Agricultural Research
in South Dakota

Fifty-seventh Annual Station Report
July 1, 1943 to June 30, 1944

AGRICULTURAL EXPERIMENT STATION
South Dakota State College of Agriculture and Mechanic Arts
BROOKINGS, S. D.
Letter of Transmittal

Dean A. M. Eberle,
Division of Agriculture,
South Dakota State College.

Dear Dean Eberle:

This publication embodies the Fifty-seventh Annual Report of the South Dakota Agricultural Experiment Station, involving the fiscal year July 1, 1943 to June 30, 1944.

The Report includes the activities of the Agricultural Experiment Station at South Dakota State College, the four substations at Cottonwood, Eureka, Highmore and Vivian, and the livestock research activities at the U. S. Belle Fourche Field Station at Newell. In order to more effectively serve the agriculture of the state some of the research activities have been conducted on the soils or in the areas of the state where the problems exist, such as, the soil fertility experiments, the selenium problem at the Reed Ranch, the shelter belt investigations in the Brown-Marshall Soil Conservation District, and the sheep parasite problem in northwest South Dakota.

In order to more effectively present the results of the experimental work conducted by the Station, field days have been held such as the Agronomy Field Day and Livestock Feeders Day. New crop varieties have been developed and the seeds from these will be distributed as quickly as quantities of the seed can be made available. In planning the future agriculture for the state, the results of the experimental work will be found useful by the local, state and federal agencies involved. The staff members of the Station have participated in formulating the agricultural production possibilities for South Dakota for both the war and the post war periods.

In spite of the handicaps due to shortage of trained scientific personnel and the inability to always secure the needed equipment and supplies, a well-rounded research program has been conducted and achievements have been attained in behalf of South Dakota agriculture.

Respectfully submitted,

[Signature]

Director, Experiment Station
Agricultural Research in South Dakota

Fifty-seventh Annual Report
July 1, 1943 to June 30, 1944

South Dakota Agricultural Experiment Station
I. B. Johnson, Director

SOUTH DAKOTA STATE COLLEGE
of Agriculture and Mechanic Arts
Brookings, South Dakota
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Soils and Crops

New Fertilizer Tests Started. Seventeen new fertilizer experiments were started in 1944. From these experiments it is hoped to find the answers to many of the questions South Dakota farmers are asking about the use of fertilizers.

The experiments have been laid out on private farms in nine counties in eastern South Dakota. Two hundred four fertilizer treatments were applied on pastures, small grain, corn and potatoes. Some plots received only nitrogen, phosphorus or potash, but on others various combinations of these plant foods were used. Some plots received as little as 100 pounds of fertilizer an acre, and others received as much as 600 pounds.

Results from these experiments should indicate not only the kinds of fertilizers suitable in various parts of the area, but also the amount to use for the most profitable return. (Project 46. Leaders: L. F. Puhr and W. W. Worzella, Agronomy Department.)

Soil Management Studied. Soil management investigations include tillage methods, comparison of legumes and grass rotations for the maintenance and addition of nitrogen and organic matter to the soil, and the use of nitrogen, phosphorus and potassium fertilizers at various rates and combinations.

Special attention is being given to the fertility value of returning all crop residues to the soil and effect of incorporating these residues in the soil by plowing and sub-surface tillage.

Corn, oats and wheat on Barnes loam soil were not decidedly influenced by application of nitrogen, phosphorus, and potassium commercial fertilizers alone or in combination in 1943.

On the tillage and residue plots, yields of corn, oats and wheat obtained from the sub-surface tilled and from the plowed plots were equal. The return of crop residues from the previous year’s crops brought some increase in yields. Return of all crop residues, the experiment indicates, have a beneficial effect on crop yields and may aid materially in maintenance of nitrogen and soil organic matter in subhumid areas. (Project 46. Leader: L. F. Puhr, Agronomy Department.)

Cropping Methods, Fertilizers Affect Soil Composition. The long-time effect of cropping and fertilizer treatment on the chemical composition of soil, with special emphasis on the progressive changes in soil organic matter, nitrogen and phosphorus, is basic to intelligent soil recommendations in South Dakota.

Organic matter, nitrogen and phosphorus analyses were made at successive intervals on eight different soil treatments conducted on Barnes loam during 1915 to 1939.

Soil nitrogen in the surface soil decreased significantly in all plots from 1915 to 1939. Nitrogen changes in sub-surface soils were small and insignificant for the same period. Application of inorganic fertilizers including nitrogen did not help in the maintenance of the soil nitrogen level in the surface soil.

Plots which did not receive phosphorus fertilizer showed a downward trend in total phosphorus. Plots which received phosphorus fertilizer showed significant gains in total phosphorus during the 25-year period.

During the 25-year period 15 percent of the organic matter was lost from the soil. All plots decreased significantly in organic matter content.

The data obtained indicate that cropping systems commonly used in South Dakota have produced significant reductions in soil nitrogen and organic matter in the soils of the state, and also have resulted in some reduction in soil phosphorus.
Results made available from this study have made possible some practical suggestions and recommendations for good soil management practices, with respect to cropping rotations and use of fertilizers. Application of these recommendations will not only increase crop yields, but also will maintain soil fertility, increase organic matter and conserve water.

This study indicates that unless definite steps are taken by South Dakota farmers to maintain soil fertility, that soils in the eastern part of the state in particular, will hold less water and produce poorer crops in the future. (Project 3. Leader: L. F. Puhr, Agronomy Department.)

**Improved Small Grain Varieties Sought.** Active breeding programs to obtain early and rust resistant varieties of small grains are being conducted. These programs include wheat, oats, barley, and rye.

Uniform nurseries of wheat, barley and flax have been planted and a new cooperative uniform oat nursery was added in 1944. Rod row plots were planted at Brookings, Highmore, Vivian and Eureka and 1/66th of an acre plots were planted at Brookings.

Numerous varieties and segregating populations of crosses are being tested and selected as part of the breeding program. Approximately 800 lines of wheat, 2,000 lines of oats and 5,000 lines of barley are involved. (Project 25. Leader: J. E. Grafius, Agronomy department.)

Two lines of wheat, Rival x Thatcher 2280 and 2259, are being increased and purified with a view to early release to farmers. Three lines of barley, Peatland x Vaughn, 317, 391, and Peatland x Dryland 252 are being increased and purified for the same purpose. (Project 25. Leader: J. E. Grafius, Agronomy Department.)

It pays the farmer to keep crop residues on the surface where they protect the soil from erosion and help keep the rain where it falls. (See Project 46, page 3.)
Vikota—A New Oats Released. A new variety of oats, Vikota, was released to farmers of South Dakota. This variety is medium early oats. It is a rust resistant selection from a Victoria x Richland cross. The line was obtained in 1941 from Dr. H. C. Murphy and L. C. Burnett of the Iowa Experiment station and the United States Department of Agriculture.

More Than 4,000 Barley Strains Collected. In any breeding program, where special needs, such as disease resistance are to be met, it is necessary to search for desirable parental material.

In many cases there are no known sources which fully meet the needs of the plant breeder and subsequently the farmer. This is true for barley, and for this reason the station now is growing more than 4,000 varieties collected by plant explorers in all parts of the world.

A new barley variety possessing all the desired qualifications may not be found in this collection, but it is highly probable that germ plasm usable in the production of better barley varieties for South Dakota will be found. (Project 25. Leader: J. E. Grafius, Agronomy Department.)

Hybrid Corn Adapted for South Dakota. South Dakota farmers are planting some 50,000 acres of corn originating from foundation seed developed from the breeding work done by the Agronomy Department of the South Dakota Agricultural Experiment station.

During the past year 231 lines from 28 adapted open-pollinated varieties of corn, representing 58 sources of new germ plasm were isolated and are being purified. One hundred thirty-seven single crosses made from pure lines selected from 18 adapted varieties of corn for nicking, yield, broken stalks, lodging and diseases also were combined and tested.

Tests were run on 144 double-cross combinations and open-pollinated varieties on six plots located at two substations and four private farms. Four hundred eighty-four double-cross combinations and open-pollinated varieties were tested at Brookings.

The 1943 test showed that the better adapted double crosses yielded 28 percent more than open-pollinated corn. The percentage of moisture in the harvested hybrid corn was lower than for the open-pollinated varieties.

Testing of these unreleased double crosses and released Sokota hybrids has brought information for recommending better adapted hybrids in the areas where corn becomes a greater risk crop. A 20 to 30 percent yield per acre of corn can be obtained in these areas by using a better adapted hybrid. (Project 66. Leaders: C. J. Franzke and A. N. Hume, Agronomy Department.)

Low HCN Sorghums Being Bred. One hundred twenty-five strains and varieties of grain and forage sorghums were tested at plots located at three substations, at Brookings, and on two private farms in the sorghum area.

Fifty-six low HCN content forage sorghum lines were isolated. In the sorghum breeding nursery, 518 combination crosses of grain and forage types are being studied for adaptability, earliness, yield, drought and disease resistance. Last year 30 new combination crosses of grain sorghum were made combining earliness, low HCN, high yield and grain quality.

The low HCN lines vary from a trace to 230 ppm. of HCN, which is considerably lower than the original 39-30-S variety released in 1935. Two of the HCN lines are being increased for distribution and many others appear promising. Testing of the grain and forage sorghums at several locations in the state will furnish basic information for definite recommendations to farmers.
Increased use of sorghum as a crop in the risk corn area has followed swiftly the release of low HCN varieties. Increased forage capacity in these areas has meant that more livestock could be handled during the wartime food production emergency. No livestock losses have been reported from low HCN sorghum forage. (Project 61. C. J. Franzke, Agronomy Department; Animal Husbandry Department cooperating.)

**Sorghum Seed Harvest, Storage Studied.** Harvesting and storage experiments on field scale were carried out with one variety of milo. A 24-acre field was used. A portion was harvested by removing the heads and storing them in slatted cribs with canvas covers. The other portion of the field was harvested with a combine and the grain stored in a wooden farm bin.

Both lots were sampled regularly for moisture, germination and seed-borne diseases. Sorghum grain stored in the head kept better than that harvested by combine and stored in a bin. Germination was higher and molds fewer on the sorghum stored in the head. (Project 112. Leader: E. L. Erickson, Agronomy Department.)

**Adapted Forage Crops Sought.** Demand for forage crops adapted to particular South Dakota areas is rapidly increasing.

Fifty-six lines of crested wheatgrass, 44 lines of brome grass, and 89 lines of *Agropyron intermedium* were grown in greenhouses on indexed soils from different cropping systems. Observations and readings were made on root rot and blight resistance.

Several of these lines were selected for the grass breeding nursery for further observation. Promising results in selecting crested wheatgrass resistant to drought root rots and brome grass resistant to blight seem to be indicated. Thirty acres of

New types of grain sorghum have been developed which allow use of a combine for harvesting. The sorghums (grain and forage varieties) have been a lifesaver for farmers in areas of light rainfall.
Agropyron intermedium and a small plot of Festuca rubra stolonfer have been planted for increase.

Among new species being studied for forage production in central and western South Dakota are six native legumes as well as an introduced plant.

Kochia—A Promising Forage. Kochia hay was found superior in palatability for lambs than good brome grass and western wheatgrass hay. The Kochia hay was inferior to alfalfa in protein content and digestibility, but superior in digestibility of fat and nitrogen-free extract. Also, the fiber content of Kochia was lower than that of alfalfa.

One species of Kochia was used in the experiment. (Project 74. Leaders: E. L. Erickson, C. J. Franzke, Agronomy Department; Animal Husbandry Department cooperating.)

Adapted Soybean Varieties Sought. Addition of a soybean adapation nursery in southeastern South Dakota occurred during the year, in addition to regular testing and breeding work at Brookings.

Twenty-five early and medium early soybean varieties were tested for yields and other characteristics. In addition 400 rod rows of new crosses were grown and the various types harvested separately for further selection and testing. Selections were made from the Manchukota variety.

Inoculation tests indicated that an increase of 20 percent or more may be expected when inoculation is used on adapted varieties. (Leader: E. L. Erickson, Agronomy Department; U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering cooperating.)

Katahdin Potato Variety Resists Scab. One hundred twenty named varieties and lines of potatoes were grown in a nursery for the second time and evaluated for susceptibility to scab. Of the named varieties, the Katahdin has been most free of scab during the two years of the test.

Spindle tuber units again sprouted more slowly than healthy units of the Bliss Triumph variety, especially in a late planting on June 5. A more striking differentiation between foliage of healthy and spindle tuber units occurred in the late planting than in two earlier plantings.

A seed lot grown at a high altitude near Roubaix has remained free of spindle tuber for two seasons; it has been planted there for the third year.

Late blight was first found at Brookings on July 30, 1943, and immediately reported to growers. (Project 107. Leader: W. F. Buchholtz, Plant Pathology Department.)

Tests Started on Wheatgrass. The 16 rotation plots at Brookings and a similar set at Highmore were maintained during the 1943 crop season. Soil samples were taken in October, 1943, and in June, 1944. Crested wheatgrass was sown uniformly on all rotation plots at Brookings and Highmore in November, 1943. Stand counts were made in May, 1944.

Original stands of crested wheatgrass were best on cultivated and fallow land, poor on small grain land, and especially poor on rye plots. Other information remains to be collected and assembled. (Project 115. Leader: W. F. Buchholtz, Plant Pathology Department.)

Sugar Beet Root Pathogens Studied. Soil samples were collected from the four rotations 46 and the continuous beet plots at the U. S. Belle Fourche Field Station, Newell. These samples were analyzed in the greenhouse for content of Apanomyces cochlioides and in the laboratory for content of nitrates and phosphates.
As in other years, only in the old rotation 46 and the continuous beet plots without heavy applications of manure and phosphate fertilizer was *A. cochlioides* present in quantity. (Project 126. Leader: W. F. Buchholtz, Plant Pathology Department.)

**Treated Sooner Milo Yields Largest.** Treated and untreated seed of Sooner Milo was planted May 18, June 3 and June 17. Untreated seed produced stands of 9.2, 19.4, and 66.2 percent and yields of 17.2, 24.2, and 20.4 bu. per acre respectively.

Copper carbonate treated seed planted at the same times produced stands of 30.4, 54.4, and 74.6 percent and yields of 49.3, 45.1 and 22.6 bu. per acre, respectively. (Project 110. Leader: W. F. Buchholtz, Plant Pathology Department.)

