

South Dakota Agricultural Experiment Station

ANNUAL REPORT
OF THE DIRECTOR
For the Fiscal Year Ending
June 30, 1926



South Dakota State College of Agriculture
and Mechanic Arts
Brookings, South Dakota

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I N D E X

	Page
Animal Husbandry	5
Agronomy	8
Agricultural Engineering	14
Chemistry	14
Dairy Husbandry	15
Entomology	19
Home Economics	23
Farm Economics	24
Financial Statement	36
Horticulture	28
Poultry Husbandry	32
Rural Sociology	34
Veterinary	35

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 Agricultural Experiment Station of South Dakota State College for the fiscal year ending June 30, 1926.

At the close of the year there were twelve divisions of the experiment station. In these divisions, there were fifty-three experimental projects being considered. A detailed report of each will be found in the following pages, as well as the financial statement by the secretary of the college as to how the funds were expended.

Yours truly,
James W. Wilson
Director of Experiment Station and
Animal Husbandman.

Department of Animal Husbandry

The following experiments were conducted during the year:

Sheep Breeding

The experiment was conducted to determine whether it was practical to produce a lamb suitable for mutton at an early age and at the same time a hide that could be used for fur purposes. If so, at what age should the lamb be marketed; also what is the value of using karakul on the ordinary breeds of sheep in the Northwest in respect to the quality of fleece produced by each? At the time of this report, lambs are on a full feed of grain while nursing their dams.

The object of a second experiment in sheep breeding is to develop a breed of sheep that will not require docking. Good progress was made in this line.

Cattle Feeding

Barley vs rye for fattening cattle. Twenty head of two-year-old steers were divided into two lots and fed from self-feeders all the rye and barley they would eat. Pigs were put in lots to pick up waste. This was the third year in feeding rye to cattle as a fattening ration and a bulletin giving results will be published, probably during the next fiscal year.

The value of green corn stacked as a feed for cattle. Twenty-five head of two-year-old cattle were divided into five lots of five head each and fed on stacked green corn, corn silage, corn fodder, alfalfa hay and one-half corn silage and all the alfalfa hay steers would eat. Corn from the same field was used for the stacked corn lot, the corn fodder lot and the corn silage lot. This stacked green corn was the poorest feed ever fed to cattle at this station. During the 54-day trial, the steers not only lost weight but they were inferior to cattle in any other lot while at the beginning they were similar to other lots both as to breeding and individuality.

Hog Feeding

Factors in summer feeding of market pigs. Seven lots of ten pigs each were fed in a similar manner as in the three preceding years to determine the economy of producing feeder or stocker pigs on various limited rations of farm grains, to study value of alfalfa pasture, and to compare the economy of full vs limited rations for pigs on alfalfa pasture. After the close of the pasture season, all lots were finished on corn and tankage to study the influence of the several methods of summer feeding. The results obtained during the past year are in agreement with earlier indications that for producing thrifty uniform feeder pigs on alfalfa pasture, the limited rations rank in the following order: (1) corn and tankage, (2) ground barley and tankage, (3) corn without tankage, (4) whole oats and tankage.

Tankage requirements of market pigs fed barley and pasture. Ten pigs each were fed mixtures of ground barley and tankage to determine the most efficient proportions of these feeds for producing economical gains. The results to date indicate that the proteins supplied in a ration of ground barley, tankage and alfalfa or rape pasture form such a

efficient combination that a smaller quantity of digestible crude protein is required in the concentrates fed than is called for in present feeding standards. This possible saving of tankage greatly increases the value of barley as a substitute for corn for fattening pigs.

Study of alkali disease in pigs. Several small pigs were fed grains held over from the preceding year to determine whether feed loses its effectiveness with age.

Winter feeding fall pigs. Five lots of ten pigs each were used to determine the value of corn, oats, tankage, linseed meal and alfalfa hay in limited and full rations for fall pigs. The remarkable value of alfalfa hay in winter rations for fall pigs was again shown in the results of the past winter. Choice oats as a substitute for corn in limited rations including linseed meal, tankage and alfalfa hay, gave excellent results during the stocker period; but if the finishing period is also considered, oats proved to be worth only 27 cents per bushel when corn was worth 56 cents per bushel. Full feeding from weaning to market age proved somewhat more economical than a combination of limited and full feeding.

Winter rations for brood sows. Some fifty head of brood sows were divided into four different lots and fed on the following rations: Lot 1. corn and alfalfa hay. Lot 2. corn, tankage and alfalfa hay. Lot 3. ground oats and alfalfa hay. Lot 4. oats, corn and alfalfa hay. Complete records were kept for each litter produced by sows from farrowing until weaning time. The results indicate that the sows and gilts responded differently to several rations used. Rations containing oats gave poor results when fed to gilts and best results when fed to older sows.

Grazing Experiment.

Grazing cattle, sheep and swine. The object was to ascertain how many cattle sheep and swine will one acre of white clover, yellow sweet clover, alfalfa, native pasture and sudan grass supply feed for during the season. What is the comparative value? What is the danger from bloat? This experiment is in progress at both the substation at Cottonwood and the home station at Brookings. Results for 1925 were good, no cases of serious bloat resulted although the season was unusually dry.

Soybeans and Soft Pork.

The project to determine the per cent of soybeans in a pig's ration to produce a carcass termed by the meat packers as "soft" and to determine whether or not age has an influence at this writing is well under way. Pigs of the same breed and same litters will be used, all produced under the same conditions. The lots will be fed on different per cents of soybean meal and corn meal. One pig from each lot will be killed by meat packers in Sioux Falls at about 100 pounds. The second lot will be killed at 150 pounds and so on.

Publications.

Two bulletins were printed during the year, Improving Winter Rations for Pigs and Soft Corn for Fattening Steers. These bulletins carry the following digests:

No. 216—Improving Winter Rations for Pigs.

The difficulty experienced by many farmers in securing good results with fall pigs prompted a series of experiments at South Dakota State College on winter rations for hogs. Various combinations of protein supplements were tried under dry lot conditions to secure information which would make the feeding of market pigs more profitable.

The standard ration of yellow corn and tankage is not a very efficient winter ration for fall pigs because these feeds do not supply sufficiently the vitamins which are so necessary for satisfactory growth and development. Fortunately, this practical and popular ration may be easily improved by the addition of alfalfa hay and linseed meal, or buttermilk.

The addition of chopped alfalfa hay and oilmeal to a ration of yellow corn and tankage greatly increased the efficiency of the ration. Pigs fed this ration made an average daily gain of 1.54 pounds as compared to 1.32 pounds for pigs fed only corn and tankage.

Alfalfa hay fed in racks gave almost as good results as when added to the ration in chopped form. When choice alfalfa was used, the gains were just as good. There seems to be little or no advantage in chopping alfalfa hay if pigs can be induced to consume sufficient uncut hay to insure beneficial results.

Corn and alfalfa hay alone did not prove an efficient ration showing that alfalfa hay can not replace tankage as a supplement for corn.

Direct sunlight proved an important factor in producing good gains in these experiments. Results indicate that much of the unthriftiness in fall pigs is due to rickets caused by a lack of direct sunshine.

A corn, tankage and buttermilk ration proved more efficient than either a corn and tankage ration or a corn and buttermilk ration. More rapid and cheaper gains resulted as well as greater uniformity and finish.

Semi-solid and condensed buttermilk were found to be good substitutes for creamery buttermilk in rations of corn, tankage and buttermilk. These feeds might be used to advantage where skim milk or creamery buttermilk are not available.

Where ground barley was substituted for corn in the ration with tankage, it proved satisfactory. One hundred pounds of barley were equal in value to 100 pounds of the corn which graded about No. 3 or

No. 4. One could afford to feed barley and tankage instead of corn and tankage when the cost of a bushel of ground barley was not more than 83 to 87 per cent of the cost of a bushel of corn.

No. 219—Soft Corn for Fattening Cattle.

The results of this experiment indicate that farmers should plan to feed soft or immature corn rather than sell it on the market because when fed with alfalfa hay, soft corn produced gains which compared quite favorably with gains produced by the more mature corn grown the same year.

The results also indicate that husks on immature corn have considerable feeding value; steers fed snapped corn and alfalfa hay made better gains than steers fed husked corn from the same field.

This experiment shows that the low prices prevailing when corn is soft are unnecessary.

The shrinkage of the steers that received the selected soft corn was not as large as it was with the steers that received the selected hard corn, being 60 and 64 pounds per head, respectively.

Results indicate that soft corn puts a good finish on cattle as the salesmen in the stockyards rated the steers that received the soft selected corn second, and the steers that received the hard selected fourth.

The four lots of corn fed to the four lots of steers in this experiment were found to contain on close inspection, different classes of corn from the standpoint of maturity. The field run corn and even the soft selected corn contained three classes—medium hard, medium soft and soft. Even the hard selected corn, on close examination, contained two classes—hard and medium hard.

The chemical composition of the four lots showed no significant differences. When divided into classes on the basis of physical evidence of maturity, immaturity is shown by a higher total protein content, a lower per cent of normal starch, a somewhat lower per cent of crude fat, higher ash, higher moisture, a lighter weight per bushel and lower shelling per cent.

Chemical analysis of the husks from immature corn indicate that they should be more palatable and have greater nutritive value than the husks from mature corn. Husks on immature corn were found to have a higher sugar content and true protein content than the husks of the more mature corn.

Department of Agronomy

Director J. W. Wilson,
Agricultural Experiment Station.

Dear Sir:-

I beg leave to submit the following annual report of experiment station projects conducted by the agronomy department.

Influence of Crop Rotations on Soil Fertility

Soil samples are secured from several plots of land in a series where given rotations and treatment are continued for definite long time intervals. The soil samples are expected to indicate fundamental differences in the soil of the plots when they are studied chemically and biologically.

