rather sour but of good clear flavor; seeds separate easily from the pulp.

Shakoka Grape—Pedigree: Lady x N. D. wild. Fruit very large, round, black, nearly Concord size. Good quality. Seeds separate readily from the pulp. Vine, a very strong grower and very heavy bearer.

Siposka Grape—Pedigree: Lady x N. D. wild. Large, black grape; five-eighths inch in diameter.

Sonona Grape—Pedigree: Lady x N. D. wild. A very heavy bearer of large white grapes with light pink tinge turning to light red with white bloom as they ripen. Berries five-eighths inch in diameter; seeds separate readily from the pulp. Flavor, sweet with a trace of the wild grape, but sweet and good when ripe.

Tahama Grape—Pedigree: Lady x N. D. wild; fruit, large black, sweet. Seeds part readily. Vine, a strong grower and heavy bearer. Berries nine-sixteenths inch in diameter.

Teopa Grape—Pedigree: Lindley x S. D. wild. A fancy sweet, good grape; golden green with white bloom; eleven-sixteenths inch in diameter.

**Wachepa Grape**—Pedigree: Lady Washington x Beta. A large creamy white grape, good flavor; seeds separate easily.

**Wakpala Grape**—Pedigree: Merrimac x Beta. Fruit very large, black, good flavor. Bunch long.

**Wecota Grape**—Pedigree: Lady Washington x Beta. Sweet, meaty, yellow with bloom. Bunch small, compact; berry about nine-sixteenths inch in diameter.

**Wetonka Grape**—Pedigree: Beta x Salem. Large, black grape; strong grower, heavy cropper. Fruit, five eighths inch in diameter; flavor rather wild; seeds separate easily from flesh.

**Yasota Grape**—Pedigree: Merrimac x Beta. Fruit large, black, eleven-sixteenths inch in diameter; flavor wild; compact bunch.

**New Gooseberries**

The largest gooseberries in the world are those grown in western Europe. A few years ago these giant gooseberries were crossed with the wild Sioux Valley gooseberry (Ribes gracile), from Lake Oakwood and Gary, South Dakota. This work was done in the fruit-breeding greenhouse at South Dakota State College. The European gooseberries did not live long even with special care, but long enough to make a cross. In the spring of 1924, the Sunset Gooseberry was offered for the first time as the first result of this work. The following ten varieties are now offered for the first time. The names are taken from the Sioux Indian language and are not difficult to pronounce if the accent is given on the penultimate syllable.

**Kabu Gooseberry**—Bush of strong growth and heavy producer of large red fruit. The original plant bore 4 pounds, 7 ounces in 1923 in a crowded plantation.

**Kaduza Gooseberry**—Round, oval, 7/8 x 5/8 inch in diameter; dark red, excellent table quality. Very productive; largest in 1922.

**Kana Gooseberry**—Bush of strong growth and very productive. Fruit large, dark red.

**Kanega Gooseberry**—Bush of vigorous growth, very productive. Fruit green, with transparent skin; size 13-16 x 11-16 inch in diameter. The original plant bore 4 pounds, 4 ounces of fruit in 1923 in crowded plantation.

**Kapoza Gooseberry**—Very productive. Fruit large, fine dark red, oval; 7/8 x 5/8 inch in diameter and runs about 8 to the ounce.

**Kataga Gooseberry**—Berry large, light red, smooth; 13-16 x 3/4 inch in diameter. Bush strong, upright growth, productive.

**Kawaika Gooseberry**—Fruit green with transparent skin. Size large, 13-16 x 11-16 inch in diameter. Bush of upright habit, very productive.
Kazonta Gooseberry—A large, fine, round, smooth red gooseberry, ½ x ¾ inch in diameter. Bush a good grower and productive.

Keza Gooseberry—A fine round red gooseberry; ¾ inch in diameter. Bush strong, upright, productive.

Kopa Gooseberry—Bush very productive. Fruit large, green; size ¾ x ½ inch in diameter.

Wild Black Currants

The wild black currant (Ribes floridum) is abundant throughout the state. Many thousand seedlings of this species have been grown at this station through several plant generations. These currants were found at Lake Oakwood and Gary, South Dakota, beginning in the fall of 1895. But in 1923 there was a decided break and a number of plants appeared with fruit of remarkable size and so productive that they appear worthy of propagation and introduction, although the ideal berry in quality has not yet arrived.

The wild black currant is a good ornamental shrub with large yellowish white flowers in drooping racemes and smooth black fruit. One advantage of the wild black currant as a low shrub is that they endure more partial shade than many other shrubs. In European gardens, this American species is considered worthy of a place in the ornamental shrub collection and it should receive equal consideration here at home. The foliage turns to a handsome brown red color in the fall.

Tonah Currant—Large plant, bearing heavy crop of fruit, weight of 10 berries, 12 grams; total weight, 335.7 grams.

Atta Currant—Plant large, good cropper. Fruit large, round, 9-16 inch in diameter. Weight of 10 berries, 13.2 grams; weight of total crop, 286.7 grams.