**Plant Experimental Shelterbelt.** An experimental shelterbelt to study the effect of spacing on cottonwood rust was planted at Hecla. A stand of cottonwoods is being established at Brookings; it will be used to study the effect of defoliation on winter hardiness.

Species and strains of *Populus* which may be rust resistant are being collected. (Project 142. Leader: C. M. Nagel, Plant Pathology Department.)

**Tomato Leaf Spot Studied.** Eight different promising chemical treatments are being tested for their fungicidal value for the control of leaf spot diseases on tomato. All are being applied as sprays while four are being tested as dusts. Each treatment is replicated four times in a randomized block design.

Tomato crosses involving commercial and wild parents are being studied both in the green house and in field plots for the purpose of securing selections resistant to the destructive leaf spot pathogens which attack the commercial varieties of tomatoes in South Dakota. (Project 146. Leader: C. M. Nagel, Plant Pathology Department.)

**Drug Plant Found Productive.** The medicinal plant, *Hyoscyamus niger*, was found to yield in sufficient quantities and in quality to meet pharmaceutical requirements.

Although the annual form contains slightly more of the alkaloids which enter into a number of pharmaceutical preparations, the yield per plant is considerably less when calculated as weight of drug obtained.

Age of the plant apparently has little to do with the alkaloidal content, so collection may be made at any time during the growing season.

Chief difficulty in growing the biennial form will be lack of seed, inasmuch as seeds are not formed until the second year. Further tests will be necessary to test mulching procedures or other methods that will insure lack of winter-killing of the plants.

Although the plants are susceptible to insect attack, the attacks may be controlled readily by use of nicotine or pyrethrum preparations. (Project 116. Leaders: R. P. Ahlquist and F. J. LeBlanc, Pharmacy Department; Entomology and Zoology Department cooperating.)

**Early Cut Hay Has Higher Feeding Value.** Samples of western wheatgrass, *Agropyron smithii* and blue grama grass *Bouteloua gracilis*, were taken from the plots located in 11 different areas of the state. The western wheatgrass samples were taken early in July, early in September, and late in October. These samples represented shooting to heading, seed-ripe, and mature and weathered stages of development of the grasses. The early July sampling was omitted for the blue grama grass.

The samples were all analyzed for moisture, fat, fiber, protein, total ash, nitrogen free extract, calcium, phosphorus, iron, and manganese.
The protein content and the phosphorus content of the grasses showed drastic changes between the early samples and the mature and weathered samples which were collected late in October. Average values for the protein content are shown were collected late in October. Average values for the protein, calcium and phosphorus are shown in the following table:

<table>
<thead>
<tr>
<th>Counties in which Plots Are Located</th>
<th>Protein</th>
<th>Ca*</th>
<th>P†</th>
<th>Protein</th>
<th>Ca*</th>
<th>P†</th>
<th>Protein</th>
<th>Ca*</th>
<th>P†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnehaha County</td>
<td>10.51</td>
<td>.45</td>
<td>.25</td>
<td>8.49</td>
<td>.34</td>
<td>.18</td>
<td>3.61</td>
<td>.33</td>
<td>.08</td>
</tr>
<tr>
<td>Sanborn County</td>
<td>10.42</td>
<td>.38</td>
<td>.27</td>
<td>7.02</td>
<td>.35</td>
<td>.16</td>
<td>4.33</td>
<td>.33</td>
<td>.09</td>
</tr>
<tr>
<td>Day County</td>
<td>10.49</td>
<td>.32</td>
<td>.25</td>
<td>7.13</td>
<td>.33</td>
<td>.16</td>
<td>3.61</td>
<td>.33</td>
<td>.10</td>
</tr>
<tr>
<td>Spink County</td>
<td>8.29</td>
<td>.34</td>
<td>.26</td>
<td>7.16</td>
<td>.40</td>
<td>.20</td>
<td>3.94</td>
<td>.34</td>
<td>.11</td>
</tr>
<tr>
<td>McPherson County</td>
<td>9.74</td>
<td>.30</td>
<td>.30</td>
<td>7.47</td>
<td>.34</td>
<td>.21</td>
<td>3.72</td>
<td>.36</td>
<td>.11</td>
</tr>
<tr>
<td>Brule County</td>
<td>9.44</td>
<td>.34</td>
<td>.22</td>
<td>7.61</td>
<td>.24</td>
<td>.16</td>
<td>3.80</td>
<td>.27</td>
<td>.08</td>
</tr>
<tr>
<td>Lyman County</td>
<td>8.66</td>
<td>.37</td>
<td>.25</td>
<td>10.50</td>
<td>.40</td>
<td>.27</td>
<td>4.52</td>
<td>.32</td>
<td>.10</td>
</tr>
<tr>
<td>Todd County</td>
<td>8.66</td>
<td>.37</td>
<td>.25</td>
<td>10.50</td>
<td>.40</td>
<td>.27</td>
<td>4.52</td>
<td>.32</td>
<td>.10</td>
</tr>
<tr>
<td>Jackson County</td>
<td>8.68</td>
<td>.46</td>
<td>.23</td>
<td>6.26</td>
<td>.44</td>
<td>.19</td>
<td>3.50</td>
<td>.36</td>
<td>.09</td>
</tr>
<tr>
<td>Butte County</td>
<td>12.23</td>
<td>.35</td>
<td>.30</td>
<td>6.98</td>
<td>.40</td>
<td>.24</td>
<td>5.05</td>
<td>.26</td>
<td>.13</td>
</tr>
<tr>
<td>Perkins County</td>
<td>9.42</td>
<td>.31</td>
<td>.23</td>
<td>6.58</td>
<td>.37</td>
<td>.18</td>
<td>4.02</td>
<td>.31</td>
<td>.08</td>
</tr>
</tbody>
</table>

* Ca—Calcium
† P—Phosphorus

It is apparent that either grass is of much more value for hay if cut in July or August than if it is left until late in the fall before it is cut. The values for protein and phosphorus in grass which is cut for hay in late October or left for winter grazing are so low that supplementary feeding of protein and phosphorus would be advisable. On the other hand, if the grasses are cut for hay early in the season the hay should furnish adequate supplies of protein and phosphorus for wintering range cattle. (Project 120. Leaders: A. L. Moxon and I. B. Johnson, Co-leaders: C. J. Franzke and L. E. Johnson. Agricultural Chemistry, Animal Husbandry, Dairy Husbandry, and Agronomy Departments cooperating.)

**Livestock Production**

**Sweet Clover Silage in the Ration of Fattening Calves.** The purpose of this experiment is to determine the value of sweet clover silage in the ration of fattening calves.

Sweet clover used in the 1943-44 feeding trial was cut on June 30, 1943, when approximately 10 percent of the crop was in bloom. After cutting, the sweet clover was allowed to wilt until it carried from 58 to 68 percent moisture. Two-hundred pounds of ground ear corn was added to each ton of sweet clover ensiled. The sweet clover yielded approximately 8.6 tons of silage per acre.

Rations fed were (1) shelled yellow corn, linseed oil meal, and alfalfa hay, (2) shelled yellow corn, linseed oil meal, corn silage, and alfalfa hay, (3) shelled yellow corn, linseed oil meal, sweet clover silage, and alfalfa hay, and (4) shelled yellow corn, sweet clover silage, and alfalfa hay.

The calves now weigh approximately 700 pounds. It is too early to predict final results. However, the following facts have been noted:

1. Sweet clover silage is very palatable to the steers and to the hogs following them,
2. The calves getting corn, a silage, and a protein supplement have out-
gained those getting corn, protein supplement, and alfalfa hay and those getting corn, sweet clover silage, and alfalfa hay, and (3) sweet clover silage appears to be a satisfactory substitute for the protein supplement in a corn, linseed oil meal, alfalfa hay ration. (Project 143. Leaders: Leslie E. Johnson and I. B. Johnson, Animal Husbandry Department.)

Lambing Off Corn and Sorghum Grains Tested. Objectives of this experiment are: (1) To determine if adaptable South Dakota sorghum varieties can be lambed-off satisfactorily, and (2) To compare the value of South Dakota sorghum varieties with corn for lambing-off.

Lambs for the 1943 trial were placed in the fields on October 4 and remained there until December 10, except for a nine-day period in early November when deep snow prevented grazing. All lambs were treated for worms and dipped before being placed on test. One-half pound of alfalfa hay per lamb was fed daily to balance the ration and prevent overfeeding on grains, and mineral was kept before the lots at all times. The accompanying table gives the results of this year’s trial.

<table>
<thead>
<tr>
<th>67 Days in Field</th>
<th>Corn, Alfalfa Hay</th>
<th>Sooner Milo, Alfalfa Hay</th>
<th>Low Prussic Acid Cane, Alfalfa Hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial weight (Av.)*</td>
<td>60.8</td>
<td>60.4</td>
<td>60.4</td>
</tr>
<tr>
<td>Final weight (Av.)</td>
<td>78.5</td>
<td>74.7</td>
<td>71.7</td>
</tr>
<tr>
<td>Daily gain (Av.)</td>
<td>.26</td>
<td>.21</td>
<td>.17</td>
</tr>
<tr>
<td>Grain yield per acre (Est.)</td>
<td>2648.8</td>
<td>404.5</td>
<td>424.0</td>
</tr>
<tr>
<td></td>
<td>or 47.3 bu.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain per acre</td>
<td>93.0</td>
<td>75.3</td>
<td>61.4</td>
</tr>
<tr>
<td>Grain left in field per acre</td>
<td>1909.6</td>
<td>7.3</td>
<td>66.5</td>
</tr>
<tr>
<td></td>
<td>or 34.1 bu.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*All weights in pounds unless otherwise stated.

All lots of lambs remained healthy throughout the 67 days in the fields. Only one lamb died during the period. The death, caused by overeating, occurred in the low prussic acid cane lot 17 days after the lambs were turned into the fields.

None of the lambs were finished sufficiently for the killer market at the time of removal from the fields. All groups were finished in dry lots. General observations indicate that lambs waste considerable grain in low prussic acid sorghum fields. Some milo was also trampled under foot, but the amount was small. Little grain was lost in the corn field.

This experiment will be repeated next year. An attempt will be made to get the lambs in at a much earlier date as it is believed lambs fatten more economically in corn and sorghum fields if started late in August. (Project 111. Leader: J. W. Wilson, Animal Husbandry Department.)

Test Sorghum Fodder for Wintering Breeding Ewes. During recent years there has been considerable increase in sorghum acreage in South Dakota. Much of the increased acreage has occurred in the sheep producing areas of the state. This has resulted in many questions regarding the value of sorghum fodders for wintering breeding ewes.

The following rations were fed to bred ewes last winter: (1) Shelled corn, alfalfa hay, and salt; (2) sorghum fodder and salt; (3) sorghum fodder, linseed oil meal, and salt; (4) sorghum fodder, mineral mixture, and salt; and (5)
sorghum fodder, alfalfa hay, mineral mixture, and salt. The sorghum used as the fodder was Low Prussic Acid Cane.

There was a slight tendency for the ewes getting protein supplement to shear the heaviest fleeces. Ewes getting alfalfa hay tended to have a little heavier, stronger lambs, although the differences were not large. The fodder appeared to be palatable to all lots. All leaves and finer particles were eaten, only the butts being refused. This amounted to 22.4 percent of the amount fed.

The following table gives a summary of last year’s results:

<table>
<thead>
<tr>
<th>Lot 1</th>
<th>Lot 2</th>
<th>Lot 3</th>
<th>Lot 4</th>
<th>Lot 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelled corn, alfalfa hay, salt</td>
<td>Sorghum fodder, linseed oilmeal, salt</td>
<td>Sorghum fodder, mineral, salt</td>
<td>Sorghum fodder, alfalfa hay, mineral, salt</td>
<td></td>
</tr>
<tr>
<td>Ewes:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial weight (av.)</td>
<td>128.6</td>
<td>126.8</td>
<td>130.0</td>
<td>129.3</td>
</tr>
<tr>
<td>Final weight (av.)</td>
<td>149.4</td>
<td>139.6</td>
<td>153.3</td>
<td>147.2</td>
</tr>
<tr>
<td>Gain (av.)</td>
<td>20.8</td>
<td>12.8</td>
<td>23.3</td>
<td>17.9</td>
</tr>
<tr>
<td>Feed consumed per ewe during wintering period:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>62.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linseed oilmeal</td>
<td></td>
<td>38.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>354.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum fodder</td>
<td></td>
<td>538.3</td>
<td>556.4</td>
<td>551.4</td>
</tr>
<tr>
<td>Mineral</td>
<td></td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Salt</td>
<td></td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Fleece weight (av.)</td>
<td>8.3</td>
<td>7.3</td>
<td>8.1</td>
<td>7.8</td>
</tr>
<tr>
<td>Percent lamb crop born</td>
<td>114</td>
<td>121</td>
<td>129</td>
<td>136</td>
</tr>
<tr>
<td>Lambs:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight (av.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singles</td>
<td>12.0</td>
<td>11.1</td>
<td>10.3</td>
<td>11.0</td>
</tr>
<tr>
<td>Twins</td>
<td>9.1</td>
<td>8.5</td>
<td>7.6</td>
<td>7.4</td>
</tr>
<tr>
<td>Condition (av.)</td>
<td>Fat— Average+ Average Average+ Average—</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitality (av.)</td>
<td>Strong+ Strong Average+ Average+ Strong—</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Possibility of using sorghum fodder as the major roughage in wintering bred ewes appears promising. Further work will need to be done, however, to determine its most efficient use in the wintering ration. (Project 122. Leader: J. W. Wilson, Animal Husbandry Department.)

**Fattening Fall Pigs on South Dakota Grains.** Work under this project has been divided into two general fields one having to do with different types and qualities of barley and the other with grain sorghums.

**Whole Sooner Milo Compared With Ground Sooner Milo for Fattening Pigs.** The third of a series of feeding trials to determine the feeding value of whole milo as compared with ground milo when fed to fattening pigs was conducted in the spring of 1944. Sooner milo which previously had been used in the storage tests being conducted by the South Dakota Agricultural Experiment station was fed. Two lots of 10 pigs each were used, one lot being fed whole milo and the other ground milo. Chemical analysis of the milo showed a protein content of 11.78 percent.