A history of recorded crop yields from the small fields is now available for a continuous period of 17 years—thus furnishing opportunity for studying soil fertility changes due to cropping systems which may have the largest continuous record of any in the northwest.

During the season of 1925, the plots were cultivated in corn. During the course of rotation, it happened that the season was exceedingly backward for the corn crop and for that reason differences in yield of corn on the plots which might be traceable to essential soil differences were slight. As an average of all years during which this project has been conducted, crop yields indicate almost unmistakably that (1) phosphorus and (2) nitrogen, are the "limiting elements." Furthermore, there is some indication from the chemical analyses completed that fundamental changes in soil fertility of which variations in crop yield are only an indication are measurable. The establishment of such a fact would bear directly upon the present research project.

Phosphorus and Sulphur

This is 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; also the availability of phosphorus in different forms.

This project includes vegetation pots and tumbler cultures treated with phosphorus and sulphur and their combinations. Approximately 200 analyses are completed for water soluble phosphorus.

Different phosphorus carriers produce different results. The introduction of some organic matter into some supplementary sand cultures receiving phosphorus in the form of rock phosphate has shown a very marked increase in the growth of plants when compared with organic matter and rock phosphate alone.

Corn Ear Rot

This is a project to discover the occurrence of corn ear rots in given areas and to determine the effect which ear rots may have upon constituents of affected ears, and upon the progeny therefrom.

Since the previous report, approximately 100 separate strains of corn have been produced from selections of the previous year. A number of the strains just produced are selfed or inbred strains and they have been found to possess several heritable characters peculiar to strains of such corn. These characters include chlorophyll deficiency, rolled top, leaning tops, striped leaves, and apparently some others less distinct. During the year, at least two moulds have been isolated from strains of corn included in this project, namely *Aspergillus niger* and *Fusarium moniliforme*.

An attempt has been made to associate disease organisms with the development of supposedly heritable characters previously mentioned. There is no reason to doubt the indication mentioned in the previous annual report that organisms commonly associated with corn diseases reduced the percentage of germination, usually interfere with growth, and furthermore seemed to be associated with peculiarities of growth which may also be heritable.

Carbohydrate Variations

This project is a study of carbohydrate variations in leaves and husks in early and late maturing varieties of corn and their relation to moisture and temperature.

It is well understood by practical corn growers that weather conditions including rainfall and temperature combined with sunshine have noticeable influence upon process of growth and ripening of corn. These implied conditions of growth may be only partly within the possibility of control but their influence is none the less unmistakable and whether controllable or not needs to be understood. Once understood they might be practiced even if not controlled. These influences may largely be indicated and perhaps measured by photo-synthesis.

One series of 48 corn plants in 12 separate pots has been vegetated in the greenhouse and samples removed by removing sections of the leaves with a Sachs-Geunug leaf punch. Determinations of starch, pen-

tosans and sugars on these are just being completed and computations being made.

Cursory examination of results shows decided variations in photosynthesis between different plants. These differences are apparently correlated not only with the arranged variations in temperature and light but especially with the stage of development of the corn plants. The curve of these variations remains to be plotted.

Long Time Experiments

Several projects involving fundamental investigations and long time experiments are being continued. These include the following:

Crop rotation trials including (1) continuous corn, (2) corn, small grain (3) corn, small grain, legume; to discover the influence of balanced rotations upon quality and production of field crops.

Breeding corn for (1) protein content (2) height of ear.

Weed eradication including destruction of quack grass, wild morning glory, perennial pepper grass, wild oats.

Comparing the influence of not plowing with plowing several depths for corn, wheat, oats, and clover, including forages; 6, 7, 12.

Comparisons of crop residues with stall manure applied with lime and phosphorus upon the quality and quantity produced of corn, oats and clover.

Variety testing of field crops including corn, small grains, soybeans, alfalfa, and field peas.

It is increasingly evident that different results expressed in crop yields are secured from different crop rotations. One of the principal reasons for resorting to what might be called balanced crop sequence is evidently the need for the control of specific weeds, notably wild oats, quack grass, wild morning glory, and perennial peppergrass.

It is observed that a field in wheat continuous since 1897 has reverted almost completely to wild oats—but that the latter can be reduced and ultimately eliminated with a comparatively simple method of mowing the infested crop for hay sufficiently early to remove the wild oats for hay before the seed is ripe.

Again certain crop rotations permit land on which they are carried through to become increasingly infected with quack grass. Since the publication of the previous report, the latter weed on a given rotation has been eradicated. The procedure by which this was accomplished is apparently possible of general application.

The rotation involved consists of corn, oats, winter wheat, and sweet clover. Previous to last year, the sweet clover was regularly harvested both for hay and seed. Such rotation allowed insufficient opportunity for giving quack grass sufficient late summer cultivation to eradicate the same. Accordingly the plan was devised to conduct the rotation in question as follows:

1. Corn
2. Oats
3. Winter wheat (with sweet clover seeded in the spring)
4. Sweet clover (cut for hay and land summer fallowed twice per week with sweep attachments to surface cultivator in the latter of summer).

This procedure obviously does away with any seed crop from the

sweet clover but makes opportunity for summer fallowing which is necessary to permit summer fallow after soil moisture has been reduced by sweet clover, which is necessary to interfere with growth of quack grass.

Since the publication of the previous annual report analyses of corn have been completed and published in co-operation with the Department of Animal Husbandry in experiment station bulletin No. 219. The analyses of the lots of corn fed to cattle are put down in detail in the bulletin and the following statements are made concerning the analyses:

"The chemical composition of the four lots showed no significant differences. When divided into classes on the basis of physical evidence of maturity, immaturity is shown by a higher total protein content, a lower per cent of normal starch, a somewhat lower per cent of crude fat, higher ash, higher moisture, a lighter weight per bushel and lower shelling per cent.

"Chemical analyses of the husks from immature corn indicates that they should be more palatable and have greater nutritive value than husks from mature corn. Husks of immature corn were found to have a higher sugar content and true protein content than the husks of the more mature corn."

During the fiscal year, at least two varieties of barley have been noted in our variety test plots which produce high yields and which also possess smooth awns or beards instead of the rough barbs borne by such varieties as Odessa and Manchuria. These varieties of barley it is hoped will develop favorable and may be disseminated to growers. If this proves possible, the character of smooth awn will diminish the discomfort which usually attends the harvesting and threshing of ordinary varieties of barley.

It is only attempted in the foregoing to make specific mention of the more prominent results secured since the previous annual report. In addition to these, a good many other items of progress might be mentioned except for the limitation of space.

Soil Investigations

One of the phases of investigational work carried out with the use of special state appropriation is that of soil investigations which are given the title of soil survey. This work may be divided into four general parts—

1. The surveying and mapping of soil areas proper
2. Sampling of soil types and analysis of samples
3. Soil field experiments
4. Technical soil investigations based largely on information secured from the foregoing survey.

Since the previous annual report, surveying and mapping of two counties has been completed, Brown and Hyde. This makes a total of eight counties completely surveyed and mapped and a special West River area of six townships in addition; the surveying of Moody county is also practically complete, making roundly ten counties.

Numerous physical and chemical analyses of typical soil samples have been completed during the last year and results from these along with those previously completed are constantly utilized in making replies to inquiries about the fertility of South Dakota farms. These replies furnish direct information to farmers and others who wish to know for

example whether a given soil might be acid or alkaline, whether lime is needed for alfalfa or other legumes; whether any kind of fertilizer ought to be used or any other would pay; plowing deep or shallow; best methods of tilling or cultivation; or the most productive methods of handling crops in rotation.

Out of a total of 5000 letters of inquiry answered by the Agronomy department in the past year, 2000 replies were based upon these soil investigation. Such investigations also furnish direct information for teaching College and School of Agriculture classes. During the past year, a special use for information from soil investigations was made by drawing off advanced copies of soil survey maps already completed and sending them to the South Dakota State Highway Commission. Although this was incidental to the agricultural purpose of soil investigations highway engineers found it possible to secure indications of possible gravel deposits from the maps thus saving time and expense.

These soil investigations, supported by the state under the heading "Soil Survey", are conducted cooperatively with the soil survey of the United States Department of Agriculture. The latter contributes practically dollar for dollar along with the amount appropriated by the state. During this cooperation it has applied not only to field surveying and mapping soils but also to the printing of reports and to soil colors.

The surveying and investigation of South Dakota soils under the auspices made possible by state appropriation not only has made it possible in the past year to extend information to farmers for direct use in their business but also cooperation with the United States has furnished world wide information.

Results of field experiments conducted at Brookings have established that it is possible to produce an increase of 30 per cent in cereal crops as an average for several years by the application of phosphorus-fertilizer. Similar indications although of shorter duration have been obtained from soil field trials conducted by the soil survey at Vermillion and Groton, and also at Highmore experiment farm.

Substations: Highmore, Eureka, Cottonwood, Vivian

The following experiments are being pursued: comparing crop rotations; variety testing of wheat, oats, corn, barley, flax, potatoes, alfalfa, sweet clover, millets, grain sorghums, field peas, soybeans and sunflowers; the selection and breeding of disease resistant and drought enduring strains of the foregoing crops; trials with different kinds of tillage and fertility applications.

It is possible to report in connection with cereal breeding that two strains of smooth awned barleys which have been under selection and test especially at Highmore for several seasons are apparently productive enough to warrant their being utilized for distribution. These smooth awned barleys will be a valuable addition to varieties in South Dakota if they can be substituted without loss in production for such barbed varieties as Odessa.