Mato Currant—Large plant, heavy cropper. Fruit large, berries 9-16 inch or a trifle more in diameter. Weight of 10 berries, 12.6 grams.

Wanka Currant—A very large plant bearing a good crop of medium size fruit which is red instead of black. Weight of 10 berries, 9.3 grams. An interesting variation in color of fruit.

Russian White Apple

Introduced fall of 1924. Noteworthy for its snow white color and a favorite at our State Fair exhibits. A good summer apple, flesh snow white, juicy, slightly subacid. This tree is growing in the old Russian apple orchard at State College and the name, Russian White, is given until the real name can be determined.

Oka Cherry

Introduced fall 1924. This is really not a cherry but is a good substitute for a cherry. It is a Sand Cherry hybrid, a seedling of
Champa. Black red flesh, rounder than Sapa and color brighter on outside. The original one year seedling tree bore fruit in 1923, the year after planting and again in 1924. Plant of bushy habit but taller than the Tom Thumb Cherry. The fruit dries into a sweet prune-like fruit and later can be cooked up into excellent sweet sauce.

**Tawena Plum**

Introduced fall 1924. A full sister to the Waneta and Kahinta, and originated at the same time. Not quite as large as Waneta, fruit more round, an immense bearer. This has been much admired at our State Fair exhibits and the introduction has been urged. The name is a rearrangement of the name Waneta.

**Spearfish Yellow Chokecherry**

Introduced fall 1924. A yellow-fruited wild chokecherry from Spearfish, South Dakota. An interesting novelty. Of value mainly from the ornamental standpoint but the fruit has some culinary value. The main objection to our native chokecherry is that the trees send up so many suckers or sprouts from the roots. The trees sent out were one year buds on May Day tree stock which does not sucker.

**Horticultural Explorations**

October 17, 1924, I returned from my sixth tour to foreign lands in search of new plants of horticultural and agricultural value. This time the tour was of twelve weeks to North China by way of Japan and Korea in search of hardy pears resistant to blight. From many thousand pounds of the fresh fruit gathered in the mountains of North China, sixty-eight pounds of seed were selected and are now stratified in sand for spring sowing. It is my hope to send this material out as one year seedlings for spring 1926. Much other material was obtained, incuding new plums, apricots and other orchard fruits, various ornamentals, some farm seeds, vegetables and some new melons.

**Breeding Hardy Pears**

In the spring of 1921, some of the best collections of cultivated pears in Arkansas, Missouri, Iowa and Illinois, were visited to obtain pollen for use in this 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. Many hybrids have already been originated and at least three of these hybrids are of full commercial size and appear worthy of propagation.

The quantity of seed of the hardiest pear in the world secured in North China in the summer of 1924 will make it possible to raise seedlings through as many plant generations as possible. The starting point lies in this North China and Siberian pear.
Equipment for Originating Hardy Fruits

The long list of hardy plums and other fruits introduced by this department was made possible by the fruit-breeding greenhouse given to the State College a few years ago by the South Dakota State Legislature. But the work now under way has greatly outgrown this house. In order to prevent any check in the development of this work, a new fruit-breeding greenhouse should be provided. The word "greenhouse" does not give the right idea. This is really a laboratory for originating new fruits. The lack of this necessary equipment greatly hampers any future development and a host of new plants must remain only dreams until facilities are provided for their development. A cold storage building for the storage of fruits is also needed. The Legislature has provided $2,000.00 for a tree cellar which will be a great help in this work. More land suitable for horticulture at Brookings is also needed. The Waneta plum is the best out of 10,000 seedling plums. The Anoka is probably the best out of 10,000 seedling apples. It is best to work with large numbers.

Yours truly,

N. E. HANSEN, Horticulturist.
Director James W. Wilson,  
Experiment Station.

Dear Sir:

In keeping with your recent request, I am submitting herewith a report on the experimental work carried on by this department. Most of the work was done under the Hatch Fund.

**Direct Marketing of Poultry Products**

During the year, 187 cases (30 dozen) eggs were marketed in the eastern centers and Chicago and a record kept of net returns as compared with local prices. The margin of profit over home market varied from as low as one cent per dozen in the peak of production period to twelve cents per dozen during winter months. The margin the past year was considerably less than the previous year because of improvement in local prices.

Marketing of milk fed broilers (live) was attempted, but with unsatisfactory results. There was a very large shrinkage (more than 25 per cent) and the birds arrived in market (Minneapolis) in very poor condition. It would seem that in direct marketing of this product it would prove more profitable to kill and dress birds and ship in iced packages.

Shipments of capons were made to Chicago market in February and prices equal to best turkey quotations realized. Birds were capon dressed and shipped in barrels. Best prices are given for the heavier birds.

**The Influence of Artificial Lighting**

Two lots of pullets of 150 and 100, the first under lights and the other not lighted, were trapnested for January and February and records of production kept. The average production of the lighted lot for the two months period was 31.25 eggs, and the unlighted lot 23.03 eggs. This work will be continued during the coming year, with a view to cost figures and effects on progeny.