Both lots of pigs were fed a protein feed composed of two parts tankage and one part soybean oil meal; good quality alfalfa hay; and a mineral mixture composed of bone meal two parts, ground limestone two parts; and salt one part. All
feeds and feed mixtures were self fed free choice method. The results of the tests are shown in the following table:

<table>
<thead>
<tr>
<th>Lot 1</th>
<th>Lot 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Sooner</td>
<td>Whole Sooner</td>
</tr>
<tr>
<td>Milo, Protein Mixture, Alfalfa Hay, Mineral</td>
<td>Milo, Protein Mixture, Alfalfa Hay, Mineral</td>
</tr>
<tr>
<td>Average Number of days fed</td>
<td>44</td>
</tr>
<tr>
<td>Average initial weight per pig</td>
<td>130.0</td>
</tr>
<tr>
<td>Average final weight per pig</td>
<td>228.0</td>
</tr>
<tr>
<td>Total gain per pig</td>
<td>98.1</td>
</tr>
<tr>
<td>Average daily gain per pig</td>
<td>2.24</td>
</tr>
<tr>
<td>Feed consumed for 100 lbs. gain:</td>
<td></td>
</tr>
<tr>
<td>Sooner Milo</td>
<td>340.3</td>
</tr>
<tr>
<td>Tankage</td>
<td>13.2</td>
</tr>
<tr>
<td>Soybean Oil Meal</td>
<td>6.6</td>
</tr>
<tr>
<td>Alfalfa Hay</td>
<td>9.5</td>
</tr>
<tr>
<td>Mineral Mixture</td>
<td>1.2</td>
</tr>
</tbody>
</table>

As in the first test the pigs fed the whole milo required more feed to produce 100 pounds of gain than did those fed the ground milo. The extra amount of milo required by this lot for a unit of gain about offset the cost of grinding the milo for the pigs in the other lot. The pigs fed the whole milo, however, ate more protein feed than those fed the ground milo. In the first test the two lots required practically the same amount of protein feed, alfalfa and mineral. While the rate of gain was good for both lots, pigs fed the ground milo reached a market weight of 228 pounds in seven days less time than those fed the whole milo.

Comparison of Barleys Grown in Different Sections of the State as Feeds for Fattening Pigs. The first of a series of feeding trials to determine the value of Spartan barley grown in different sections of the state when fed to fattening pigs was conducted in the spring of 1944. It has been observed that Spartan barley grown in some sections of the state shows a rather high protein content when compared with barley grown in other sections. It also has been thought that barley with a high protein content would be more valuable for feeding growing and fattening pigs than barley with a lower protein content. This would be especially important at this time when the protein feeds usually used are difficult to obtain.

Three lots of Spartan barley grown in different sections of the state and one lot of feed barley of malting type were purchased for a feeding trial. The three lots of Spartan barley were grown near Selby, Alpena, and Oldham, respectively; and the feed barley of the malting type was grown near Brookings. The test weights per bushel for these different barleys were: Malting type, 41½ lbs; Spartan (Selby) (Alpena), 48 lbs.; and Spartan (Oldham), 47 lbs. The corn used tested 54 pounds per bushel with a 16 percent moisture content at the beginning of the feeding trial. Five lots of 10 pigs each were used for the test. One lot of pigs was fed shelled corn for a check.

All pigs were fed a protein mixture composed of tankage two parts and soybean oil meal one part; good quality alfalfa hay; and a mineral mixture composed of bone meal two parts, ground limestone two parts, and salt one part. Feeding was done in dry lots and all feeds or feed mixtures were self-fed, free choice. The results of the feeding trials are shown in the following table.
The results do not show any great difference in the feed value of the Spartan barley grown in different sections of the state. Barley grown near Oldham was slightly musty, and the pigs did not seem to eat it with the relish shown by the pigs in the other lots. Pigs in this lot also had a slower rate of gain. (Project 24. Leader: Turner Wright, Animal Husbandry Department.)

Open Sows Bring Greatest Market Profit. Many farmers fatten and market sows following the weaning of their first or second litters, and many follow the practice of breeding the sows before placing them on feed. The feeders believe this results in both faster and more economical gains.

Packers, in general, disapprove this method and believe that both packer and producer lose from its use. This experiment is designed to determine advantages or disadvantages that result from the practice of breeding sows that are being fattened.

Two lots of 10 sows each were fattened and marketed during the summer of 1943. Lot 1 sows were bred. Lot 2 sows remained open. A severe attack of necro occurred in both lots and may or may not have affected the comparative results.

The bred sows gained 1.42 pounds per day while the open sows gained only 1.26 pounds. Feed costs per 100 pounds gain was $8.45 for the bred lot and $9.83 for the open lot. Due to the amount of the dockage on the bred sows, the open sows returned the greatest profit. Profits for the open and bred lots were $7.32 and $6.61 per head, respectively. There were practically no difference in the two lots in the quality of the carcasses. This test will be repeated during the next two or three years. (Project 135. Leaders: Leslie E. Johnson and Turner Wright, Animal Husbandry.)

Swine Breeding Methods Studied. The chief purpose of this project is to test the possibility of using inbred lines of swine in commercial swine production. Breeding systems being compared are (1) crossing inbred lines of a purebred breed, (2) crossing inbred males of a purebred breed with non-inbred, purebred females of the same breed (topcrossing), (3) crossing purebred hogs of different breeds (crossbreeding), and (4) purebred breeding as usually practiced.
Considerable difficulty was experienced in getting the inbred Black Star sires to mate. None of first three sires purchased for the 1944 pig crop would breed. All litters in this year's test were sired by 820, a boar used in the 1943 test. From the findings to date it must be concluded that little commercial use should be made of inbred lines until such lines have been proved valuable. (Project 124. Leaders: Leslie E. Johnson and Turner Wright, Animal Husbandry Department.)

**No-Tail Sheep Project Develops.** The No-tail flock now consists of 137 head. Fifty-eight of these were mature breeding ewes. Forty-two ewes produced 45 lambs, 20 of which were tailless. The remaining 25 had an average length of tail of 1.3 inches. The half-blood Columbia ram sired two lambs without tails and the average length of tail for the other nine was 2.75 inches, there being two that had tails 4 and 4 1/2 inches long. This cross of the Columbia was made to increase the length of staple of wool and thereby increase the shearing qualities.

Ram 5780-81 sired 15 lambs of which 8 were without tails and the 7 had an average length of tail of 1.28 inches.

Ram 6781-82 the largest of the flock, and a heavy shearer sired 18 lambs, 10 of which were without tails and the average for the remaining 8 was .93 of an inch, the longest tail being 1.5 inches.

The average fleece weight of all ewes two years old and older was 6.5 pounds of clean marketable wool. (Project 9. Leader: J. W. Wilson, Animal Husbandry Department.)

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**Dairy Production**

**Bloat in Dairy Cattle**

**Bloat Experiments Continued.** The testing of gas from legumes and non-legumes fermented in the laboratory was continued in an effort to determine the causes of bloat in dairy cattle. The gas was tested with the hydrogen sulfide detector.

One acre of alfalfa was covered with two tons of gypsum. Plants from this acre were also fermented in the laboratory and tested for hydrogen sulfide. A number of animals which had died from bloat on sweet clover, alfalfa, and one on Sudan grass, were delivered to the department. The pressure was determined with a mercury manometer. The gas was tested for hydrogen sulfide and a sample of the gas taken. A chemical method for determining hydrogen sulfide gas was compared for accuracy with the hydrogen sulfide detector.

The soil on which the gypsum was spread is to be analyzed for sulphur content, also the plants grown on the soil. The plot is to be grazed by cows to note the effect on sulfide content of rumen gas. Circular No. 52 has been prepared on this project including the data for the fiscal year and all available information on the subject of bloat in dairy cattle from other stations. (Project 17. Leader: T. M. Olson, Dairy Husbandry Department.)

**Mastitis Experiments Conducted.** The college dairy herd was tested regularly for mastitis using the following tests: Bromthymol blue, chloride, hotis, and microscopic. Several farmers’ herds and three herds from which market milk was being sold direct to consumers were tested for mastitis.

One or more cows whose milk reacted positively to one or more of the above tests, were found in every herd tested. A cow was not classified as infected with...
mastitis, however, unless the long chain Streptococci were found under microscopic examination.

Cows infected with the Streptococci organism were treated with the following products: Sulvetil; Sulfanilamid in water; sulfamerazine in water; sulfamerazine in oil; tyrothricin; phemerol; novoxil; and azochloramide. The latter product was found to have high bacterio-static properties, but was harmful to mammary tissue. In fact, azochloramide caused nine out of ten quarters treated to go blind.

The phemerol and novoxil were also irritating to the mammary tissue. The effects of novoxil in some cases was noticeable for several days to a week in abnormal milk. The sulfa products had no irritating effects on the mammary tissue even when used in cows in heavy milk. These products were used suspended in water and suspended in mineral oil. Sulfamerazine, 40 percent, suspended in mineral oil, seemed to give the most satisfactory results, particularly when the cow was milking. The milk appeared normal the second milking after the treatment. Forty milliliters were injected into the infected quarters.

Tyrothricin was only slightly irritating to the mammary tissue when used on cows in milk. Results from its use were not quite as satisfactory as sulfamerazine. The trials indicated that best results were had by treating the infected quarter or quarters as soon after the infection was detected as possible. In chronic mastitis, in which scar tissue was formed, treatment was of no avail. (Project 134. Leaders: F. M. Skelton and T. M. Olson, Dairy Husbandry Department.)

Livestock Diseases and Poisoning

Further Selenium Work Analyzed. Experimental work with cows on seleniferous range was continued for the second year on the Reed Ranch in Lyman County. Results substantiated the conclusions drawn from the first year's work which were: (1) That linseed meal when fed at the rate of one pound per head daily does not reduce the severity or incidence of selenium poisoning in cattle on seleniferous range, and (2) that arsenic when fed at the rate of 25 parts per million in the salt reduces the incidence of symptoms of selenium poisoning in cattle on seleniferous range. The arsenic-salt mixture was used by a number of ranchers in seleniferous areas of the state and all reports indicate excellent results.

During the past two years, blood samples were taken at 14 different times from the 40 head of cattle on experiment at the Reed Ranch. Hair samples were clipped from the left hip of each cow in October, 1942. These blood and hair samples were all analyzed for selenium and the results were subjected to statistical study during the past year. There was a highly significant seasonal difference in the selenium content of the blood samples but no significant difference in selenium content of the samples from the different treatments.

Average selenium content of the hair samples was 19.19 parts per million with a high of 29.42 parts per million and a low of 2.30 parts per million. No correlation was found between the selenium content of the hair samples and either the selenium content of the blood samples taken at the same date or the mean selenium content of the blood samples taken at the six dates previous to the sampling of the hair.

Blood samples which were analyzed for selenium, were also analyzed for hemoglobin, calcium, phosphorus, carotene, vitamin A, vitamin C, and total plasma protein. These values are being summarized and will be a valuable contribution to the limited data available on the blood composition of range cattle.
Two groups of rats were kept for nearly a year on rations containing six parts per million of selenium without the development of liver cancers. Research work by the Food and Drug Administration has shown that rats kept for 18 months on rations containing low levels of selenium develop a rather high incidence of liver cancers, but the ration which was used in this laboratory proved to be so toxic, even with only 6 parts per million of selenium, that the rats had practically all died by the end of 12 months.

The mechanism by which arsenic counteracts selenium toxicity was given further study during the past year. One of the newer B vitamins, p-amino-benzoic acid, appears to be associated with selenium-arsenic antagonism. The toxicity of selenium to rats is aggravated by one gram of this B vitamin in a kilogram of ration. If, however, arsenic and selenium are both included in the ration the p-amino-benzoic acid appears to be beneficial and promotes better growth of the animals.

Metabolism studies were made with rats to determine what influence arsenic might have on the absorption and excretion of selenium by the animal body. The arsenic appears to cause a greater accumulation of selenium in kidney tissue but does not change, appreciably, the rate of excretion of selenium from the animal body. This is further evidence that the protective action of arsenic against selenium poisoning is brought about by a binding of selenium by arsenic in a relatively non-toxic form.

*Astragalus pectinatus* was grown in water culture solutions containing various trace elements in addition to the elements which are considered to be essential for plant growth. This species of *Astragalus* is one of the "indicator" plants which require selenium for growth under natural conditions. The following trace elements were used at a level of 0.2 parts per million in the culture solutions: Germanium, tin, antimony, arsenic, tellurium, and selenium. Germanium, tin, and arsenic were toxic to the plants at the level used. None of the elements appeared to stimulate growth of the plants. (Project 19. Leaders: A. L. Moxon, E. I. Whitehead, and George Gastler, Agricultural Chemistry; Animal Husbandry and Veterinary Departments cooperating.)

**Sheep Parasite Control Study Started.** The world over, internal parasites have always been among the worst hazards of the sheep raising industry. For the past several years serious losses from parasites have been experienced in the principal sheep raising counties of western South Dakota among range sheep, as well as among the smaller farm flocks in other parts of the state. Losses have been not only in deaths during the summer but also in lighter lambs at weaning time.

The project, "The Control of Parasitism in Sheep in South Dakota," was started this year. Stomachs and intestines of 30 lambs from different areas of the state have been examined to identify the various species of worms. Three kinds of stomach worms, (1) the common stomach worm (*Haemonchus contortus*), (2) the brown stomach worm (*Ostertagia circumcincta*), (3) small stomach worm (*Trichostrongylus axei*), and nine kinds of intestinal worms (4) thread-necked strongyle (*Nematodirus species*), (5) Bankrupt worm (*Trichostrongylus sp.*), (6) *Cooperia sp.*, (7) the Nodular worm (*Oesophagostomum columbianum*), (8) large mouthed bowel worm (*Chaberia ovina*), (9) whip worm (*Trichuris ovis*), (10) *Strongyloides papillosis*, (11) broad tapeworm (*Moniezia sp.*), and (12) fringed tapeworm (*Thysanosoma actimoides*) have been found in this preliminary survey. In addition, lung worms (*Dictyocaulus filaria*) and tapeworm cysts (*Cysticerus tenuicollis*) are found outside the alimentary tract. The species contributing to the most serious infestations are the common and brown stomach
worms, and the thread-necked strongyle Trichostrongylus species, nodular worms, and tapeworms of the intestine. Nodular worms have not been found in sheep on western ranges.