Potato Experiments

State appropriations for potato experiments have been utilized for completing experiments with the propagation by cuttings; comparison of high pressure and low pressure spraying and tuber indexing. The latter

has been pursued only in the present season. Tests of growers strains of varieties were conducted at Brookings.

Seed Testing

Three thousand three hundred and fifty samples of seed have been tested in the past fiscal year for individuals who have sent in the samples with inquiries as to germination and purity of seed. These replies were stated as far as possible in a way to dispense information regarding the desirability of maintaining the quality and purity of seed for sowing on South Dakota fields and for placing on the markets inside and outside of the state.

Rust Resistant Grains

Hybridizing of cereals including wheat, oats, emmer, barley, and the testing and selection of same with a view to finding varieties that would be resistant to or free from rust especially the red rust of wheat, *Puccinia graminis*, have been given increased attention the past year. This was possible owing to special appropriation for the purpose. It has also been possible to increase the amount of co-operation in caring for the uniform rust nursery with strains sent out by the United States cereal office.

Some progress is indicated in the direction of securing strains that resist rust; for instance certain crosses between Marquis and Kota wheats. Too much need not be promised until it is possible to determine further qualities of these strains and produce them in larger quantities.

Flax Scholarship

A special fund was made available to the institution and assigned to this department for use in enabling an advanced student to solve some phase of a problem connected with the production of flax. About half of the amount available was expended for making a comparative study of the effect upon soil and subsoil of clear flax, wheat-flax mixture and clear wheat. This study was accompanied with special studies of moisture and of nitrate nitrogen in soils following the different kinds of cropping indicated. The idea involved was to follow up the well known tradition that "flax is hard on the land" and to get some scientific data concerning it whether pro or con. Generally speaking the results indicated no definitely harmful effect of flax upon the soil on which it grew.

Very respectfully,
A. N. HUME,
Agronomist and Supt. of Substations.

Department of Agricultural Engineering

Director James W. Wilson

South Dakota Experiment Station,

Dear Sir:

I wish to submit the following report on the experimental work done by the Department of Agricultural Engineering during the fiscal year ending June 30, 1926.

Relation of Electricity to Agriculture

This study is being made to find out the relative efficiency of electric power to other kinds of power for farm operations. It is also made to find out the relative cost of electric power from the power line to other kinds of power now used, and to study the uses to which it is now adapted for the farm, and uses to which it may be adapted in the future. An electric power line built especially for farm service has been furnished by the Northern States Power Company for this study. Forty-two individual meters have been installed on individual electric motors and appliances, and readings of the electric current used have been made at regular intervals throughout the year. A special study was started during the year on the home electric refrigerator and on the relative efficiency of separating cream from milk with the electric motor for power versus other power. These studies will be continued.

Another test of importance that was started and will be continued in detail is that of grinding feed with a small grinder and electric motor. One installation is already set up for this study and another will be installed soon. The study will be made to find out three things in particular: the capacity of the small outfit with different grains and with different moisture content; the amount of current consumed, and the degree to which the outfit may be made automatic in its operation.

This work is being carried on in cooperation with a national committee and a state committee, and both the farming and power company interests are represented on these committees. The power company has also co-operated to the extent of furnishing meters, labor assistance, and a small amount of funds to this study.

Very truly yours,
RALPH L. PATTY,
Agricultural Engineer.

Department of Chemistry

Director J. W. Wilson,
Experiment Station.

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, 1926.

The department has continued its work for cooperative analytical problems connected with the projects now carried on by the Animal Husbandry department and having to do with the special investigations

of that department along the lines of silage feeding and other work in animal nutrition as described under the report of that department as herein published.

We have also cooperated with the problems carried on in the Department of Dairy Husbandry by way of analyses of cereals, dairy products, excreta, used and obtained during their work dealing with the feeding of dairy animals. Many hundreds of analyses have been carried out in this cooperative work.

In cooperation with the department of Home Economics, we have done a number of analyses having to do with the quality, quantitative composition and dye-content of various textile fabrics.

Our analyses covering the whole of the above work have totaled approximately three thousand separate pieces of analysis.

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 brief report of the experimental work of the Dairy Husbandry Department for the fiscal year ending June 30, 1926.

Self Feeders for Calves

This project has been continued for the past four years in order to secure more data. For the past three years, close observation has been made on a condition which was observed in the calves the first year. That is that the calves developed crooked legs and in later cases crooked back bones.

The crooked legs and apparent stiffness was first attributed to the excessive eating of grain particularly corn; however, later observations seem to indicate that this condition was corrected when the calves were allowed access to the direct sunlight. Hence, to further check on this phase of the problem part of the calves were allowed to exercise in the direct sunlight while the others were kept indoors during the daytime and allowed to exercise at sundown. The latter group, however, were allowed steamed bonemeal ad libitum.

It was thought that the group which was not allowed access to the dry lot during the daytime, perhaps did not get sufficient exercise and that this might be a contributing factor for their condition, hence another trial is in progress in which the "no direct sunlight group" has a large pen in which to exercise. The control group has free access to a large pen and in addition a dry lot on the south side of the building.

The conclusions which were given in last year's report were further substantiated by this year's trial although the deformities in the "no sunlight group" were not as noticeable as in the calves in the three previous trials.

Bacterial Flora of Normal Cows' Udders

The work on this project has been completed and the results put out in bulletin number 218 of this station.

The digest of this bulletin summarizes the results of this experiment as follows:

1. Milk drawn aseptically from each quarter of the udder of forty cows gave an average bacterial count of 1,541 per cc.
2. Cell counts of the udders of the forty cows showed an average of 657,000 per cc.
3. Bacterial and cell counts compare quite closely. The coefficient of correlation between bacteria and cell counts was plus .6379-.03364.
4. Lactation exerted no appreciable effect on bacterial content of the udder.
5. The age of the cow exerted no effect except in the case of older cows past maturity in which both bacterial and cell counts were greatly increased.
6. Fore milk was considerably higher in bacteria than the middle milk or strippings. Strippings were found to run slightly less in bacterial count than milk from the middle of the milking.
7. Colostrum usually was very high both in bacterial and cell content although considerable variation was noted.
8. Bacteria of the udder was usually gram positive and micrococci. They ferment sugar without the formation of gas and may or may not liquefy gelatin.
9. Udder cocci gave uniformly low total and volatil acidities.
10. In some cases, curdling of the milk was accomplished by an enzyme. Digestion of the curd was noted in several instances.
11. Milk from different cows seems to vary in germicidal power. Cultures of bacteria artificially introduced into the udder do not survive over a few days.

Milk Clarifiers and Milk Filters

Comparisons have been made using a standard make of clarifier and filter and their effect on market milk. Points studied in particular were bacterial counts, cell counts, keeping quality, effect on cream line, methylene blue reduction tests, H-ion determinations, sediment tests, and labor involved.

Numerous tests indicate that there is very little, if any, difference in keeping quality of milk that has been clarified and pasteurized and milk that has been pasteurized and filtered. Acidity tests taken at intervals of 12, 24 and 36 hours show little difference. Time of pasteurization exerted a much more noticeable effect. Bacterial counts, methylene blue reduction tests and Cooledge H-ion determinations substantiated the above results.

The clarified samples showed over 50 per cent reduction in cell counts, made by the Breed method, while the filter exerted no appreciable effect on the number of cellular elements in milk.

Sediment tests were invariably in favor of the clarified samples. Filtered samples, although rarely showing visible sediment in the bottle, usually showed a slight deposit of dirt on the cotton disc.

The cream line seems least affected by the filter when measured

in a graduated cylinder. Clarification at 80 degrees F caused a slight decrease in cream line. Temperature of clarification is an important factor in cream line determinations and this deserves more thorough study. Milk filters also appear to have an advantage in saving labor. The time required in assembling, dismounting, washing and sterilizing the filter, was approximately two-thirds of the time for the clarifier.

Influence of Starter on the Quality of Butter

The use of starter in buttermaking and its effects upon the quality of butter, both fresh and storage, is not agreed upon by practical buttermakers, or authorities on the subject. Hence data on this subject should prove of value to the dairy industry.

In this experiment butter is churned from good quality cream. In one batch of cream a good grade of starter was used and in a second batch of the same quality of cream no starter was used. Detail churning records are kept on both and four ten-pound tubs of each churning were kept for storage, two tubs were kept in the Creamery refrigerator and two were shipped to a cold storage in Boston.

The tubs were scored regularly every month, those in the cold storage at Boston by a Government Inspector and those in the Creamery refrigerator by the Dairy Department staff.

This project will be continued for at least one year in order to get data on butter made during the various seasons of the year.

Because of the limited period of storage it seems advisable not to make a report on this experiment.

Ground Soybeans vs. Soybean Meal

Inasmuch as soybeans are being grown in many sections of South Dakota, it was thought that data on the feeding value of soybeans and soybean meal would be of interest and value to South Dakota farmers.

The experiment was divided into four 30-day feeding periods with a 10-day preliminary period. Seven cows, representing three dairy breeds were used. All of these cows were heavy producers.

The digestion trials of five days duration were run, and careful records were kept of feeds consumed and refused.

The soybeans were grown in South Dakota and ground as needed. The soybean meal was purchased from a Minneapolis dealer. No differences were noted in the palatability or physiological effect on the cows, between the two feeds.

The two feeds seemed to be about equal in feeding value. The slight difference in favor of the ground soybeans could be accounted for through experimental error. However, the soybeans can usually be purchased by South Dakota dairymen at a lower price per ton, hence it would be the most economical feed to use.

The data obtained in this experiment, together with data obtained in previous experiments on soybeans and soybean hay will be published in bulletin form at an early date.