**Effects of Feeding High Fiber Content Grains**

In this experiment, 25 hens were fed on a diet of barley, oats, buckwheat and emmer. A check pen of 25 hens was run on a ration which consisted of corn and wheat; barley and oats and good 20 per cent tankage mash. The average egg production for the period for the first pen was 21.72 eggs and the check pen 36.56 eggs. The
hens in the check pen were in good laying condition at close of period while hens in fiber feed pen were overfat and practically stopped laying and went into a molt. One died of bowel inflammation. The cost of feed was slightly higher in check pen.

**Grain Feeds Versus Grains Plus 20 Per Cent Tankage Mash**

Two pens of 25 hens each (Leghorns) were fed as follows: one fed ordinary farm grains—oats, corn, wheat and barley; the other fed the same plus a 20 per cent tankage mash. The cost of feed for both ran practically the same, but the pen receiving mash laid an average of 36.6 eggs per hen during period run to 23 for the other pen. The hens receiving grains alone were excessively fat and had practically stopped laying while other hens on balanced ration continued to lay well.

**Ventilation of Poultry Houses**

Various ventilating devices and methods were used, but the best results were obtained with wind baffler ventilators combined with straw lofts with gable vents or cupolas.

**Turning of Hatching Eggs Being Held for Hatching**

A number of incubators were run with eggs held up to 10 days, some turned during the time daily and others not turned. The eggs not turned gave as good per cent hatches as the turned eggs. This experiment is to be repeated another spring.

**Effect of Holding Eggs on Per Cent of Hatch**

Eggs were set varying in age from one to twenty-one days. The eggs up to ten days of age hatched about equally well but there was gradual deterioration after this. Some eggs twenty-one days old hatched 50 per cent.

**Effect of Soil and Washing on Hatching**

Dirty eggs, washed eggs, wiped eggs and clean eggs set with following per cents of hatch respectively: 16.6 per cent, 40 per cent, 80 per cent and 83.33 per cent. Leghorn eggs were used.

Yours truly,

G. L. STEVENSON, Poultryman.
DEPARTMENT OF VETERINARY

Director James W. Wilson,

College.

Dear Sir:

Progress on the hemorrhagic septicemia project upon which we have been working for several years is slow. During the past year, it was slower than in previous years on account of the fact that material submitted by residents of the state and from which the hemorrhagic septicemia organisms are isolated was not as plentiful as in previous years. This subject requires careful study and to make it of the utmost value to the residents of this state the organisms with which we work should be collected from as many different sources within the state as possible. In order to do this, we must use material that is submitted for diagnosis from time to time. As previously reported, we are making a study of the pathogenic properties of the organisms isolated by inoculating them into rabbits and white mice. Their cultural characteristics are carefully studied, especially in their reaction to the various sugars. Thus far, between thirty and forty separate strains have been studied, and it is hoped that a much more definite report can be made within the next year or two, after which a sufficiently large number of strains will have been examined to justify conclusions. We are already in possession of a considerable fund of information, but inasmuch as we feel that a larger number of strains of this organism should be examined before drawing conclusions, it is necessary to withhold further statement until a later time.

Yours truly,

C. C. LIPP, College Veterinarian.
ANNUAL REPORT

FINANCIAL REPORT

EXPERIMENT STATION FUNDS FOR 1924-25

**United States Appropriation**

<table>
<thead>
<tr>
<th>Item</th>
<th>Hatch Fund</th>
<th>Adams Fund</th>
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<tr>
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<table>
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**Substation Fund**

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<thead>
<tr>
<th>Appropriation</th>
<th>Cottonwood</th>
<th>Eureka</th>
<th>Highmore</th>
<th>Vivian</th>
</tr>
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<tbody>
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<td><strong>Totals</strong></td>
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<td><strong>$3,230.00</strong></td>
<td><strong>$3,230.00</strong></td>
<td><strong>$3,230.00</strong></td>
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</table>

**Horticulture Experiment Fund**

| Appropriation                      |            |        |          |        |
| Expenditures                      |            |        |          |        |
| Labor                             |            |        |          |        |
| Supplies                          | $2,486.06  |        |          |        |
| Communication service             | 4,063.97   |        |          |        |
| Travel expenses                   |            |        |          |        |
| Transportation of things          | 2,239.09   |        |          |        |
| Furniture and fixtures            | 301.45     |        |          |        |
| Tools                             | 420.25     |        |          |        |
| Buildings and land                | 147.50     |        |          |        |
| **Total**                         |            |        |          |        |

$10,000.00
### Livestock Experiment Fund

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### Potato Experiment

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<td><strong>Tools and machinery</strong></td>
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### Experiment Substation Fund

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<td>Sales Eureka</td>
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<tr>
<td>Sales Highmore</td>
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<tr>
<td>Sales Vivian</td>
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<td><strong>Total Receipts:</strong></td>
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### Livestock Experimental Revolving

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<td><strong>Expenditures:</strong></td>
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<tr>
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## Sales Fund

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<td>$501.20</td>
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<tr>
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**Total:** $8,843.99

**Ending Balance:** $9,814.81