The rate of increase in numbers of the different species of parasites, the factors favoring the increase during the grazing season, and the value of control measures, which includes range rotation and treatment as practiced by various ranchers in western counties, are being watched during the present grazing season.

Information is also being accumulated on factors other than parasites which may contribute to the poor quality of lambs leaving some of the western ranges in the fall. (Project No. 139. Leaders: G. S. Harshfield, F. N. Carlson, J. B. Taylor, Veterinary Department; Animal Husbandry Department, South Dakota Livestock Sanitary Board and the Zoological Division, Bureau of Animal Industry cooperating.)

**Fowl Cholera Control Sought.** No entirely satisfactory means of prevention and control of fowl cholera, an acute infectious disease of barnyard fowls has been developed. A new project, “The Control of Fowl Cholera,” was started during the year.

The object of the study is to determine whether “carrier birds” can be detected by an agglutination test so that these sources of infection can be removed from the flocks. It is also planned to observe whether chemotherapeutic agents such as the “sulfa” drugs have any value as control agents. Sufficient progress has not been made on the work for a report at this time. (Project No. 141. Leaders: G. S. Harshfield, J. B. Taylor, Veterinary Department; W. O. Wilson, Poultry Husbandry Department.)

**Attempt to Produce Cornstalk Disease.** Cattle losses from cornstalk poisoning were exceedingly heavy in certain areas of the state in the winter of 1942-43 but during the past winter (1943-44) no authentic reports of losses from this cause were received. Thus, it was necessary to confine work on the project to an attempt to produce the condition locally.

A study of the previous year’s losses revealed that practically all of the trouble was limited to fields of squaw or flint corn. In the spring of 1943, a plot of flint corn and a plot of open-pollinated dent corn were planted on the North Station farm at Brookings, to furnish material for a study of the differences in chemical composition of these two types of corn. Samples of stalks were taken at various dates in the fall and winter and were analyzed for different nitrogen fractions. No striking differences in chemical composition were found.

During the winter months, three head of young beef cattle were placed in each plot until the feed was all consumed. Half of the rows in each plot of three and one-half acres had been picked before the cattle were turned in. At two-week intervals, blood samples were taken for analysis and the cattle were weighed. No symptoms of poisoning were noted. (Project 130. Leaders: A. L. Moxon, J. B. Taylor, and W. F. Buchholtz. Agricultural Chemistry, Veterinary, and Plant Pathology Departments cooperating.)

**Sub-soil Content Affects Oat Hay.** Wide variations in the nitrate content of oat plants were found within relatively small areas of a field. This condition makes careful sampling extremely important in this project. The variations in nitrate content appear to be due to differences in accumulation of nitrate nitrogen in the sub-soil. (Project 87. Leaders: A. L. Moxon and E. I. Whitehead, Agricultural Chemistry Department.)
Hatchability of Turkey Eggs Studied. The uncertainty of supply, together with possible spread of disease, makes the shipping in of turkey hatching eggs hazardous. On the other hand, eggs produced locally are not early enough to hatch many large flocks which would be ready for Thanksgiving market. The use of artificial lights will produce early eggs for hatching poults. In general, the hatchability and fertility of turkey eggs is lower than for chicken eggs.

The past year's work was along many lines. Nutritional investigation included a comparison of pellets and mash when fed with and without sprouted oats. A pen of small-type white turkeys was kept as an additional control. This variety of turkey has previously been shown to possess high-hatchability. An investigation as to the proper relative humidity of turkey eggs was conducted. Humidities of 37 percent, 46 percent and 57 percent were compared. Blood constituents were studied. These included vitamin A, vitamin C, carotene, calcium, phosphorus, glutathione, sugar, hemoglobin, hematocrit, and plasma protein. Artificial insemination of hens consistently low in fertility was a routine procedure.

The results are not complete, but at the present time there appears to be no difference in the egg production, hatchability, and mortality of the rations compared. Hatchability of fertile eggs was low in all pens; however, the white turkeys hatched better than the bronze. A test is in progress to determine if treating the breeders with phenothiazine reduced hatchability. There did not appear to be any difference in the percent of hatch whether the relative humidity was 37 percent, 46 percent, or 57 percent.

Blood studies were started to determine if any differences existed between groups of high and low fecundity. There appeared to be no relationship existing except for perhaps hematocrit. Individual hen variation was found for phosphorus, hemoglobin, hematocrit, calcium, and carotene. Fluctuations between dates were noted for carotene, vitamin C, glutathione, sugar, and phosphorus. Laying and non-laying hens showed differences between the calcium levels of the blood. (Project 96. Leaders: W. O. Wilson and F. R. Sampson, Poultry Husbandry Department, and A. L. Moxon, Agricultural Chemistry Department)

Dried Distillers' Grains Fed to Poultry. Efficient utilization of all feedstuffs is essential in time of war. Spent grains are a by-product of the commercial production of alcohol in the state. The Yankton plant had facilities for drying these grains.

Tests were made on the value of these dried distillers' grains without the solubles. The grains used consisted of about 90 percent corn and 10 percent barley. Without the dried solubles the grains are not considered a good source of vitamins. A starting test showed that up to 25 percent of the total ration could be made up of corn distillers' grains.

Using the same source of grains, laying mashes containing 5 and 10 percent corn distillers' grains were fed to two lots of White Leghorn pullets. Egg production was about the same in the two pens. Hatchability was not as good in the 10 percent level.

A test to determine the effect of adding B complex vitamins to a ration consisting exclusively of vegetable proteins is in progress. Present results indicate that the addition of choline chloride, riboflavin, and calcium pantothenate improved the hatchability over the control lot. A pen fed sprouted oats as a source
of these and other vitamins did equally as well in hatchability as the lot given synthetic vitamins.

Growing tests are in progress which are designed to study levels of soybean oil meal in the mash ration of growing pullets. Three lots of White Rock pullets and two lots of White Leghorn pullets are being used. (Project 52. Leaders: W. O. Wilson, Poultry Husbandry Department, and A. L. Moxon, Agricultural Chemistry Department.)

**Chicken Egg Hatchability Studied.** The loss to the farmer from eggs failing to hatch is enormous. Only about two-thirds of the eggs set produce chicks. Research for the past year has been directed along the lines of finding physical measurements that might be correlated with hatchability.

Four pens of New Hampshire pullets of the same breeding were used in this year's study. The same 20 percent protein mash was fed to each of the four pens, but each pen was hopper fed a different scratch grain. Corn, wheat, barley, and a combination of the three grains were fed.

Although the mash contained ample vitamin A for hens when fed in equal quantity with grains, losses from vitamin A deficiency were encountered in the pen hopper fed wheat. These hens, and those fed barley, were consuming 4 parts of grain to 1 part of mash. Blood analyses and liver storage determinations on representative birds from these pens showed the levels of carotene and vitamin A to be sub-marginal.

Specific gravity is one of the physical measurements of the egg that is associated with hatchability. In last year’s report, a seasonal trend in specific gravity was reported. In order to determine if this variation was entirely seasonal, or if age played a part, two different ages of birds were kept in the pens under identical environmental conditions.

It was found that pullets ranging in age from 365 to 445 days produce eggs of about the same specific gravity, and that the variation was chiefly seasonal. (Project 113. Leaders: F. R. Sampson and W. O. Wilson, Poultry Husbandry Department, and A. L. Moxon, Agricultural Chemistry Department.)

**Soybeans Used in Turkey Rations.** In the past year, increasing amounts of soybean meal were used in the growing ration for turkeys. Sixteen percent of soybean meal and 4 percent meat and bone scraps gave as good results as approximately equal parts of the two ingredients. No benefit was obtained from grinding oats or proso when mixing mash for turkeys, according to the results obtained during the past year.

Starting rations were fed different lots of poult in order to find a good ration containing little or no animal protein. One such ration is as follows:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>41.5</td>
</tr>
<tr>
<td>Dehydrated alfalfa leaf meal</td>
<td>10.0</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>38.0</td>
</tr>
<tr>
<td>Dried milk</td>
<td>4.0</td>
</tr>
<tr>
<td>Bone meal</td>
<td>5.0</td>
</tr>
<tr>
<td>Salt mixture</td>
<td>1.0</td>
</tr>
<tr>
<td>Fish oil concentrate (400D)</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
This ration containing wheat gave better results than a similar ration containing yellow corn meal. Two percent sardine meal added to a ration containing soybean meal as the only source of protein gave increased growth.

Starting and growth rations were tested at the North Central Substation at Eureka. High mortality prevents conclusions from being drawn on these tests. (Project 79. Leaders: F. R. Sampson and W. O. Wilson, Poultry Husbandry Department.)

**Fruits and Vegetables**

**New Fruit Varieties Introduced.** Four new fruit varieties were introduced during the year, including one apple variety, one apricot, and two bush cherries.

The new apple variety, the South Dakota Golden, is of the same pedigree as Gordo, a cross of Grimes Golden and Duchess of Oldenburg. It is a clear, light golden yellow in color, ripening to near white. It is round and tapering, measuring about 2 1/4 inches across. It is a high quality eating apple and also cooks up quickly for sauce. It ripens in fall.

The Harbin Apricot, also introduced last spring, is from the same lot of seed that produced the 12 varieties already introduced for use in the northwest by this station. It is named after the locality where the seed originally was found in North Manchuria. The fruit is larger than any of its 12 predecessors.

The South Dakota Amber Bush Cherry, one of the two bush cherry introductions last spring, has a large fruit, a clear golden yellow color and is excellent for eating when picked from the bush or cooked as sauce. It probably is the best yellow sandcherry introduced thus far. It is a selection of *Prunus Besseyi* of South Dakota.

The South Dakota No. 155 Hybrid Bush Cherry has been a heavy bearer for a number of years. It is green-fleshed, of the Opata type, but somewhat smaller. If it proves to be productive throughout the northwest area as it has been in trials at Brookings, it will be named. (Project 1. Leader: N. E. Hansen, Horticultural Department.)

**New Hardy Perennial Introduced.** The N. E. Hansen Monarda, a red-flowered perennial which blooms in late July and early August was introduced this year. It is a hybrid, originated in 1932 by pollinating the local form of Horsemint (*Monarda fistulosa*) with Oswego Beebalm (*Monarda didyma*).

**Wild Flower Experiments Postponed.** Work planned toward development of native South Dakota wild flowers was postponed because of lack of growing space. Many native species show promise of becoming popular varieties. (Project 2. Leader: N. E. Hansen, Horticultural Department.)

**Cultural Practices and Adapted Varieties Improve Tomato Yields.** Tomatoes have been listed as a “must” crop for all Victory gardens. This is because of the large yields of highly nutritional fruit obtainable from a small area of land. Due to severe infestations of defoliation diseases and the planting of unadapted varieties, tomato production has been low for the past two years.

Various cultural practices were tried to increase the yield of two standard varieties, the Bounty and the Stokesdale. Young, vigorous plants about 6 to 8 weeks old were found to be best for transplanting. Bounty plants set in the field on May 15 yielded 50 percent more fruit than plants set in the field on June 1. Field seeding on May 1 was satisfactory for a small late crop with the Bounty variety.
Yields were practically doubled by use of a liquid "starter solution" on both the Bounty and Stokesdale varieties. This "starter solution" was prepared by dissolving .8 of a pound of ammonium phosphate and .4 of a pound of potassium nitrate in 10 gallons of water. One-half cup of this solution was poured around the roots of the plant at transplanting time. A side-dressing of a complete 4-12-4 fertilizer applied at the rate of ½ of a pound per plant at transplanting time was nearly as effective as the "starter solution." Other cultural practices tried such as straw mulch, protection with shingles, and planting in holes had little effect on yields.

Stokesdale was again the high yilder among the 28 varieties tested. Penn State and Firesteel also gave excellent results. Of the 55 seedlings tested, eight outyielded the Stokesdale.

Vitamin determinations showed the current tomato and F₁ crosses between the current and standard varieties to be much higher in Vitamin C than the standard varieties. (Project No. 49, Leader: L. C. Snyder, Horticulture Department.)

Development of Hybrid Drought Resistant Sweet Corn Sought. While the major work with sweet corn has been plant breeding some work has been done in testing hybrids and varieties.

On a basis of tolerance to high artificial temperatures during the seedling stage and also by tolerance to high temperatures in the field, inbred lines have been segregated. A few possess desirable characteristics in addition to their ability to tolerate high temperatures. Hybrids from some of these were planted in 1943, but temperatures were not high enough to measure heat tolerance. Some did appear fairly resistant to smut.

Most sweet corn hybrids mature their ears over a comparatively short period. The home gardener frequently finds it desirable to plant all his sweet corn at one time. A collection of varieties to give a continuous succession of sweet corn over a long period would be desirable. By using samples with different maturity dates and by making two plantings a continuous supply of sweet corn was available for a 58-day period at Brookings. The following recommendations are based on observations made in previous years as well as 1943. Where more than one hybrid is listed for a maturity season the first is more highly recommended.

<table>
<thead>
<tr>
<th>Season</th>
<th>Hybrid</th>
<th>Days to Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>North Star</td>
<td>70 days</td>
</tr>
<tr>
<td></td>
<td>Spancross</td>
<td>70 days</td>
</tr>
<tr>
<td>Mid-season</td>
<td>Carmelcross</td>
<td>73 days</td>
</tr>
<tr>
<td>Late Mid-season</td>
<td>Golden Cross Bantam</td>
<td>80 days</td>
</tr>
<tr>
<td></td>
<td>Lincoln</td>
<td>80 days</td>
</tr>
<tr>
<td>Late</td>
<td>Ioana</td>
<td>83 days</td>
</tr>
<tr>
<td></td>
<td>Narrowgrain Evergreen</td>
<td>86 days</td>
</tr>
</tbody>
</table>

(Project 68. Leader: S. A. McCrory, Horticulture Department.)

Test Survival of Conifer Seedlings. Evergreens are especially valuable in furnishing year around wind protection for the farmstead. Many attempts to
establish evergreen windbreaks have met with failure. This is because of the difficulty of transplanting small seedlings in an open field.