Effect of Ground Soybeans and Cottonseed Meal on Butter

It is quite generally accepted that the feeding of ground soybeans results in a soft butter, while cottonseed meal produces a firm butter.

The trials also contemplated ascertaining the amount of feed necessary to produce these effects.

With these problems in mind, four cows were fed a basal ration of alfalfa hay, ground oats, ground corn, and either ground soybeans or cottonseed meal. The ration was balanced according to the Morrison Standard. After a ten-day preliminary period the soybean or cottonseed meal part of the ration was increased to 25 per cent by weight of the grain ration.

Every ten days the soybeans or cottonseed meal was increased until a 100 per cent grain ration of either cottonseed meal or soybeans were fed.

Ten-day composite milk samples were taken, and the milk on the tenth day was separated and churned.

Four cows were used, two Jerseys, one Holstein and one Ayrshire. All the cows were milking heavy. One of the Jerseys refused to eat her grain ration when 75 per cent of the ration was made up of cottonseed meal, hence she was taken off the trial. The other cows ate all of the ration although it was evident from the way the cows ate that the ration lacked palatability. No noticeable harmful physiological effects were noted. The feces seemed normal even when 100 per cent cottonseed meal or soybeans was fed. During the last 10-day period when 100 per cent of the ration was made up of either cottonseed meal or soybeans, some of the cows were receiving as high as 10 pounds.

No marked difference was noted in the churning of the cream or consistency of the butter. When 50 per cent or more of the soybean ration was fed, the butter had an oily taste, resembling castor oil.

The chemical analysis have not been reported as yet, hence no further conclusions can be given in this report.

Breeding-Up Experiment

No additional information has been secured on this experiment. The additional data merely corroborates last year's report. That is that good purebred sires are effective in building up high producing herds.

The problem which needs the greatest attention in this work is the securing of good purebred sires, sires which are prepotent and will increase rather than decrease production in their progeny.

Cross Breeding Experiment

This work is carried on in conjunction with the Animal Husbandry department and the purpose has been reported by that department.

To date, four heifers and one bull have resulted from the crosses. The birth weight of the calves seem to conform to the average weight of the two breeds rather than the birth weight of either breed.

No further report can be made on this experiment at this time.

Respectfully submitted,

THOMAS M. OLSON,
Dairy Husbandman

Department of Entomology-Zoology

Director James W. Wilson,
Experiment Station.

Dear Sir:

In conformity with your request, I herewith submit a report of the investigations carried on by the Entomology-Zoology department during the fiscal year ending June 30, 1926. The project dealing with the wheat-stem magot (*Meromyza americana* Fitch) was completed during the fiscal year ending June 30, 1925. The results of this investigation were published in Bulletin 217, "The Wheat-stem Magot". The investigation dealing with the common field cricket (*Gryllus assimilis* Fab.) was continued during the past year while a new project dealing with the plum tree borer (*Synanthedon pictipes* G. and R.) was added.

The Common Field Cricket

The distribution, economic importance and life history of the common black field cricket were discussed in former reports. During the past year most of the time was devoted to a study of the importance of the natural enemies of this insect and to further study of control as could be economically practiced by man.

Gryllus assimilis (Fab.) has a host of parasitic and predaceous enemies, the most important being the following:

Ceratoteleia marlatti Ashmead, an hymenopterous parasite of the eggs.

Paradris brevipennis Fouts, an hymenopterous parasite of the eggs.
Exoristoides johnsoni Coq., a tachinid parasite of the nymphs and adults.

Sarcophaga kelleyi Ald., a tachinid parasite of the nymphs and adults.
Cephalobium microbivorum Cobb, a nematoparasite of the intestine of the nymphs and adults.

Paragordius varius (Leidy) a thread or hair—worm parasite of the nymphs and adults.

Gregarina (sp.?) a protozoan, parasitic chiefly in the alimentary canal of the nymphs and adults.

Euthrombidium (sp.?) a mite parasite upon the adults.

Gamasidae (sp.?) another mite parasite upon the adults.

Chlorion cyaneum Dahlborn, a predaceous wasp which uses the nymphs and adults as food for its offspring.

Spiders (several species) which catch and feed upon the nymphs chiefly.

Birds (several species) that feed upon both nymphs and adults.

Chickens and turkeys that feed upon both nymphs and adults.

Of the two egg-parasites listed, *Ceratoteleia marlatti* Ashmead is the more important. From 20 to 50 per cent of the cricket eggs are destroyed each year through this parasite alone. Neither of the two tachinids acts as important checks upon the crickets, for comparatively few nymphs or adults are found parasitized by these flies. However, *Sarcophaga kelleyi* Ald. acts as one of the most important means of natural control of some of our South Dakota grasshoppers. *Cephalobium microbivorum* Cobb is found in the intestine of a large number of our crick-

ets, but it does not seem to injure them in any way that we could determine. *Paragordius varius* (Leidy) infests only a small per cent of crickets and consequently cannot be regarded as an important check upon the numbers of crickets produced in a locality. We have found as many as five of these nematode worms in the body cavity of a single cricket. The protozoan, *Gregarina* (sp?), is exceedingly common in the alimentary canal of immature as well as adult crickets. The number which we found ranged from one to more than one hundred per insect. It is the opinion of the writer that a heavy infestation with this parasite reduces the vitality of a cricket considerably, shortens its length of life and, if it be a female cricket, limits egg production. The two parasitic mites which we listed cannot be regarded as economically important.

Chlorion cyaneum Dahlborn, a digger wasp, does not occur in large numbers and, therefore, may be disregarded as an important check upon cricket increase. Spiders of several species are much more important for they capture and destroy large numbers of nymphs, especially those of the first four or five instars. Birds, likewise, destroy large numbers of crickets, but how important they really are in various sections of South Dakota we have not determined. Chickens and turkeys, when given the run of a field, exercise a controlling influence upon crickets. In a field of a few acres, such influence may be quite important but in a large field it tends to become negligible.

Control measures for crickets have been directed along two lines; first, the destruction of the eggs and, second, the destruction of the immature and adult crickets. Of these, the former is the more effective and also the more economical.

To destroy the eggs, it is only necessary that they be exposed to the air, sun and wind for three to five hours. At the end of this time, they are shrunken and dead. Since the eggs are not laid deeper than one and one-half inches beneath the surface of the ground as a rule, and since they are laid singly and not in pods and are not protected by any special secretion, any process that will disturb the soil so as to bring the eggs to the surface will serve the purpose. Whatever treatment is given the ground, it should take place late in the fall after the crickets are dead and again early in the spring before the eggs have hatched. In alfalfa fields, a large number of eggs will be exposed to the elements and thus destroyed if a spring tooth harrow is run over the field first lengthwise, and then crosswise a few days later. The edges of such fields as well as the sides and tops of irrigation ditches should be gone over. Whenever grain fields become overrun with crickets, these should also be worked.

The most effective method of destroying the black field cricket in any of its nymphal stages or in its adult form was through a poisoned bait. In our experimental work we have tried out more than 50 different baits, which varied from one another in the ingredients used or in the proportions of the ingredients. We frequently were able to kill more than 50 per cent of the crickets in a field with one application of these baits but in no case did we succeed in obtaining what we considered a satisfactory kill.

The bait which we found most satisfactory was made up according to the following formula:

Bran.....	25 pounds
*White arsenic.....	1½ pounds
Black strap molasses.....	1 gallon
Water.....	3¾ gallons

*Just as satisfactory results were secured by substituting paris green or sodium arsenite for the white arsenic.

Since the crickets feed chiefly from 4 P. M. till 8 or 9 A. M. the bait was put out late in an afternoon. In each case it was broadcast by hand, 8 pounds (figured on the dry-bran content) being used per acre. In alfalfa fields, the applications were made shortly after the first cutting of hay had been removed. In sections where irrigation was practiced, the fields were first irrigated and two days later they were baited, while in the non-irrigation sections, the bait was applied shortly after a rain had fallen. If this procedure is not followed, a larger number of the crickets may remain in cracks in the ground and not come in contact with the bait. In spite of our most strenuous efforts, we never found it possible to obtain an accurate count of the number of crickets that were killed through the baits; first, because the crickets may crawl into cracks to die and these cracks may be many feet in depth; second, because we have no way of knowing how many dead or perfectly healthy crickets are in these cracks; and, third, because many of the dead and dying crickets are carried away or eaten by other insects such as ants and unpoisoned crickets.

A series of experiments were conducted in which an attempt was made to destroy crickets in alfalfa fields through the use of cyanogas, calcium cyanide granules. This material contained not less than 40 per cent nor more than 50 per cent calcium cyanide. Forty pounds of the granules were used per acre, the material being applied through a clover seeder on warm, still afternoons, after 4 P. M. Some of the fields had been irrigated several days previous to the treatment and were fairly dry on the surface, while others had not been irrigated. It is estimated that we did not kill more than 10 per cent of the crickets in any of these experiments. No injury was done to the alfalfa through the insecticide.

Cocks or stacks of old hay or straw may serve as a place of refuge for thousands of crickets. If these be burned during the middle of the day by setting fire all around their basal edges, many of the insects are destroyed. Weeds cut, raked into piles and allowed to lie on the ground will also attract many of the crickets. Such weeds should also be burned.

The Plum Tree Borer

The plum tree borer is a moth belonging to the family Sessidae or clear wing moths. In the plum tree plantings of South Dakota, this insect has proven itself to be a serious pest. In the eastern half of the state it has been found attacking all cultivated varieties of plum, cherry and choke cherry and native wild plums. In the western half of the state, it has been encountered in plantings of cultivated plums, in nurseries, and here and there in native wild plums.