To overcome this difficulty, seedlings of Ponderosa pine were grown in clay pots in a protected spot for a year and then set in the field along with bare root seedlings. These were planted in early May, 1943. On April 26, 1944, 96 percent of the potted seedlings were still alive while only 78 percent of the bare root seedlings were living.

In May, 1944, 50 seedlings each of Colorado blue spruce, Douglas fir, Ponderosa pine, Austrian pine, and Rocky Mountain cedar were planted in No. 10 cans and 50 each in a nursery row. The cans were plunged in the soil where they could be watered when necessary. Next spring these will be set out in a shelter-belt along with bare root seedlings. (Project 117. Leader: L. C. Snyder, Horticulture Department.)

**Vegetable Yields and Quality Improved by Cultural Practices.** Eight vegetables (snap beans, carrots, cauliflower, kale, lettuce, onions, peas and peppers) were grown with and without irrigation and with and without lath shade. Five fertilizer treatments, including manure (fall application), ammonium sulphate, superphosphate, a complete 4-12-4 fertilizer and a 4-12-0 fertilizer, were used under each of the above conditions.

The yields were considerably higher on all vegetables grown in the open than under shade. Irrigation increased yields on all vegetables except peas. The highest yields were obtained on plots receiving ammonium sulphate and complete fertilizer. Superphosphate gave but little benefit. Palatability studies made by the Home Economics Department showed that vegetables grown in open were of better quality than vegetables grown in the shade.

Experiments with a variety of cultural practices in growing garden vegetables have been instrumental in obtaining information valuable both to commercial growers and to "Victory gardeners."

[22]
The phase of the experiment dealing with lengthening the garden season gave some interesting results which have been published in detail in Experiment Station Bulletin 374. The following recommendations are based on this study.

1. Use transplants on all long season crops and certain cool season crops that must mature before warm weather such as head lettuce. Transplants gave higher yields and matured as much as a month earlier than field seeding with broccoli, Brussels sprouts, cabbage, cauliflower, celery, eggplant, head lettuce, onions, peppers, and tomatoes.

2. Use succession plantings to increase the length of the garden season with spinach, leaf lettuce, cabbage, kohlrabi, beets, carrots, green onions, snap beans, and peas. Fresh snap beans were harvested from July 10 to September 20.

3. Plant cool season crops such as peas and spinach early for highest yields.

4. Use legume inoculants with peas and various types of garden beans. (Project 118. Leader: L. C. Snyder, Horticulture Department.)

**False Indigo Seeds Provide Limited Insecticide.** Native *Amorpha fruticosa* plants (false indigo) have been investigated for the past several years to determine their insecticidal value. The following conclusions are based upon the findings of the past three years.

The seed carries a greater amount of the toxic principle than do any other parts of the plant. The outer seed coat appears to be the part of the seed carrying the greatest toxicity. The maximum amount of the toxicity is reached as the seed matures.

The toxic principle is something other than rotenone and no chemical method of analysis was found sufficiently accurate to measure the toxic content. Acetone was a better extracting material than carbon tetrachloride, chloroform, ethyl alcohol or ethyl ether. Most samples were no more than 50 percent as effective in killing bean aphid (*Aphis rumicis*) than was a similar extract from Derris roots containing 5 percent rotenone.

The extracted material from *amorpha fruticosa* loses its effectiveness after exposure to either air or direct sunlight for a period of one hour. The toxic material is also greatly reduced if held at a low temperature in sealed containers. Plants growing in soil which received a generous application of phosphorus fertilizer contained a greater toxic substance than did those receiving ammonium sulphate or a 4-12-4 fertilizer. The plants may be propagated from seed or stem cuttings. Seed more than one year old gave a poor germination.

Because of the low yield of seed per plant and the difficulty of harvesting, this plant would be an expensive source of an insecticide. (Project 119. Leader: S. A. McCrory, Horticulture Department.)

**Western South Dakota Vegetable Production Studied.** In February, 1944, this station started a study of the commercial production of fruits and vegetables in the Black Hills area where irrigation is practiced. The projects were designed to do investigational work at the central station and to carry the findings to the western area by making whatever modifications were found to be necessary.

Head lettuce production as both a spring and fall crop are a part of the study. A comparison of field seeding with plants started in a forcing structure and transplanted in the field as early as practical indicates that the latter is by far the more desirable practice. Several varieties were promising. New York P.W. 55 produced large heads of good quality but observations have not been great enough to warrant a recommendation.
Other work with vegetables was concerned with varietal comparisons, cultural practices, irrigation and the control of insects and diseases. (Project 144. Leaders: S. A. McCrory, E. O. Olson, Horticulture Department.)

**Growth and Yield of Strawberries and Raspberries Investigated.** The study of fruits has been largely confined to raspberries and strawberries. Leading varieties of each were planted in the spring of 1944 at Brookings and Spearfish for the purpose of evaluation. Winter protection necessary for each variety will be determined. Resistance to calcium induced chlorosis will also be evaluated. (Project 145. Leaders: S. A. McCrory and E. O. Olson, Horticulture Department.)

**Substations**

A number of farm problems have been studied under experimental procedure at the substations located in the different agricultural areas of the state.

**Range Field Station (Cottonwood):** At the Range Field Station tests are under way to determine methods of producing more feed for livestock. This includes hay, forage and grain for roughage and concentrates.

Yields of hay from native grass from 1/40 acre plots were determined. In this test nine plots are harvested every season. Three plots are cut every season, three every two years, and three every three years. In 1943, 696 pounds per acre of air dry hay were obtained in the plots cut each year.

Several crops rotations are under way to study (a) The injurious effect of sorghum on succeeding crops, (b) Effect of corn, small grains, sorghum and legumes grown continuously or in various combinations, and (c) The advantage of using a cultivated row-crop as a seed bed for the following grain-feed-crop.

The main shelterbelt, started in the spring of 1942, is growing nicely. Species which have proved well adapted are ash, Siberian elm, indigo bush, 3-leaf sumac, chokecherry, caragana, and golden currant. Difficulty has been experienced in establishing hackberry and honey locust. Evergreens have done poorly at Cottonwood.

**Wintering, Summer Grazing, and Breeding of Range Beef Cows Studied.** Adequate winter rations, proper stocking of summer ranges, and the use of high producing, good quality breeding stock are the chief factors affecting successful production of feeder beef cattle in western South Dakota.

At the Cottonwood Range Field Station, 48 high-grade Hereford cows are being fed four wintering rations, summer grazed on the range at three intensities of stocking, and bred to different purebred sires. Two and one-half years work has been completed to date. The results of wintering and summer grazing are included in the tables on page 27.

The data on wintering and summer grazing to date, are too few to draw final conclusions. Also the results are complicated by the large departure of climatic condition from the average. During the last two years the rainfall has averaged 17.4 inches per year at the station as compared to 12.5 inches for the 10-year period, 1932-41.

It appears safe to conclude, however, that beef cows can be wintered satisfactorily without the use of protein concentrates if plenty of good quality, local feeds are available.

The 1943 calf crop is now on feed at the local station. To date the offspring from sire No. 1 have excelled those from sire No. 2 in both body conformation
Table 1. Effects of Different Wintering Rations on Beef Cows and Calves*

<table>
<thead>
<tr>
<th></th>
<th>Winter grazing; (Wheat grass hay if necessary)</th>
<th>Winter grazing; 1 lb. CSCC daily. (Wheat grass hay if necessary)</th>
<th>Winter grazing; ½ feed wheat grass hay daily</th>
<th>Winter grazing; ½ feed sorghum fodder daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cows</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>Initial weight (Av.)†</td>
<td>918.2</td>
<td>980.6</td>
<td>982.9</td>
<td>993.7</td>
</tr>
<tr>
<td>Final weight (Av.)</td>
<td>914.8</td>
<td>914.2</td>
<td>927.8</td>
<td>922.7</td>
</tr>
<tr>
<td>Loss in weight (Av.)</td>
<td>73.4</td>
<td>84.4</td>
<td>55.1</td>
<td>71.0</td>
</tr>
<tr>
<td>Number of calves dropped</td>
<td>23</td>
<td>22</td>
<td>24</td>
<td>22</td>
</tr>
<tr>
<td>Number of calves raised</td>
<td>23</td>
<td>21</td>
<td>24</td>
<td>21</td>
</tr>
<tr>
<td>Birth weight of calves (Av.)</td>
<td>76.6</td>
<td>72.8</td>
<td>72.9</td>
<td>73.4</td>
</tr>
<tr>
<td>Weaning weight of calves (Av.)</td>
<td>358.2</td>
<td>391.7</td>
<td>394.2</td>
<td>396.8</td>
</tr>
<tr>
<td>Age of calves at weaning (Av.)</td>
<td>171.5</td>
<td>188.5</td>
<td>191.3</td>
<td>194.5</td>
</tr>
<tr>
<td>Daily gain of calves to weaning</td>
<td>1.64</td>
<td>1.69</td>
<td>1.68</td>
<td>1.66</td>
</tr>
<tr>
<td>Feed per cow:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cottonseed cake (lbs.)</td>
<td>121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat grass hay</td>
<td>168</td>
<td>157</td>
<td>1071</td>
<td></td>
</tr>
<tr>
<td>Sorghum fodder</td>
<td>104.9</td>
<td>1049</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>14.6</td>
<td>15.6</td>
<td>7.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Bonemeal</td>
<td>.85</td>
<td>.61</td>
<td>1.55</td>
<td>.92</td>
</tr>
<tr>
<td>Ground limestone</td>
<td>.11</td>
<td>.13</td>
<td>.13</td>
<td>.19</td>
</tr>
</tbody>
</table>

*Data are from 3 years of winter feeding but only two calf crops.
†Cottonseed cake.
‡All weights in pounds.

Table 2. Effect of Different Intensities of Summer Grazing on Beef Cows and Calves.*

<table>
<thead>
<tr>
<th></th>
<th>Over grazing; 10 acres per cow and calf</th>
<th>Normal grazing; 16.6 acres per cow and calf</th>
<th>Under grazing; 22.9 acres per cow and calf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cows</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Initial weight (Av.)†</td>
<td>898.7</td>
<td>905.0</td>
<td>934.9</td>
</tr>
<tr>
<td>Final weight (Av.)</td>
<td>983.8</td>
<td>965.1</td>
<td>1000.3</td>
</tr>
<tr>
<td>Gain in weight (Av.)</td>
<td>85.1</td>
<td>60.1</td>
<td>75.4</td>
</tr>
<tr>
<td>Numbers of calves</td>
<td>31</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Birth weight of calves (Av.)</td>
<td>71.2</td>
<td>73.6</td>
<td>76.6</td>
</tr>
<tr>
<td>Weaning weight of calves (Av.)</td>
<td>378.6</td>
<td>384.8</td>
<td>389.8</td>
</tr>
<tr>
<td>Age of calves at weaning (Av.)</td>
<td>191.8</td>
<td>186.8</td>
<td>183.4</td>
</tr>
<tr>
<td>Daily gain of calves on pasture</td>
<td>1.58</td>
<td>1.64</td>
<td>1.73</td>
</tr>
<tr>
<td>Feed per cow and calf:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acres grazed per cow and calf (7 months)</td>
<td>10.0</td>
<td>16.6</td>
<td>22.9</td>
</tr>
<tr>
<td>Salt</td>
<td>17.2</td>
<td>18.2</td>
<td>15.3</td>
</tr>
<tr>
<td>Percent grass on range utilized</td>
<td>46</td>
<td>30</td>
<td>20</td>
</tr>
</tbody>
</table>

*Data are from 2 years of summer grazing.
†All weights in pounds.

and rate of gain. Complete data on the progeny test will be available when these calves are marketed in early fall in 1944. (Project 121. Leaders: Leslie E. Johnson and I. B. Johnson, Animal Husbandry Department.)

Central Substation (Highmore): Crested wheatgrass, western wheatgrass, brome grass, and alfalfa planted in the fall and also in the spring was harvested on the old fertility plots. These grasses and legumes gave higher yields where fertilizer had been applied during 1912-1936. During 1943 and 1944 additional application of nitrogen, phosphorous, and potassium were made.

[25]
Five different crop rotations were started. These include (a) small grains, (b) grain and row-crop, (c) legume (sweet clover) included for hay or green manure, and (d) plowing and sub-surface tillage. Yield of Rival wheat following corn was 16.5 bushels per acre, while the same wheat grown on sorghum land yielded 15.6 bushels. Corn planted on April 28 yielded 5.0 bushels, May 5, 5.2 bushels, and May 17, 8.0 bushels per acre. Grasshoppers invaded this corn experiment and influenced the results. Corn performance test plots, small grain varieties, and variety test of sorghum for grain and forage were planted for yield and adaptation studies.

Three years of tillage and residue trials at highmore indicate that application of manure increased crop yields more than did application of straw residues. Tillage, whether by plowing or subsurfacing, had little effect on crop yields. In the fallow-wheat rotation neither the application of manure nor of straw effected crop yields.

The shelterbelts, started in the spring of 1942, are making a fine growth. Trees which have done well are ash, Siberian elm, and boxelder. Hackberry and honey locust have been difficult to establish. The Mayday tree, Tatarian honeysuckle, common lilac, buckthorn, and wild plum are good tall shrubs for this area. The buffalo-berry has proven superior to Russian olive in this planting.

Experiments with vegetables using shade and four fertilizer combinations are being conducted during the summer of 1944. Half shade has given no benefit and in the vegetables harvested the yields have been slightly less than in the open. Early yields show but slight differences between the fertilizer treatments.

The sandcherries planted in 1940 at Highmore produced the first crop in 1943. The 1944 crop will be even greater. This plant seems especially well adapted to conditions in the central area of the state. The sandcherry plum hybrid planting produced a heavy crop of fruit the fourth year. The apricots have made good growth but as yet have not produced fruit. The apple trees have made less growth than the plums and as yet are not bearing. In general all tree fruits have grown better in this area than was thought possible. The trees are spaced 25 feet and clean cultivation is practiced.

**North Central Substation (Eureka):** Agronomic problems under investigation are as follows: (1) Yield of hay from land in native grass, (2) Small grain nursery and variety test plots, (3) Hybrid corn performance test, and (4) Crop rotation.