It is the young or larval form, the caterpillar, which is designated the borer and which is responsible for the injury done to the tree. These borers may be found under the bark of the host plants and in injured areas of the plants. Usually the borers are found in the trunk and larger limbs well above the ground level, but occasionally a specimen may be

found near or just beneath the soil. The presence of the borers may be detected by a flow of sap mixed with excrement and small bits of wood. The borers are usually found feeding on the growing bark at the margins of wounds. Such areas are increased in size thru the work of the caterpillars and may result in a girdling of the trunk or limb. Very frequently the borers work in crotches of the trees.

The insect hibernates in larval stage in broadly oval cells, directly underneath the bark. In the vicinity of Brookings, about May 1, the borers construct cocoons of silk and frass about themselves. A week later the majority of the caterpillars have changed to pupae. They remain in the pupal stage until about May 29 to June 1 when they wriggle forward along a tunnel constructed by the borer and push off a thin circular disk of bark. After this has been accomplished, they protrude their bodies through the openings in the bark and soon issue as moths.

Two to five days after the moths have emerged, they mate and almost immediately after this the females begin to lay their eggs. Cracks, crevices, wounded areas, cankered areas, sun-scaled surfaces, etc., are chosen spots to receive the eggs.

The number of eggs that are laid by a single moth under normal conditions is extremely difficult to determine. While dissections seem to indicate that an average of 225 eggs may be deposited, such an average is probably not an actuality under normal conditions.

The eggs hatch in 8 to 10 days, the young caterpillars making their way out of the eggs by chewing an opening in the shell. Continuing their biting instinct, they gnaw their way through the outer bark to the inner, where they remain and feed. Feeding continues throughout the year until cold weather comes on, when preparations for hibernation and emergence of the pupae are made. Data at hand indicate that the insect under discussion is single-brooded, but further study is necessary to definitely decide this.

The natural enemies of the plum tree borer that have been discovered are as follows:

- 1—Hymenopterous parasite of the *Microbracon* group attacking the caterpillars.
- 2—Ants working on the larvae in exposed or accessible places.
- 3—Birds that destroy principally the larvae and pupae.
- 4—Fungus attacking the caterpillars and pupae.

Further study of the natural enemies is necessary to determine definitely the exact role each plays in the control of the borer.

Control of the plum tree borer by man is still in the experimental stage. The methods that are worthy of further test are the following:

Horticultural practices which tend to eliminate wounds, splitting of crotches, breaking of limbs, sun-scalded areas, areas affected with black knot, etc.

Paradichlorobenzine treatment of infested trees to destroy the larvae and pupae. At present it is planned to dissolve paradichlorobenzine in liquid parafine (melting point 50 degrees C) and while the mixture is kept liquid to paint it on infested trees. The action of the P.D.B. treatment on the trees and borers is yet to be determined as is also the effect of this treatment on the egg-laying moths.

Very truly yours,

H. C. Servin,
Entomologist.

Department of Home Economics

Director J. W. Wilson,
Experiment Station.

Dear Sir:

In reply to your request I beg leave to submit the following report of the experimental work carried on in the Division of Home Economics during the fiscal year ending June 30, 1926.

Vitamin Content of Canned Spinach

This experiment is a study of the vitamin C content of spinach canned in the pressure cooker, according to approved directions, i. e. blanch 15 minutes in steam. Place in cans and process for 90 minutes at 15 pounds pressure.

The experiments were carried on with guinea pigs, using the basal ration of Sherman, La Mer & Campbell.

The results indicate that the above method of canning spinach is exceedingly destructive to vitamin C. Ten grams of spinach, canned by this method when fed as the sole source of vitamin C failed to appreciably delay the onset of scurvy or to prolong the lives of the experimental animals. Animals receiving 10 grams of spinach steamed for 15 minutes, (the preliminary blanching process) developed scurvy at an early date but they lived longer than the animals receiving the pressure canned spinach. These results suggest that the greater part of vitamin C is destroyed in the blanching process.

Women's Coats

This is a study of the quality and relative cost of women's coats from typical retail stores of the state. The object of this project is to determine the construction of the material in women's coats in relation to their wearing qualities and their cost.

Under the construction of the material, physical, chemical and microscopic analysis has been made. The weight per square yard, the weave, the number of picks and ends, number of twists per inch in yarn and length of fibres have been studied. Tests have been made to determine the percentage of moisture the material holds at ordinary atmospheric conditions. Chemical tests have been made to determine the percentage of dyes and other finishing material, and also to determine the percentage of wool, cotton, and silk in each piece of fabric.

Microscopic studies have been made to determine the average number of fibres in the warp and in the filling of each piece of material and the variations in width of such fibres in microns. The condition of the wool fibres, as to the prevalence of split and broken fibres and the absence of epidermis, has been studied. Micrographs have been taken of portions of the yarn to show variation in size of fibres, and typical damaged fibres.

The wearing qualities have been considered under strength of material, fastness of dyes and resistance to weathering. The tensile strength and friction test is yet to be made. Tests on dyes have been made as to fastness to weathering; to oxidation; to light, mud, dust and water; to alkali; to acid; to hot pressing and to rubbing. The effect of weathering on shrinkage, texture, and strength have been studied.

Eleven coats have been carried through this analysis and much interesting data has been recorded, but no conclusions can be drawn until the next two tests on wearing qualities are completed.

The material studied so far are tweeds and twills. Next year pile fabrics will be added.

Respectfully submitted,
Edith Pierson,
Dean.

Department of Farm Economics

Director J. W. Wilson,
Experiment Station.

My dear Sir:

In response to your request I am submitting a brief report in connection with the experiment station projects of this department.

Farm Organization in Brown County

The purposes of this study are: to ascertain the amounts of the various factors of production required for operation of farms in this area; to determine what variations occur in the requirements of such factors per unit of production; to determine to what extent various methods of combining enterprises on these farms and a more efficient use of the agencies of production can be made to improve farm profits in this area. From the detailed records secured in the study, the more efficient production methods, and the more profitable choices and combinations of enterprises will be shown, and an effort will be made to establish standards of efficiency which farmers in this region may use as guides for better and more profitable farm organization and operation.

Investigations were begun in December 1924, complete detailed data being assembled through regular visits of a field man to the farms being studied. The field data thus secured are being assembled, posted, and analyzed by the project leader and his assistants.

A preliminary report on the financial phases of this project for the year 1925 has been prepared and distributed to those most interested. Requests for copies and comments by various people over the state have indicated considerable interest in this report. Wide variations in costs were found. For example, wheat production costs varied from 74 cents a bushel on the low cost farm to \$1.65 on the farm having the highest cost. The production of oats varied in cost from 18 cents a bushel to 31 cents a bushel. Barley from 26 cents to 56 cents and corn from 51 cents to \$2.20.

Similar variations were found in the costs of livestock production. The cost of a pound of butterfat varied from 33 cents to 66 cents, while the cost of 100 pounds of pork varied from \$6.06 to \$28.33.

Likewise operators' earnings varied widely, the low farm showing \$723 as compared to the high farm's \$5039. Labor and management wages likewise varied greatly from minus \$1038 to plus \$3298. In considering these figures, the fact should be kept in mind that 1924 was, in this area, the most profitable year since 1919.

The data so far collected together with those later to be secured from these farms will be analyzed to determine causes of these variations,

and to bring out variations in efficiency in the use of the physical factors of production.

Farm Organization and Management in East Central South Dakota

Investigations in this area similar to those above described for Brown County were begun January 1, 1922, and the field work was completed in December 1924. The South Dakota Department of Agriculture and the Bureau of Agricultural Economics of the United States Department of Agriculture cooperated in the work.

Data from these investigations are reported in circulars 4 and 8 of the South Dakota Department of Agriculture. These, however, were only reports, and a much more complete analysis of the data is now being made. One bulletin dealing with the use of farm management data in improving the organization of farms and based upon data from the Kingsbury county route has been prepared and has been submitted for publication to the United States Department of Agriculture. A more complete analysis of many different phases of the management of these farms is now being prepared. It had been planned that this would be completed by July 1, 1926, but it has been found to involve a great deal more computation and analytical work than was at first anticipated, and work is still being done on it.

Credit Needs of South Dakota Agriculture

The preliminary phases of this project have been made in cooperation with the Division of Agricultural Finance, Bureau of Agricultural Economics, Washington, D. C. The first step has been a first hand study of the assets and liabilities of a group of farmers in Lake County, South Dakota, securing information as to the amount of liabilities, the source of loans, the progress of farmers since coming to the farms they now occupy, interest rates, etc. This first study is designed primarily to gain familiarity with the problems involved and to develop methods of study. A progress report covering this phase of the study will be available within a few weeks.

Elevator Management, Financing, and Organization

The handling of agricultural production through agencies based upon the cooperative plan of organization is very extensive in South Dakota, and apparently is on the increase. Very little study has been given to the specific management problems of these organizations. This is especially true of the farmer owned grain elevators of which there are about 300 in the state. In some respects the problems of the elevators in this area are different from those of nearly all other parts of the country. South Dakota elevators handle coarse grains to much larger extent than do North Dakota elevators. On the other hand South Dakota elevators depend much more largely upon borrowed money for financing than do the elevators of many of the states of the corn belt.

Analysis of the studies already in progress and of those which have been completed especially those of the Minnesota College of Agriculture and of the United States Department of Agriculture, has indicated that one of the phases of this problem which has had least study has to do with the financial organizations of these elevators. This problem is

especially pertinent in South Dakota where considerable financing difficulties have been encountered by many of the elevators as a result of rapid price changes in the commodity handled.

The first approach to the problem has been an effort to determine the principal causes of failure and other financial difficulties on the part of farmer-owned elevators. Only a small portion of the time of one man has been available for this project and only a start has been made on it. All elevators, either now in existence or previously existing in the counties of Codington and Clark, and which have had financial difficulties, were visited during the past year and a schedule was completed for each elevator. In many cases further and more detailed study of these elevators will be needed.