In determining the yield of hay from land in native grass, 18 plots, each 1/40 of an acre, are used. Three are harvested annually; three every two years, and three every three years. The yield obtained from those cut annually during 1943 was 3120 pounds of air cured hay per acre.

A fruit planting made on the contour and kept clean by cultivation has resulted in excellent survival and growth of trees. The sandcherry and plum plantings are now fruiting heavily. The apple varieties which consists mainly of crab apples are beginning to bear. The exposure to the north has produced better growth of trees than has a southern exposure.

A rabbit repellant consisting of seven pounds of powdered rosin to 1 gallon of Ethyl alcohol has protected the trees against serious rodent injury.

**West Central Substation (Vivian):** Hay and seed yields were determined on brome grass, western wheatgrass, crested wheatgrass and alfalfa seeded in fall and in the spring. Seasonal conditions have been favorable in recent years and brome-
grass yielded high. However, it is not likely to displace western wheat or crested wheat on the upland soils of this area.

Planting corn and sorghum in alternate pairs of rows has been found to be profitable. Yields of silage have been stabilized by this method of planting, especially under conditions of grasshopper outbreaks, when rows of corn have been injured, sorghum has grown and contributed fair yields.

Grain nursery, sorghum and corn performance tests were continued. These tests are conducted to determine the best variety adapted for South Central and Western South Dakota.

The U. S. Belle Fourche Field Station—Newell

Sheep Breeding. A flock of approximately 40 Corriedale ewes and two rams, are maintained at the United States Belle Fourche Field Station at Newell for pasture work and to increase this breed of sheep in the irrigation district.

Thirty-two of the 36 bred ewes lambed. These ewes produced 48 lambs of which four were dead. The average weight of the fleece from the aged and yearling ewes, sheared May 19, 1944, was 11.7 pounds. The preceding year the flock sheared 10.2 lbs.

New Lamb Feeding Trials Started. A new series of lamb feeding trials was started in the fall of 1943 to compare various methods of feeding corn and alfalfa hay with and without beet by-products.

Three lots of lambs were also fed to secure some information upon the number of lambs necessary to give reliable data in feeding trials. The comparison made involved (1) whole versus chopped hay, (2) grain feeding two times daily versus grain feeding three times daily, (3) self-feeding grain and chopped hay versus hand feeding grain and whole hay, (4) grain and alfalfa hay versus grain, alfalfa hay plus beet by-products, and (5) 50 lambs per lot versus 25 and 100 lambs per lot.

The lambs were put on feed on October 15 and marketed as finished. During the first two weeks of the trial relatively heavy death losses occurred due to coccidiosis and wire worms. This necessitated taking all lambs off feed for special treatment. On November 19 they were put back on the experimental rations. The tables summarize the data from November 19 until the close of the feeding trials.

Table 1. Comparisons of Different Methods of Feeding Grain and Alfalfa Hay with or without Beet By-Products to Fattening Lambs.
The greatest profit and the most economical ration was found to be barley, chopped hay, and beet pulp. The returns per lamb amounted to $2.26, and the feed cost per 100 pounds gain was $11.05.

A new ration was tried for the first time this year in Lot 10, namely, barley fed three times daily and chopped alfalfa hay. This ration proved to be the second most profitable ration. The returns per lamb amounted to $2.17, and the feed cost per 100 pounds gain was $11.80.

The most costly ration was that used in Lot 7, namely, barley and chopped hay feed in the self feeder. This ration was made up of 70 percent ground barley and 30 percent chopped hay. The loss per lamb was $.06 and the cost per 100 pounds gain amounted to $18.02.

With the exception of lot 10 where the barley was fed three times a day, and lot 4 where beet top silage was used with the corn, corn was found to be superior to barley as a grain.

<table>
<thead>
<tr>
<th>Lot Number</th>
<th>8a</th>
<th>8</th>
<th>8b</th>
<th>8c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number lambs started</td>
<td>44</td>
<td>93</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Initial weight (av.)</td>
<td>55.5</td>
<td>51.9</td>
<td>55.8</td>
<td>57.8</td>
</tr>
<tr>
<td>Final weight (av.)</td>
<td>95.6</td>
<td>97.6</td>
<td>99.8</td>
<td>97.4</td>
</tr>
<tr>
<td>Daily gain (av.)</td>
<td>.38</td>
<td>.42</td>
<td>.42</td>
<td>.37</td>
</tr>
<tr>
<td>Death loss (no.)</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Feed per 100 lbs. gain:

| Grain | 374 | 387 | 415 | 433 |
| Hay | 233 | 204 | 226 | 237 |
| Succulent | 547 | 481 | 519 | 557 |
| Purchase price | 12.78 | 12.78 | 12.78 | 12.78 |
| Selling price | 15.59 | 15.51 | 15.72 | 15.61 |
| Feed cost per 100 lbs. gain | 12.23 | 11.57 | 12.54 | 13.52 |
| Returns per lamb | 1.78 | 1.84 | 1.63 | 1.33 |

The four lots fed the same ration (Table 2) showed considerable variation in rate of gain, feed per 100 pounds gain and returns per lamb. They certainly indicate that little faith can be put in small differences resulting from a one year feeding trial.

**Swine Production Experiment Started.** The purpose of this project is to develop more effective breeding and production methods for the irrigation area of Western South Dakota. Twelve purebred Hampshire sows and two purebred Hampshire boars compose the breeding stock used in this work. These swine are being bred as a closed herd—no new blood having been introduced since the origin of the herd in the fall of 1942.

Selection of all breeding stock is being made on the basis of (1) growth rate, (2) productivity, (3) freedom from defects, and (4) type. A total of 74 pigs was raised in the spring of 1943. The average selection index of the gilts selected as dams for 1944 pig crop was 62.5 and for the two boars was 77.5. The average for the entire 1943 pig crop was 56.5.

Wheat, protein supplement, and minerals proved a more efficient and economical ration than corn, protein supplement, and minerals. Pigs on the former ration gained 100 pounds on 387.3 pounds of feed while those on the latter ration required 492.2 pounds of feed per 100 pounds of gain. (Project 132. Leader: Leslie E. Johnson, Animal Husbandry Department.)
Crop Insects

Grasshopper Work Advances. A manuscript concerning the grasshopper mite, *Eutrombidium trigonum* (Hermann) was published as Technical Bulletin 3 of the South Dakota Agricultural Experiment Station. A committee on grasshopper research was appointed in 1942 by the President of the American Association of Economic Entomologists. Mr. Severin was named chairman of this committee. The personnel of this committee was asked to continue in office during the year 1942 and during the next fiscal year of 1943. Two reports covering research work done in 1942 and 1943 on grasshoppers in the United States and Canada were published by this committee.

Each report appeared in three parts. The first part discussed the research work that was done by state agencies principally, the second part was devoted to a discussion of the research that was done by the United States Bureau of Entomology and Plant Quarantine, while the third part included a discussion of the work done by the Dominion of Canada and the provincial works of Canada. Copies of these reports were sent to all research workers in the United States, Canada, and Mexico interested in grasshopper work.

An agreement was made with research workers in the British Empire to exchange unpublished research data on grasshoppers.

Through the exchange of reports on grasshopper research, it becomes possible for workers to learn the results of this research work long before it is published. This should speed up the end results and it should eliminate much unnecessary duplication. In addition it makes it possible for workers to correspond on subjects in which they are mutually interested. Part one of the second report of the Committee on Grasshopper Research appears as Entomology Pamphlet 7, Agricultural Experiment Station, South Dakota State College, March 15, 1944.

During the past fiscal year, additional studies were made of the grasshopper, *Boopedon nubilum* (Say). The life cycle was run through again, over a hundred specimens being carried through from the egg stage through the adult. Field observations were also made and a rough draft of a manuscript was prepared covering this research work. An adequate series of photographs and microphotographs were prepared on this subject. A final draft of a manuscript will probably be ready on this project some time before June 1, 1945. (Project 18. Leader: H. C. Severin, Entomology-Zoology Department.)

Beetle Control Dusts Tested. Little life history work on blister beetles was done during the past year. The work that was done was confined largely to laboratory experiments in which poisons were used in attempted control. The poisons used were barium fluosilicate, 1 part to lime 9 parts; sodium fluosilicate, 1 part to lime 9 parts; Paris green, 1 part to talc 9 parts; super pyro-cuper, straight (pyrocide 10 plus copper.)

The laboratory experiments were conducted as follows: The poisons were dusted on the tips of potato plants and then the tips were placed in small bottles filled with water. The beetles were then caged with the dusted potato plants; or the beetles were dusted directly and then placed in cages with undusted potato plants. In each experiment 25 blister beetles were used. Check cages in which no poisons were used either on the beetles or on the potato foliage were used to house 25 beetles of similar species.

Of the poisons used in the experiments, super pyro-cuper gave the best results when dusted directly on the beetles, all but two of the 25 beetles being dead at the
end of the first day. All were knocked down and unable to move at the end of three minutes. In the experiments where the poison was dusted on the plants but not on the insects, there was only a slight kill. Paris green and lime dusted on the beetles killed 24 out of the 25 beetles by the end of the second day but was not as effective as super pyro-cuper at the end of the first day. (Project 14. Leader: G. B. Spawn, Entomology-Zoology Department.)

Tillage Used to Kill Grasshoppers: During the year, studies were continued on the effect of tillage methods for the destruction of grasshopper eggs and for the concentration of oviposition by use of trap strips. Fall egg surveys were conducted in the Chamberlain, Onida, and Hecla areas. Sites for experiments were chosen, staked out, and various tillage methods were applied to the experimental plots. Studies in the vicinity of Onida are being conducted with an implement for destruction of grasshopper eggs in headlands and pastures. Emergence cage results will be tabulated as hatching progresses.

The emergence cage results obtained last spring along with the results of the three previous years were evaluated and were mimeographed as Entomology Pamphlet No. 6, South Dakota Experiment Station, South Dakota State College.

Copies of these pamphlets were sent to County Agents, Smith-Hughes instructors in high schools of South Dakota, all Extension entomologists, and others interested. Copies of the pamphlet were also sent to farmers upon request.

Publications:
Tillage Methods in Grasshopper Control. Entomology Pamphlet 6, South Dakota Agricultural Experiment Station.
Tillage Control for Grasshoppers. The Dakota Farmer. Vol. 64, No. 1, pp. 6-7, January 8, 1944. (Project 86. Leader: G. B. Spawn, Entomology-Zoology Department.)

Study Insect and Rodent Control for Trees and Shrubs. Appropriate literature concerning insects and diseases injurious to trees and shrubs has been gathered and filed so that it is readily available. Satisfactory progress was made on this phase of the project since the project was approved. A large number of insects are involved, the most serious and difficult to control being the borers.

Appropriate literature on the rodent control phase of developing farm trees and shrubs also has been accumulated. Some equipment and supplies have been obtained and some of the rodents and the rabbits concerned have been identified. The project was approved too late to do very much control work. (Project 142. Leaders: H. C. Severin and G. B. Spawn, Entomology-Zoology Department.)

**Farm Engineering**

**Horse-Drawn Machines Are Adapted for Power.** Four types of power buck rakes were built in the laboratory during the year. These are designed for the farm truck and tractor to be used in picking up hay or grain in the windrow or shock and hauling it to the stack or directly to the barn or the threshing separator.

A horse-drawn bucker was converted to a front-mounted tractor bucker. A front-mounted bucker of the push type was built. This bucker has the advantage of being the most quickly detachable. A rear-mounted bucker was built for the farm tractor. This type of power bucker has the advantage of throwing the weight of the load of hay on the rear wheels of the tractor. For long hauls such as hauling hay into the barn this is an advantage as the heavy load on small front wheels of
tractors may cause excessive wear. A fourth heavy duty front-mounted bucker was equipped with an extra pair of wheels for supporting the bucker load.

Work was also done a stacker-bucker. A homemade, wood framed stacker-bucker was built in the laboratory and given the first field test. A stack of hay was put-up with it, and it was also used for loading windrowed hay onto the wagon. Development work was not completed on this stacker-bucker but satisfactory operation was assured.

Using the same hoist mechanism, a manure loader has been built in the laboratory and is under field tests at this time. The buck rakes and stacker-bucker are shown in picture and drawings with brief instructions in Experiment Station Circular No. 49 which was published during the year.

Wood was used almost entirely in the buck rakes and stacker in order to save the use of critical war metals. These machines are among the most important time and labor saving equipment for harvest time on the farm, and work on this project was given special attention during the year. Experiment Station Circular No. 44, "Converting a Horse-Drawn Mower Into A Power Mower," was also published during the year. The work was done under this project last year, and was nearly ready for publication. (Project No. 34. Leader: L. F. Larsen, Agricultural Engineering Department.)

New Hard-Surfaced Floors Developed for the Farm Poultry House. Two new low cost, experimental hard-surfaced poultry house floors built in 1940 were selected and described in Experiment Station Circular No. 42 which was published in January, 1943. This was a progress report only, as the floors are still under test and close inspection. The two floors were selected from 10 new materials that are under test. They were chosen because of their promise of durability under poultry, for their low cost, and for simplicity of building. One of these is of
soil-cement, a material which has been used for light traffic highways. The other is an oil-surfaced floor in which cold cut-back asphalt oil was used in the stabilizer. Both of these floors are still standing satisfactorily.

An earth floor stabilized with one of the commercial lignin products and sealed with light road oil, showed signs of failure during the year. A floor of plain rammed earth has shown considerable advantage over an ordinary earth floor but has roughened badly in three years and is not considered as worth the labor of building. A 3-inch floor of well mixed concrete which was used as a check floor for the other nine test floors has stood in perfect condition for four years. A 4-inch cinder-concrete floor in which washed, soft coal cinders were used in place of sand and gravel, has stood equally well for four years. An asphalt oil floor ("black top") was built, but considered very difficult to build on the farm with ordinary available equipment. The test section in which the same rate of oil was used as for highways was unsatisfactory. The addition of 25 percent more oil made a satisfactory floor. The same was found true with a tar-oil floor. A 4-inch stabilized adobe floor has shown very satisfactory after three years but was expensive in labor and materials.

A new floor of insulating material was added to the test floors during the year. Rodents have gone through the black top sawdust-cement and oiled floors in a few places at the edges where soft and thin spots were left in building. Indications are that if care is used in making the edges this will not happen, but it is advisable to make all of these floors slightly thicker around edges and corners. (Project 83. Leaders: R. L. Patty, L. F. Larsen, Agricultural Engineering Department; W. O. Wilson, Poultry Department; and I. B. Johnson, Animal Husbandry Department.)