Questionnaires were sent to all elevators in the state covering various items for the years 1920 and 1925. Sixty-nine replies have been received and others are still coming in. The growth of business during this period has been indicated by the fact that the reporting elevators averaged in 1920, 135 members each, and in 1925, 147 members each. The number of patrons in 1920 averaged 209 and in 1925, 238. The volume of business in 1920 averaged \$235,054.00 and in 1925, \$234,983.00. This figure is not corrected for change in price level. The average valuation of buildings and equipment in 1924 was \$17,162.00, and the average number of men employed 2.2 per elevator.

Owing to re-arrangement of research time, the leader on this project will be able to devote more time to it this year than was possible last year as he has been relieved of one of the projects assigned to him. Assurance of cooperation from various elevators and auditing companies indicates a possibility of good progress on the project during the coming year.

South Dakota Prices and Production

It was found upon undertaking this project that conditions varied considerably in different parts of South Dakota, especially as to such crops as potatoes and corn of which the state has both surplus and deficiency areas. Considerable interest has been manifest as to whether more movement of surplus crops within the state to deficiency areas also in the state would be profitable. It was found, however, that a necessary first step in a careful analytical study of this problem is to secure satisfactory historical data as to prices in each of the principal divisions of the state. Consequently steps have been taken in cooperation with the agricultural statistician for the state to secure from all possible sources historical price data by districts and counties, the federal statistician contributing supervision and considerable of the work on the project up to this time, and the station contributing most of the clerical work.

A systematic search has been made for historical records. A mailing list of about 1500 names representing every community in the state has been canvassed. Also about 1500 other parties whose names have been suggested by leads from the first inquiries or from the price statistician at Washington. The agricultural statistician has sought during his traveling over the state for sources of price records. Also a number of old records have been secured as a result of news stories being sent out. These have had rather wide circulation. Farm records which go

back as far as 1890 and a few back to the early eighties have been secured. Besides the records which are fairly complete, a number of fragmentary records have been sent in response to inquiries.

These records have been drawn up on commodity sheets, sorted, and then tabulated by districts. Prices are being secured on about fifteen commodities. Link relatives and weighted annual prices are being used as a basis for extending such computations, as far back as possible, also a system of weighting by districts and by months.

In like manner a complete historical record of production by counties and by districts is being developed. Material on this phase of the subject is much more complete and the two series together will contribute very materially to the effective study of price relationships within the state. Other colleges are beginning similar investigations, but South Dakota is in many respects uniquely situated for carrying out such a study.

Ranch Organization in the Great Plains Area

The range areas of South Dakota and its neighboring states on the north and west have been greatly affected by the agricultural conditions of the past few years. Those areas are, for some types of farming, marginal and submarginal areas, while for other types of farming they represent rather ideal production conditions. Preliminary study of the problems of this area has been carried on by the South Dakota Department of Agriculture cooperating with this institution for several years back. However, it has been felt both by the United States Department of Agriculture and by this department that more intensive study was needed. In view of this fact, a conference was called during the summer of 1925 by the Bureaus of Agricultural Economics and Animal Industry of the United States Department of Agriculture. This included the state agricultural colleges of South Dakota, North Dakota, Montana, and Wyoming. As a result of the preliminary study of the problem, agreement was reached between these four stations and the two cooperating bureaus to cooperate in employing an experienced and competent field man to make a careful first hand study of the organization and operating methods of 60 ranches, located in the adjoining corners of the four states involved.

Active work on this project was started about February 1, 1926. The project has not yet proceeded far enough to provide a great deal of data for analysis, but is expected to be ready for more of the tabulation and analytical work before the end of this fiscal year. There is also a considerable amount of statistical work to be done in assembling and tabulating the results of previous studies of the area.

Taxation Problems of Agriculture

The project in question is in a comparatively new field of study, and has been pursued only one year under the experiment station with a comparatively small part of one man's time assigned to it. Arrangements have been made and funds assigned for a full time man to proceed with the project during the coming year.

Tax records obtained from the state auditor and state tax commission are being analyzed for the purpose of studying the causes of increases in taxes during recent years. The sources of funds have been

tabulated under general headings with a view to later analysis to determine possible alternative sources of revenue. Also considerable work has been done in determining which factors have been responsible for tax increases and which subdivisions of the state have made these increases in levies. This has included a study to determine to what extent the increases in real estate taxes have been caused by higher levies by the state and by each of its subdivisions; and to what extent and for what purposes expenditures have been increased in each subdivision of the state.

Detailed analyses having to do with the relation of net earnings to taxes paid have been made for the 1919 and 1924 years for the following counties: Brookings, Hamlin, Pennington, and Beadle. Tabulations from these counties show that 17½ per cent of the average net rent from farms in the five counties analyzed went to pay taxes in 1919 and 33½ per cent in 1924. Some very valuable data as to the relative tax burdens on different classes of property is also being found.

There is much further detailed study to be done on this project and it is hoped that it will be possible to push it forward to completion during the coming year, though somewhat more time than that may be required.

Sincerely yours,

M. R. Benedict,
Professor of Farm Economics.

Department of Horticulture

Director James W. Wilson,
Experiment Station.

Dear Sir:

I have the honor to submit the following report for the fiscal year ending June 30, 1926.

Fruit Breeding

For many years past the main experiments in apple and other fruit-breeding in this department have been made to determine the relative merits of homozygous and heterozygous material. A report of progress along this line is being prepared. The evidence accumulating year by year indicates that it is better to use homozygous parents rather than heterozygous parents in developing new and valuable types.

The breeding of hardy plums and sand cherries was continued on a large scale in the fruit-breeding greenhouse during the winter. Considerable fruit was secured. In the orchard, the hybridization of the apple was continued as usual. One tour was made to Iowa to obtain apple pollen. Some of the new red raspberries show much resistance to mosaic.

Horticultural Explorations

The plant collecting tours in 1925 included three trips into northern South Dakota and North Dakota. One of these tours extended to the Turtle Mountain region in North Dakota just over the Canadian line, returning by the way of the headwaters of the Mississippi River in Minnesota. Just before winter set in, a plant-collecting tour was made to the

western shore of Lake Michigan and to the northwest shore of Lake Superior. Further progress was checked by the snow.

New Plant Introductions

From the many thousand seedling fruits now coming on in this department, individual plants are selected as soon as they are deemed worthy of propagation and are introduced. The following varieties were introduced in the spring of 1926: four varieties of pears, one grape, one crab, one walnut, one rose, eight muskmelons, and a white-seeded white-flowered alfalfa.

Breeding Hardy Roses

The work of breeding hardy roses was continued on a large scale. One of the seedlings blossomed out with fully one hundred petals which is a decided improvement over its ancestor, the wild rose with five petals.

Progress with Pears

About 50,000 pear seedlings were grown in 1925 from the seed collected in North Manchuria in 1924. Some of them were transplanted on the grounds of this Department, many were sent to various parts of South Dakota and to other states, but the largest number was planted in the State Orchard at Watertown. The following pears were distributed for the first time: Harbin, Mugden, Chang, and Simola.

Harbin Pear.—Offered for the first time. *Pyrus Ussuriensis*. is the pear of northern Korea and Manchuria and also the Pacific Coast of Siberia. It varies much from seed. In 1924, seed from many thousand pounds of the fresh fruit was gathered in the mountains of North China, in a region approximately fifty miles east of Harbin which is very near the western limit of this species. In this region the temperature ranges to about 47 degrees below zero F. The fruit of the largest pears is 2½ inches in cross diameter and 2 inches in long diameter. The fruit varies in shape but is mostly rounded, tapering toward the stem. The foliage becomes ornamental in fall, owing to the bright red and yellow coloring. They may be hardy enough for street and lawn trees at the far North. The term, Harbin pear, is now given to this importation to distinguish it from importations of uncertain or more southern origin. This new material should be utilized in three ways:

1. Seedlings should be planted out for fruiting to provide hardy blight-resistant nursery stocks for the new hybrids which are coming on.
2. The fruit may be improved in size and quality by seedling selection through several plant generations.
3. As rapidly as possible these pears should be hybridized with the large, fancy-flavored pears from west Europe.

There is much room for improvement in the flesh in flavor but it furnishes the best starting point for hardy pears strongly resistant to blight and hardy far north. As soon as possible we should combine the winter hardiness and blight resistance of this Siberian pear with the large size and fine quality pears of west Europe. This would make it possible for many northern states to grow pears where it is not possible at the present time. The flesh is white, juicy, with much grit. The fruit ripens late and keeps well, at any rate until late in the fall.

Mugden Pear.—Offered for the first time. This name is given to

seedlings of a small, early, yellow pear about $2\frac{1}{2}$ inches in diameter found on the 1924 trip shipped in large quantities from further south into Harbin, Manchuria. The trees, it was said, are very early in bearing. This will probably not be hardy far north but is more for the latitude of Nebraska and Iowa. It was impossible at the time to determine the exact origin of these pears. The fruit ripens much earlier than the local native pears of the Harbin region. The fruit, while small, is juicy and of pleasant flavor, although it is probable that none of these oriental pears have the high spice of the best pears of west Europe.