Earth Walls for Farm Buildings Studied. Experimental stucco panels on rammed earth test walls that have stood for eight years, failed during the past year. This is an example of the need for long time studies of this project. On one long wall on which 28 panels were under test for different methods of bonding the stucco to earth walls, four panels failed. Two of these were bonded by 8d nails driven directly through the fresh scratch coat of stucco as it was applied to the wall. The nails were driven 10 inches on center. Two other panels failed on which the same 8d nails were used for bonding except they were driven in a small hole which was gouged in the wall surface. The nails were driven before the scratch coat of stucco was applied. This wall was less than seven feet high and as a result of the failures this method of bonding cannot be recommended. All panels on which any type of woven bonding wire or metal lath was used are in perfect condition.

The above test panels (without the use of bonding wire) were tried with the idea of reducing the cost of the farm poultry house of rammed earth. Since poultry house walls are low there was a chance that this practice might be practical. A 16 by 32 foot farm type poultry house was built of rammed earth on the College Poultry Farm in 1931 and was stuccoed in this way in 1933. This stucco job has stood for more than 10 years without the use of bonding wire. The stucco used was exactly the same as that used on the panels that failed.

Two test walls of rammed earth plated or veneered with a stabilizing material have failed during the year. Both of these stood for three years before failure. On one the plating material was stabilized with lignin solution. On the other the plating was stabilized with Portland cement in a 15 percent mixture—by volume. In both cases the thickness of the veneering plate was approximately two inches.
Bare rammed earth test walls built from high quality soil are standing in perfect condition after 14 years exposure to the weather. (Project 22. Leaders: R. L. Patty, and H. H. DeLong, Agricultural Engineering Department.)

**Steel Fence Post Coverings Compared.** Five hundred galvanized steel fence posts placed in the fence row in 1925 (19 years ago) are still well covered and have a good color, except where wire has rusted and stained them. No change from last year can be recognized. From the center of the highway their appearance is excellent. However, there are many small pin head sized blisters on the galvanized coat that show under close inspection. In dense shade under trees this blistering is heavier. Only a few blisters have broken, showing pin points of rust upon very close inspection. The same steel posts that were dipped in paint at the factory needed painting in five years and are now black with rust (check posts).

Three hundred of these dipped posts were repainted 12 years ago, seven years after setting. Metallic zinc paint (battleship grey) proved far superior to other lead-oil paints of the same color. The metallic zinc paint is still in excellent condition and with a good bright color after 12 years exposure. All lead-oil paints are more than one-half gone and the posts are beginning to rust. All the replaced paints were brushed on the standing posts. (Project 15. Leader: R. L. Patty, Agricultural Engineering Department.)

**Soybean Harvesting and Threshing Machinery Developed.** South Dakota farmers were urged to grow an acreage of navy beans in the 1943 season to help replace former producers in the commercial dry bean areas, who in turn were urged to shift their crops to soybeans. Production of dry beans on a large scale called for the study of harvest methods with the machinery which was available to South Dakota farmers. New and specialized machines were not available.

A tractor mounted vine cutter and windrower was constructed and used for navy beans and similar varieties. The small combine was found satisfactory in direct combining of soybeans and in windrow threshing of navy, teppary, bountiful and other varieties of string and wax beans.

The harvest and threshing of beans was found to be less of a problem than weed control. The low growing bean plants require different care than corn or sorghums which are taller and shade the ground. Marketing of the crop is difficult, as the processing plants are a long distance away. The soybean lends itself much better to machine handling by the type of machinery now on South Dakota farms. The taller growing soy plants make cultivation and weed control easier. They can be combined directly from the field without cutting or windrow.ing. (Project 136. Leader: H. H. DeLong, Agricultural Engineering Department; E. L. Erickson, Agronomy Department.)

**Sorghum Grain Storage Tests Continued.** Grain sorghum seed has a moisture content of more than 13 percent at harvest time in many seasons; and therefore is likely to mold and heat in storage. Sorghum with initial moisture content of 16 percent has reached bin temperatures of 110 degrees to 116 degrees during the months of June and July.

Severe molding takes place throughout the bin and the grain does not drive off excess moisture and cool down until September.

Seven bins of grain were carried through the summer season of 1943. The sorghum had a moisture content of 16 percent at the beginning of the test. The attempt to successfully store this grain when mixed with barley of 12 percent moisture content, in 50-50 proportions was not successful. The year before a similar test on a 50-50 mixture of sorghum and oats was successful.
Mechanical handling of the grain as it begins to heat has resulted in partial success. The bin in the 1943 trials was saved from heating by transferring the grain to wagons, allowing it to cool, and then transferring it by augur elevator to new bins. Each 70-bushel load was placed in a separate bin. During June 1944 a bin of similar grain was elevated in 10 bushel lots, 12 or 24 hours apart to an adjacent bin. The elevator used moved the grain in a slow stream, well exposed to the air. To date, the elevating process has been done twice without eliminating the heating, although the aeration process helps lower the grain temperature temporarily.

Storing sorghum grain in a 500-bushel perforated steel bin with additional large vertical flues was partially successful in the 1943 season. This procedure will be repeated with flues more closely spaced when grain is available.

Drying grain by a mechanical blower has been successful in the 1944 season. Further study is needed, however, on the placement of the removable air ducts being tried out. All processes of drying and storing will be repeated in the future. (Project 114. Leader: H. H. DeLong, Agricultural Engineering Department; E. L. Erickson, Agronomy Department; Turner R. H. Wright, Animal Husbandry Department; Alvin L. Moxon, Agricultural Chemistry Department; W. F. Buchholtz, Plant Pathology Department.)

Home Economics

**Used Wool to Receive Wearing Tests.** The manufacture of fabrics containing reused wool has been encouraged during this war-time period. The desirability of this practice as an emergency as well as a postwar measure is to be studied from the consumer's viewpoint.

Five pieces of experimental fabric have been manufactured for this project at the Lowell Textile Institute. These contain 100, 75, 50, 25, and 0 percent new wool respectively, the remainder being made up of reused wool commercially listed as "old knits." The new wool used was a mixture of about 60 percent three-eighth's blood and 40 percent half blood. The fabrics are of the same weave construction, 2 x 2 twill weave, and are a type of woolen fabric known as flannel.

These fabrics will be tested physically and chemically, (1) as they are received from the manufacturers, (2) after storage periods, (3) after certain numbers of drycleaning, and (4) after actual wear periods.

Only the manufacture of the cloth has been attempted this year. A publication on the new material should be ready by next spring, 1945. (Project 140, Cooperative with the University of Minnesota. Leader: Helen M. Ward, Home Economics Division.)

**Serge Clothing Being Investigated.** A comparison study of the serviceability of three weights of blue-grey, new wool serge has been made. The 12-, 14-, and 16-ounce fabrics were tested physically and chemically (1) as they were purchased, (2) after 5, 10, and 15 drycleanings, (3) after 1,500, 3,000, and 4,500 hours of wear, and (4) after a storage period equivalent in time to the third wear period.

A total of 27 trousers were tailored from these experimental fabrics and were worn by men students at South Dakota State College. Three pairs of trousers of each weight of fabric were included in each service period.

All the physical testing is completed, but several of the chemical tests are still in progress. A preliminary manuscript has been partially written and will be finished as soon as all data is completed.

[34]
It is interesting to note that 3,000 hours of wear resulted in a 20 percent loss in warpwise strength for the 12-ounce fabrics and a 7 percent loss for the 16-ounce fabrics. Forty-five hundred hours of wear resulted in a 31 percent loss in warpwise strength for the 12-ounce fabrics and 34 percent loss for the 16-ounce fabrics. This seems to indicate that while, for these fabrics the lighter weight fabrics are likely to show wear first, with care, their useful life can be prolonged to equal the life of the heavier fabrics. Many of the 27 pairs of trousers were worn to the point of discard at the end of 4,500 hours of vigorous service. (Project 99, Cooperative with the University of Minnesota. Leader: Helen M. Ward, Home Economics Division.)

Food Nutrient Loss Studied. Since there is a gradual loss of food nutrients in fruits and vegetables after harvesting, a study was made this year, first, of the vitamin content of some freshly harvested products and second, identical samples held for one, two, three and five days in a refrigerator at about 40 degrees F.

Amounts of nutrients in the freshly harvested products will be compared with the same kinds in products that were quick frozen and kept for six months in the freezer locker.

The ascorbic acid content of one sample each of snap beans, spinach, and kale is as follows:

Beans—Pencil Pod Black Wax

<table>
<thead>
<tr>
<th></th>
<th>Freshly harvested</th>
<th>Kept one day</th>
<th>Kept two days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.11 mgms per 100 grams (3.5 oz.)</td>
<td>12.87 mgms per 100 grams</td>
<td>9.72 mgms per 100 grams</td>
</tr>
</tbody>
</table>

Spinach—King Denmark

<table>
<thead>
<tr>
<th></th>
<th>Freshly harvested</th>
<th>Kept two days</th>
<th>Kept five days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>34.61 mgms per 100 grams (3.5 oz.)</td>
<td>12.91 mgms per 100 grams</td>
<td>9.24 mgms per 100 grams</td>
</tr>
</tbody>
</table>

Kale—Dwarf Curl

<table>
<thead>
<tr>
<th></th>
<th>Freshly harvested</th>
<th>Kept one day</th>
<th>Kept three days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66.55 mgms per 100 grams (3.5 oz.)</td>
<td>64.71 mgms per 100 grams</td>
<td>42.07 mgms per 100 grams</td>
</tr>
</tbody>
</table>

Kale harvested at different dates in the summer showed a decrease in the amount of ascorbic acid as the plant matured.

Kale—Dwarf Curl

<table>
<thead>
<tr>
<th></th>
<th>Harvested June 15</th>
<th>Harvested July 9</th>
<th>Harvested July 23</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>146.00 mgms per 100 grams (3.5 oz.)</td>
<td>90.03 mgms per 100 grams</td>
<td>66.55 mgms per 100 grams</td>
</tr>
</tbody>
</table>

Ascorbic acid determinations were made on three varieties of spinach, one of kale, chard, wax beans, cauliflower, soy beans, two of peas and lima beans, several varieties of corn in the vegetable products, and three varieties of rhubarb. In all of the vitamin C determinations made for the freshly harvested vegetables and those kept one to five days, there is evidence of a rapid loss, hence it is important to get the products in the quick freeze as soon as possible after picking. A home garden is a help in obtaining quality in frozen fruits and vegetables because the products can be harvested when ready to be frozen.

The amount of B-Carotene found in some freshly harvested vegetables is included.
Food Product | Variety          | Average microgram per gram
-------------|-----------------|-------------------
Beans, wax   | Pencil Pod-Black | 0.91              
Beans, soy   | U. S. D. A. Edible | 9.07            
Chard        | Lucullus        | 34.25             
Kale         | Dwarf Curl      | 67.63             
Peas         | Radio           | 7.25              
Spinach   | Bloomsdale L. S. | 45.75           
            | King Denmark    | 63.00             
            | Victoria        | 53.13             

Palatability tests were made on all vegetables and fruits frozen. (Project 98. Leader: Minerva Kellogg, Home Economics Division.)

**Home Drying of Vegetables.** One of the less common methods of food preservation is that of drying and it is particularly useful in the preservation of fruits since it does not require sugar at the time. Foods dried do not take much space in storing nor as much equipment as is used in other methods of food preservation. Although a simple means of food preservation, it takes time and care in doing.

Here as with freezing, freshly harvested products should be used and the best quality selected for drying. Methods of refreshing and cooking are being studied. (Project 129. Leader: Minerva Kellogg, Home Economics Division.)

**Emergency Projects Studied.** In connection with home drying, the fruit of the rose, one of the common plants in South Dakota has large quantities of Vitamin C.

The rose hip or haw is the fruit of the rose left after the flower has bloomed and died. The fruit has more ascorbic acid after it has been lightly touched with frost. The flesh of the hips contain a high percent of ascorbic acid and it is used in making jam and puree. The puree can be used in making fruit soups.

The ascorbic acid content of some samples ranged from 495 to 1226 mgm. per 100 grams (3.5 oz.) (Project 129. Leader: Minerva Kellogg, Home Economics Division.)

**Farm Income and Community Welfare**

**Efficiency Affects Farm Earnings.** The analysis of 83 farm records in the North Central and Southeastern Areas of South Dakota shows a close relationship between high farm earnings and the number of efficiency factors in which a farmer excels. The six farm management factors studied were size of business, labor efficiency, crop yields, amount of livestock and efficiency in use of power, machinery, and equipment. The average earnings for the farmers who were below average in all of these factors were $2,100 compared to $6,600 for the farmers who excelled in five or more of these factors. The importance of efficient farm production is illustrated in the following table:

<table>
<thead>
<tr>
<th>No. of factors farmer excelled in</th>
<th>No. of farms</th>
<th>Average operator's labor earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3</td>
<td>$2108</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>$3002</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>$3375</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>$3629</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>$5270</td>
</tr>
<tr>
<td>5 or 6</td>
<td>5</td>
<td>$6660</td>
</tr>
</tbody>
</table>
That a high wartime production was profitable is indicated by the fact that total cash farm receipts for the high profit farms in the southeastern group averaged $19,800 compared to $6,700 for the low profit farms. Total farm expenses were also much larger on the high profit than the low profit farms. However, operator’s labor earnings were four times higher for the high than for the low profit farms.