Chang Pear.—Offered for the first time. This seedling was grown from fruit grown on the trees of *Pyrus Simoni*, a Chinese wild pear received many years ago from Arnold Arboretum, Boston, Massachusetts. The original tree bore fruit in 1923 and 1924. Fruit, clear yellow, oblong pyriform; flesh, white, firm, juicy. As described in South Dakota Bulletin 159, further investigations by Alfred Rehder at the Arnold Arboretum divide the species so that the tree is now called *Pyrus Ovoidea*. The bright red leaves in autumn are attractive. The first fruits of this select seedling pear, Chang, are $1\frac{3}{4} \times 2\frac{1}{4}$ inches in diameter and of fair quality. Experience here at Brookings indicates that the ordinary commercial *Pyrus Ussuriensis* stocks winter-kill readily, so these trees should be mulched carefully in winter to prevent root-killing.

Simola Pear.—Offered for the first time. Fruit yellow, acute pyriform with a long stem; the first fruits are $2 \times 2\frac{1}{2}$ inches in diameter. The original tree is of tall upright habit and fruited in 1923 and 1924. Pedigree: *Pyrus Simoni* x *Marguerite Marillat* pear pollen. The original *Pyrus Simoni* trees were received from the Arnold Arboretum, Boston, Massachusetts, many years ago. The juicy, pleasant flavored fruit is somewhat larger than the typical *Simoni*.

SUNGARI GRAPE

This is *Vitis amurensis*, Rupr., a wild grape found in great profusion in the mountains, beginning a few miles east of Harbin, North China, and extending east to the Pacific Ocean. The wild-flavored berries are somewhat larger than our wild grapes. Some of the berries are $\frac{5}{8}$ inches in diameter; color, purple black. In autumn the foliage becomes very ornamental with purple and red tints, so that this grape should be well adapted for arbors. These plants are one-year seedlings.

MANCHURIAN CRAB

These are seedlings of *Pyrus baccata*, var., *Mandshurica*, Maxim, a form of Siberian crab grown from seed gathered in 1924 in the mountain region, about fifty miles east of Harbin, Manchuria. The small fruit varies in size; tree of somewhat stronger growth than the ordinary Siberian wild crab and for that reason is worthy of testing as a stock. The tree is quite ornamental, heavily branched in the open but grows taller when crowded by other trees in the forest.

MANCHU WALNUT

Offered for the first time. The local Harbin form of the Manchurian Walnut, *Juglans Mandshurica*, Maxim. The nuts are larger than those illustrated in Bailey's Encyclopedia of Horticulture under this species. Grown from native seed obtained at Harbin, China, in 1924.

TEGALA ROSE

Offered for the first time. This attractive deep pink rose blossoms very freely in June, and is semi-double much like the *Tetonkaha* Rose, but more dwarf in habit. The plants offered are all sprouts from one original planting. Growth up to about 4 feet in height without pruning. Pedigree: *Tetonkaha* x *Rosa gallica grandiflora* pollen.

MANCHURIAN MUSKMELONS

In a search for pears along the Siberian railway in North China, many small samples of Chinese muskmelons and other vegetables were secured. In the hands of melon-breeder, the muskmelons might be of value from the plant-breeding standpoint as a starting point for new varieties. Seed of eight varieties was distributed.

WHITESEED ALFALFA

Offered for the first time. In 1921 white-seeded and white-flowered alfalfa was announced, but was not ready for distribution. Since then many inquiries have been received for seed. In the beginning I had over 40,000 white-flowered alfalfa plants, but how to breed this color true, both as to flower and seed has been a problem. This would be desirable as the farmers would know before sowing what they are getting. So far as I know this is the first alfalfa with a definite trademark—an easily distinguished characteristic for the protection of the purchaser. Both seed and flower are white. The pedigree indicates hardness sufficient for all practical purposes, even far to the North and for dry uplands. But this must be determined by actual comparative field trials with other varieties. The work of selection is not yet completed. I now have 396 plants in the field all with white flowers and white seed and all grown from seeds of plants bearing white flowers and white seeds. These individual plants are all of strong and vigorous growth and productive of seed and forage, but no comparative tests have been made with other varieties.

STATE ORCHARDS

In the spring of 1926, the State Board of Charities and Corrections assigned for the use of this department twenty-five acres more land at Watertown and ten acres at Sioux Falls, making a total of forty acres at Watertown and twenty-five acres at Sioux Falls. Eight acres more were brought under cultivation at the State Orchard at Eureka. This affords opportunity for the fruiting of many thousand seedlings and the selection of the best for future propagation.

Yours truly,

N. E. Hansen,
Horticulturist.

Department of Poultry Husbandry

Director J. W. Wilson,
Experiment Station.

Dear Sir:

In keeping with your request, I am submitting a report of the experimental work carried on in the Poultry department for the year 1925-1926.

Poultry Marketing

Under the Hatch Fund we have continued the work in direct marketing of poultry products. Eggs marketed in Eastern markets have returned a margin of profit over local markets in all months except March, April, and May but each year the margin has decreased. In 1923 the maximum margin was 22 cents per dozen; in 1924, 12 cents; and in 1925, 4 cents. Local markets have greatly improved and follow more closely the Eastern markets. The main criticism of eggs from this section is that they show excessive evaporation and run high in under-weight eggs.

Several shipments of live fowls were made to Chicago markets and on closely selected, heavy stock good margins over local prices were realized.

The electric lighting experiment was badly broken up the past winter on account of condemnation of wiring and the need of rewiring the plant.

Feeding Fibre and Farm Grains

Experiments in feeding fibre grains and general farm grains along with a balanced ration containing 20 per cent tankage mash duplicated our previous results. Fibre grains alone gave poor production and threw hens out of condition, while corn and wheat added to mixture gave better production but not nearly so large or economical production as did the full mash ration. For health and profit, the balanced ration seems essential.

Poultry Housing

To retain the animal heat and at the same time provide for escape of moisture and inter change of air is the big problem in poultry housing. Our best results thus far have come from use of wind bafflers in south wall of building and at east and west gables over straw lofts supported by octagonal mesh poultry netting. Open cupolos on roofs above straw loft and galvanized metal shafts extending from below ceiling up through roof have been combined with wind baffles to good advantage.

Alfalfa for Poultry

Under the Purnell Fund we have conducted experiments to determine best use of alfalfa in poultry feeding. Alfalfa meal was used to replace bran and middlings in the mash and up to 40 per cent of the mash ration, a 20 per cent alfalfa meal mash gave practically as good production as a 20 per cent bran or 20 per cent middlings mash. The other ingredients in the mash being corn meal and tankage but the higher percentage of alfalfa seemed to lower the production. Alfalfa fed green gave as good results as sprouted oats but could be used through much more limited

season. Alfalfa hay and soaked alfalfa chaff were also used but with no marked advantage. If one can grind alfalfa on the farm, it apparently offers a fine poultry mash ingredient at a low cost.

Comparison of Protein Feeds

In our experiment to compare feeding values of protein feeds, milk powder, tankage, meat scrap, soybean meal, ground soybeans, and cotton seed meal were used but some difficulty was met in trying to get enough pens of birds under same conditions for the work. Best results were obtained from milk powder tankage and meat scrap with quite a drop off for soybean meal, ground soybeans, and cotton seed meal. Of the last three mentioned ground soybeans gave best returns. This work is more or less preliminary and needs to be worked out more completely. A ration balanced up with 10 per cent tankage and 10 per cent milk powder gave the most economical egg production and the birds also gained an average of three-tenths pounds in weight.

Work with yellow and white corn could not be carried on as the white corn available ran high in moisture content and was not suitable for grinding.

Cafeteria Style Feeding for Hens

To determine if hens would balance their own corn ration, a cafeteria style feeder was arranged with ingredients of a balanced ration in separate compartments. Throughout the test some ingredients like bran, middlings, tankage, and ground oats and alfalfa meal were eaten very sparingly while others like meat scrap and corn meal were dipped into much more freely, the corn meal being consumed in large quantities.

Raising Chicks

It is often asserted that chicks need to get out on the ground to do well. To test this out a flock of chicks were put in a room with board floor under an electric brooder and fed a good scratch and mash. They received sunlight through open windows but no green food. They were kept in this environment for seven weeks or until all were well feathered and able to do without artificial heat. At this time, they were in excellent condition and weighed on an average nearly 1½ pounds each. It would seem that if birds have proper feed elements and sunlight the soil is not essential.

Incubation

Tests were made of temperature readings in various parts of different incubators and considerable variation noted in some cases as much as three degrees. In glass front machines the low temperatures were near the front. In some where no shield was used under heating pipes, the temperature ran relative high. The test showed the necessity of shifting the position of eggs in the trays during the hatch. Eggs not shifted gave very low hatches.

Hatches run with relatively low evaporation from eggs seemed to give heavier and fluffier chicks.

Yours truly,

G. L. Stevenson,
Poultryman.

Department of Rural Sociology

Director James W. Wilson,
Experiment Station.

Dear Sir:

In keeping with your recent request, I am submitting herewith a report of the reseach work accomplished during a portion of the year ending July 1, 1926. This is the first attempt in this institution of any such work being done in rural sociology, the department having been started September 1, 1925.

The following project has been conducted, partly under Prunell funds and partly from funds supplied by the section of Rural Life Studies in the Federal Bureau of Agricultural Economics.

Rural Social Agencies in South Dakota

The scope of this study has been to ascertain the extent, location, nature and trend of the important social agencies of the state. The federal census statistical definition of "rural" has been used denoting open country and all villages and towns up to 2500. Throughout, the objective has been to determine how well adapted these agencies are to the needs and development of a stable agriculture.

The following agencies have been studied grouped under six different headings:

Community Organization Farmers' Clubs	Communicational Rural Press Library Service	Educational Rural Elementary Schools High Schools Extension Clubs Parent-Teachers Ass'n. Fairs
Religious Rural Church Ind. Sunday Schools	Sociability Recreational Agencies Movie Theatres Dance Halls Pool Halls Community Music Picnics Fraternal Orders	Social Welfare Health Agencies Physicians Public Health Nurses Hospital Service County Health Units Child Welfare Agencies

It is recognized that some of the above agencies are voluntary, others are tax supported while the remainder are purely commercial. Some of the agencies are merely branches of statewide or national organizations while others are independent local groups. Inasmuch as all of these agencies are fairly well established as a part of the community life in the state and function in meeting the social needs of rural people, their being included seems justifiable.

The procedure followed in obtaining data for the study has been by personal interviews with leaders of state-wide agencies, analysis of published reports, questionnaires sent out to leaders or local agencies and by personal correspondence. A total of 24 maps have been made setting forth the location and extent of above agencies within the state. Numerous statistical tables and charts, together with other data, has been pre-

pared dealing with the nature and apparent trend of these agencies. Much of this material can be used to distinct advantage as information for extension workers, social workers and class room work with students.

After completing the study in a preliminary way, it was felt that perhaps some of the material would be too bulky and general for publication. Consequently, at the present time, the original scope of the study is being modified so as to obtain more detailed information relative to three or four of the more important social agencies such as the rural public school, the country church, the rural library service and health agencies available to rural people. This material is being gathered largely by questionnaire and is now coming in rapidly. It is hoped that final report on this study can be made within the present calendar year of 1926.

Respectfully submitted,

W. F. Kumlien,
Prof. of Rural Sociology.

Department of Veterinary Science

Director James W. Wilson,
Experiment Station.

Dear Sir:

Complying with your request for a brief report covering the progress made on the investigation of hemorrhagic septicemia in farm animals and fowls by the Animal Health Laboratory of State College, permit me to submit the following:

Work on the Adams Fund project stated above is progressing according to our original plan. A large number of strains of hemorrhagic septicemia bacilli have been studied microscopically, culturally and by inoculations into test animals. Numerous new facts have been collected thus far and it may be that some additional new information will be developed before the project is completed. A year or more of work will be required in order to secure the information that we think should be on hand before a final report is formulated.

Yours truly,

C. C. Lipp,
College Veterinarian.

Financial Report

EXPERIMENT STATION FUNDS FOR 1925-26

United States Appropriation

	Hatch	Adams	Purnell
Received from U. S. Treasurer.....	\$15,000.00	\$15,000.00	120,000.00
Expenditures:			
Salaries	\$ 8,228.25	\$ 8,378.22	\$12,925.26
Labor	8,020.25	8,031.63	2,884.18
Stationery and Office Supplies	20.89	2.08	63.63
Scientific Supplies Consumable	430.21	592.47	630.04
Feeding Stuffs	191.30	240.22	608.34
Sundry Supplies	140.31	1,119.64	9.15
Communication Service	15.55	52.39	6.76
Travel Expense	225.55	720.16	1,036.82
Transportation of things	24.30	207.60	73.66
Publications	1,863.81		
Heat, Lights, Water, etc.....		9.50	
Furniture and Fixtures	53.27	60.00	956.57
Library		250.37	776.29
Scientific Equipment	649.01	250.37	776.29
Livestock		255.00	
Tools, Machinery and Appliances	137.30	80.72	21.75
Totals.....	15,000.00	15,000.00	20,000.00

SUBSTATION FUND

	Cottonwood	Eureka	Highmore	Vivian
State Appropriation	\$3,230.00	\$3,230.00	\$3,230.00	\$3,230.00
Expenditures:				
Salaries	\$2,381.65	\$2,009.99	\$2,183.54	\$1,586.42
Labor	257.41	735.49	458.70	439.00
Feeding Stuffs	9.28		4.00	120.55
Sundry Supplies	78.73	21.95	21.41	6.25
Communication Service	24.00	9.80	3.30	3.00
Travel Expenses	74.55	99.14	128.63	23.05
Transportation of things	2.08	2.47	4.60	58.79
Heat, Light, Water, etc.,	38.57	9.76	32.15	58.79
Scientific Equipment				
Tools, Machinery & Appliances	23.45	18.40	23.77	648.69
Buildings & Land	16.65		46.90	21.25
Totals	2,906.37	2,907.00	2,907.00	2,907.00
Balance	323.63	323.00	323.00	323.00

HORTICULTURE & LIVESTOCK EXPERIMENT FUND

Appropriation		\$20,000.00
Expenditures:		
Salaries		\$ 2,349.98
Labor		6,825.66
Stationery & Office Supplies		75.79
Feeding Stuffs		1,863.66
Sundry Supplies		203.06
Communication Service		132.46
Travel Expenses		476.01
Transportation of things		446.29
Heat, Light, Power, Water		6.78
Furniture & Fixtures		43.03
Livestock		4,455.49
Tools & Machinery		31.72
Total		17,909.93
Balance		2,090.07
		20,000.00

EXPERIMENT STATION

37

POTATO EXPERIMENT FUND

Appropriation		\$1,000.00	
Expenditures			
Salaries	\$794.99		
Labor	90.00		
Sundry Supplies	14.92		
Total	899.91		
Balance	100.09		1,000.00

BARBERRY ERADICATION OR RUST EXPERIMENT

Appropriation		\$5,000.00	
Expenditures:			
Salaries	\$2,583.27		
Labor	252.90		
Feeding Stuffs	121.52		
Sundry Supplies	28.58		
Communication Service47		
Travel Expenses	764.85		
Transportation of things	9.27		
Publications	515.04		
Tools & Machinery	65.90		
Contingent (supplies)	5.00		
Total	4,346.80		
Balance	653.20		5,000.00

SOIL SURVEY FUND

Appropriation		\$10,000.00	
Expenditures:			
Salaries	\$4,608.24		
Labor	470.80		
Scientific Supplies Consumable	532.63		
Sundries Supplies	70.01		
Fertilizer	23.82		
Communication Service	10.10		
Travel Expenses	1,320.24		
Transportation of things	122.26		
Publications	1,200.00		
Scientific Equipment	436.67		
Tools & Machinery	9.22		
Buildings and Land	196.50		
Total	9,000.49		
Balance	999.51		10,000.00

SEED TESTING FUND

Appropriation		\$1,000.00	
Expenditures:			
Salaries	\$958.32		
Balance	41.68		1,000.00

ANIMAL HEALTH LABORATORY

Appropriation		\$8,000.00	
Expenditures:			
Salaries	\$5,583.30		
Labor	206.91		
Stationery & Office Supplies	18.02		

ANNUAL REPORT

Scientific Supplies Consumable	725.64	
Feeding Stuffs	200.93	
Sundry Supplies	109.48	
Communication Service	58.24	
Travel Expenses	19.28	
Transportation of things	54.41	
Furniture & Fixtures	6.00	
Library	50.80	
Scientific Equipment	130.37	
Livestock	36.55	
Total	7,199.93	
Balance	800.07	8,000.00

EXPERIMENT SUBSTATION FUND

Balance on Hand July 1, 1925					\$6,507.23	
Receipts:						
Land Endowment					4,800.32	
Sales Cottonwood Sub Station					226.74	
Sales Eureka Sub Station					646.60	
Sales Highmore Sub Station					560.37	
Sales Vivian Sub Station					1,246.11	
Total Receipts						\$13,987.37
Expenditures						
Salaries						Total
Labor	\$ 80.00	\$ 430.00	\$ 510.32	\$1280.23		\$2300.55
Scientific Supplies Consumable	14.00	160.00	57.10		231.10
Feeding Stuffs		9.58	37.70	665.59		712.87
Sundry Supplies	56.83	53.12	89.84	250.75		450.54
Fertilizer	17.47	17.06	62.77		97.30
Communication Service	27.63	40.07	24.37	44.02		136.09
Travel Expenses	68.82	153.98	116.88	1.25		340.93
Transportation of things	2.38	1.26	5.18	9.40		18.22
Heat, Light, Water, etc.	24.76	40.90	13.50	49.54		128.70
Furniture & Fixtures				28.69		28.69
Scientific Equipment	13.33	13.33	13.33	13.34		53.33
Livestock				3.00		7.75
Tools & Machinery	157.05	144.15	143.40	130.10		574.70
Buildings and Land		123.05	181.90	199.65		504.60
Totals	462.27	1186.50	1259.29	2681.56		5589.62
						8,397.75
Balance on hand June 30, 1926						13,987.37

LIVESTOCK EXPERIMENTAL REVOLVING

Balance on hand July 1, 1925	\$1585.97	
Receipts (Sales of Stock)	2277.74	
Total Receipts		\$3863.71
Expenditures:		
Salary	307.37	
Feed	3324.37	
Sundry Supplies	48.92	
Livestock	120.00	
Tools and Machinery	23.61	
Total Expended	3824.27	
Balance on hand June 30, 1926	39.44	
Total		3863.71

EXPERIMENT STATION

39

LIVESTOCK PUREBRED REVOLVING

Balance on hand July 1, 1925.....	\$1291.38	
Receipts (Sales of Stock)	800.62	
		\$2092.00
Total Receipts		
Expenditures:		
Livestock Purchased	442.74	
Balance on hand June 30, 1926	1649.26	
		\$2,092.00
Total		

SALES FUND

Balance on hand July 1, 1925.....		\$2,286.36
Received from sales of produce		\$6,245.95
Total Receipts		\$8,532.31
Expenditures:		
Labor	\$1,704.05	
Stationery & Office Supplies	48.11	
Feeding Stuffs	3,286.21	
Sundry Supplies	301.71	
Fertilizer	57.03	
Travel Expenses	104.02	
Transportation	5.48	
Furniture & Fixtures	57.03	
Livestock	740.45	
Tools & Machinery	142.02	
Total	6,446.11	
Balance on hand	\$2,086.20	\$8,532.21
In addition to the above amount there were transfers of property between departments to the value of		\$402.77