A comparison of earnings and the importance of the six management factors is shown as follows:

<table>
<thead>
<tr>
<th>Farm Organization and Management Efficiency Measures—Southeastern South Dakota</th>
<th>Average of 33 farms</th>
<th>7 most profitable farms</th>
<th>7 least profitable farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator’s labor earnings</td>
<td>$4,334.00</td>
<td>$7,754.00</td>
<td>$1,966.00</td>
</tr>
<tr>
<td>Size of business (man-days productive work)</td>
<td>536</td>
<td>766</td>
<td>427</td>
</tr>
<tr>
<td>Days productive work per worker</td>
<td>285</td>
<td>337</td>
<td>281</td>
</tr>
<tr>
<td>Value crops per crop acre</td>
<td>$27.00</td>
<td>$29.00</td>
<td>$23.00</td>
</tr>
<tr>
<td>Total productive livestock units</td>
<td>39</td>
<td>65</td>
<td>31</td>
</tr>
<tr>
<td>Livestock returns per $100 feed</td>
<td>$169.00</td>
<td>$195.00</td>
<td>$134.00</td>
</tr>
<tr>
<td>Power, Machinery, equipment and building expense per work unit</td>
<td>$2.59</td>
<td>$2.47</td>
<td>$2.74</td>
</tr>
</tbody>
</table>

Size of business, as measured in terms of both crop acres and livestock numbers, was found to be one of the most important factors affecting earnings. This was particularly true for the North Central Area where a large farming unit is needed to assure an adequate income. High crop yields was also found to be closely associated with high earnings. A large amount of livestock kept during the war period contributed greatly to income when they were efficiently produced. The results of the two farm record summaries are given in Agricultural Economics Pamphlets Nos. 10 and 11. (Project 137. Leader: C. R. Hoglund, Agricultural Economics Department.)

Farmers Adjust Production to War and Postwar Needs. Changes in wartime and postwar requirements for various agricultural products has made it important to study the year-to-year adjustments needed on South Dakota farms and ranches. Cropland has been utilized more fully during the present war period than for any year since 1933. Livestock production has also reached an all-time peak in the state.

Requirements for most farm products will be high during 1945 and the early demobilization period. However, it will be necessary for farmers and ranchers to consider some of the long-time desirable changes in farming operations during 1945 to avoid a serious maladjustment during the post-war period. Wartime needs for such crops as flax and soybeans will decrease as the war progresses. Livestock feed requirements, particularly of roughage, will be high. Demand for most meat, dairy, and poultry products is expected to be maintained at a wartime level during 1945 but is expected to decline thereafter.

The study indicates that it will be desirable to increase the acreage of flax, wheat, oats and tame hay and make reductions in the acreage of barley and idle land from 1944 to 1945 as follows:
Estimates (in acres) of South Dakota Cropland Utilization for 1945, with Comparison*

<table>
<thead>
<tr>
<th>Kind</th>
<th>1924-33 Average (000)</th>
<th>1942 (000)</th>
<th>1943 (000)</th>
<th>1944 (000)</th>
<th>1945 Suggested is of 1944</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>5005</td>
<td>3169</td>
<td>3834</td>
<td>3987</td>
<td>4000 100.3</td>
</tr>
<tr>
<td>All sorghums</td>
<td>30</td>
<td>1002</td>
<td>739</td>
<td>665</td>
<td>665 100.0</td>
</tr>
<tr>
<td>Potatoes</td>
<td>58</td>
<td>33</td>
<td>49</td>
<td>39</td>
<td>40 102.5</td>
</tr>
<tr>
<td>Soybeans</td>
<td>19</td>
<td>31</td>
<td>13</td>
<td>30</td>
<td>230.8</td>
</tr>
<tr>
<td>Sugar beets</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>10 142.9</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>1 50.0</td>
</tr>
<tr>
<td>Total Intertilled</td>
<td>5093</td>
<td>4233</td>
<td>4667</td>
<td>4713</td>
<td>4746 101.0</td>
</tr>
<tr>
<td>All wheat</td>
<td>3450</td>
<td>2730</td>
<td>3198</td>
<td>3291</td>
<td>3520 107.0</td>
</tr>
<tr>
<td>Oats</td>
<td>2620</td>
<td>2360</td>
<td>2478</td>
<td>3073</td>
<td>3200 104.1</td>
</tr>
<tr>
<td>Barley</td>
<td>1678</td>
<td>2496</td>
<td>2321</td>
<td>1857</td>
<td>1500 80.8</td>
</tr>
<tr>
<td>Flax</td>
<td>520</td>
<td>382</td>
<td>630</td>
<td>321</td>
<td>50 155.7</td>
</tr>
<tr>
<td>Rye</td>
<td>369</td>
<td>816</td>
<td>522</td>
<td>397</td>
<td>400 100.8</td>
</tr>
<tr>
<td>Principal Small Grains</td>
<td>8637</td>
<td>8784</td>
<td>9149</td>
<td>8939</td>
<td>8720 97.5</td>
</tr>
<tr>
<td>Tame hay</td>
<td>1156</td>
<td>637</td>
<td>595</td>
<td>612</td>
<td>700 114.4</td>
</tr>
</tbody>
</table>

*1924-45 data from South Dakota Crop and Livestock Reporting Service.

A great need exists for the expansion of the tame hay acreage during the next few years as the present acreage is only about 60 percent of the pre-drought level (1924-33). Present numbers of roughage consuming livestock are about equal to the numbers for this (1924-33) 10-year period.

Present wartime cattle and sheep numbers are somewhat higher than the long-time carrying capacity of pastures and ranges. The results of this year's study, as reported in Agricultural Economics Pamphlet No. 13, suggests that all cattle numbers should be reduced to 89 percent, beef cow numbers to 83 percent, all sheep numbers to 90 percent and hen and pullet numbers to 81 percent of the January 1, 1944, numbers by January 1, 1946. The suggested livestock numbers for 1945 and 1946 for South Dakota are as follows:

Estimates of South Dakota Livestock Numbers for 1945 and 1946, with Comparisons

<table>
<thead>
<tr>
<th>Kind</th>
<th>1924-33 Average</th>
<th>1943</th>
<th>1944</th>
<th>Suggested 1945</th>
<th>1946 is of 1944</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horses and mules, all</td>
<td>668</td>
<td>348</td>
<td>330</td>
<td>325</td>
<td>320 90</td>
</tr>
<tr>
<td>Cattle and calves, all</td>
<td>1898</td>
<td>2172</td>
<td>2367</td>
<td>2250</td>
<td>2120 89</td>
</tr>
<tr>
<td>Milk cows</td>
<td>572</td>
<td>545</td>
<td>545</td>
<td>535</td>
<td>530 97</td>
</tr>
<tr>
<td>Beef cows</td>
<td>287</td>
<td>408</td>
<td>482</td>
<td>420</td>
<td>400 83</td>
</tr>
<tr>
<td>Sheep and lambs, all</td>
<td>862</td>
<td>2407</td>
<td>2223</td>
<td>2000</td>
<td>2000 90</td>
</tr>
<tr>
<td>Ewes</td>
<td>674</td>
<td>1645</td>
<td>1479</td>
<td>1330</td>
<td>1330 90</td>
</tr>
<tr>
<td>Hens and pullets</td>
<td>8007</td>
<td>10106</td>
<td>10768</td>
<td>8722</td>
<td>8722 81</td>
</tr>
<tr>
<td>All hogs</td>
<td>2574</td>
<td>1977</td>
<td>2392</td>
<td>2400</td>
<td>2400 101</td>
</tr>
<tr>
<td>Sows farrowed</td>
<td>642</td>
<td>549</td>
<td>380</td>
<td>550</td>
<td>550 145*</td>
</tr>
</tbody>
</table>

*Percent 1945 is of 1944.

Concentrate feed supplies will be more than adequate for the suggested livestock numbers for the two years, 1945-46, if normal crop conditions exist. Con-
centrate feed requirements will not greatly exceed 60 percent of the production for these two years. Livestock producers will be in a more precarious position regarding roughage supplies during the next few years. Drought or below average climatic conditions could seriously reduce roughage supplies below the quantities needed if livestock producers failed to adjust cattle and sheep numbers downward.

As an indication of the economic condition of South Dakota farmers it is interesting to note that farm mortgage foreclosures in 1943 reached the lowest point for any year for which the department has records. Data have been gathered for 1913, 1918 and for every year since 1921. There were 172 foreclosures in 1943 covering 32,429 acres. In 1942 the comparable numbers were 378 and 77,052 acres. In 1918, also a war year, there were 445 foreclosures on 103,442 acres of farm land. Foreclosures from 1921 to 1940 inclusive were very high because of the excessive increase in farm mortgage debts during the World War I inflation period. The current data are now available in a mimeographed supplement to Circular 17. (Project 92. Leaders: C. R. Hoglund and Gabriel Lundy, Agricultural Economics Department; All Station Departments and U. S. Bureau of Agricultural Economics cooperating.)

Marketing Studies Temporarily Discontinued. Farm and ranch income is dependent on satisfactory markets as well as on efficient production. In recognition of this fact the study of livestock marketing, in cooperation with the Corn Belt Livestock Research Committee, has been continued.

During the past year efforts have been concentrated on collecting and analyzing market prices of hogs, cattle and sheep for a period of years. The markets for which prices have been studied, or at least assembled and tabulated, have been Sioux Falls, Sioux City, Omaha, St. Paul, Kansas City and Chicago. Results thus far reveal the possibility of improving the market price reporting service for the benefit of livestock producers.

This research work has had to be discontinued temporarily due to the project leader's departure for service with the Navy. (Project 127. Leader: Everett M. Jennewein, Agricultural Economics Department.)

Recommendations Issued for Schools. This project, which involves study of the public school organization and its financial support in South Dakota, originally was started in informal cooperation with the state department of public instruction and the South Dakota Education Association.

Immediate problems in the schools were those of small enrollments, high cost per pupil, and a large number of closed schools. More economic adjustment of school services was found needed.

Attention of the state was called to the situation and a number of suggestions and recommendations were made to school leaders and taxpayers.

Two mimeographed preliminary publications were issued under the general title of "Local School Units in South Dakota." The first of these has the sub-title, "School Districts," and was issued in March, 1944, as Pamphlet 110. The second mimeographed pamphlet, No. 111, "Special Problems of the Small High Schools in South Dakota," was issued in June, 1944.

Two additional mimeographed pamphlets are being planned for this fall. One will be a school district atlas, arranged by counties, and the second entitled, "Natural Community School Units," will treat the problem of forming natural school community centers. (Project 64. Leader: W. F. Kumlien, Rural Sociology Department.)
Cooperative Project Agreements With Federal Agencies

The following cooperative research projects were conducted by specified Federal Agencies or Bureaus cooperating with the South Dakota Agricultural Experiment Station.

Bureau of Agricultural Economics

1. Transportation of Livestock, Other Farm Products, and Supplies Between Farm and Market. This is a research activity in which the 12 North Central states, Kentucky and Oklahoma have participated. The results were published in the Missouri Station bulletin 479 entitled "Trucking Livestock in the Corn Belt Region." Copies of this bulletin may be obtained from the South Dakota Station. (Project C-21.)

Bureau of Animal Industry

1. Cooperative Research for the Improvement of Swine Through Breeding (Agricultural Experiment Stations of Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, and Wisconsin). The purpose of this work is to study the improvement of swine through breeding methods. A report of the year's work will be found on pages 13 and 14. (Project C-6.)

2. Improvement of Viability in Poultry (Agricultural Experiment Stations of Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Missouri, Pennsylvania, New York, Ohio, Michigan, Indiana, Illinois, Wisconsin, Iowa, West Virginia, Maryland, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, Delaware, and New Jersey). (Project C-9.)

Bureau of Animal Industry and Bureau of Plant Industry

1. The Maintenance and Operation of a Cooperative Field Station on the Belle Fourche Reclamation Project Near Newell (Animal Husbandry Department). The object of the major project is to study problems pertaining to the sheep industry under conditions of irrigation farming, relative to (1) sheep breeding, (2) sheep feeding, (3) sheep pasture utilization and management, (4) lamb production, and (5) wool production. A summary of this work will be found on page 27. (Project C-1.)

A swine production project is carried on at this Station to develop more efficient swine breeding and production methods for the irrigated area in western South Dakota. A more detailed statement of this project appears on page 28.

Bureau of Plant Industry

1. Testing the Growth and Rubber Production of Kok-saghyz. Tests were made on the growth and adaptability of the Russian dandelion (Kok-saghyz) as a source of rubber. Local work was largely with seeding dates and fertilizer studies.

Few plants seeded in 1943 survived. During germination and early stages of growth, rainy and cloudy weather prevailed.

The plots were on a mineral soil that was rather fertile. There was a measurable difference in total yield when plants were given a commercial fertilizer. The rubber content did not appear to be influenced by fertilizer treatment.

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After observing this plant for three years it appears that Kok-saghyz will grow well in this area. It does not seem that Kok-saghyz will present a weed problem. Its use as a source of rubber will likely be influenced by demand. (Project C-18.)

2. **Investigation on Seed-Flax Improvement.** The uniform regional flax nursery consisting of 25 varieties and strains of flax was grown at Brookings in 1944. The yields of Bison and Redwing, the two check varieties, were 13.8 and 15.8 bushels respectively. Fifteen varieties outyielded Bison and seven outyielded Redwing by a significant difference. These seven varieties were Koto, Dakota, Redson, Custer and three unnamed strains.

In 1/55th acre drill strips Koto outyielded the eight other varieties tested by a significant difference. (Project C-20.)

**Bureau of Plant Industry, Soils and Agricultural Engineering**

1. For the Development and Production of Improved Strains and Varieties of Soybeans for Industrial Uses (Agricultural Experiment Stations of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, and Wisconsin). The objects of these cooperative investigations are (1) to develop through breeding and selection superior soybean strains and varieties for industrial uses, (2) to test varieties of soybeans under different cultural treatment, and (3) to determine the effect of soil differences and other environmental influences, including diseases, on yield and composition of soybeans. A report of this Station’s activity on this project may be found on page 7. (Project C-22.)

**Soil Conservation Service and Bureau of Plant Industry**

1. Research in Soil Erosion and Its Control. The project involves field trials, tests and the application of research findings to conservation programs, soil and water conservation research on pastures and cultivated lands and the activities for improving the effectiveness of vegetation in controlling soil erosion. (Projects 3, 15, 16. Leader: E. C. Joy.)

Use of this machine allows accurate appraisal of damage to soil from wind erosion. The movement of air in the tunnel may be regulated, ranging from a gentle zephyr to a wind of hurricane proportions.
Field studies were conducted throughout the state on farmer’s fields to determine the practical value and adaptability of soil conservation practices in various sections of the state.

**Contour Farming and Terraces Prove Valuable in South Dakota.** Contour farming has increased crop yields in all parts of South Dakota. When all the contour row crop trials conducted in South Dakota are considered, yields have been increased an average of 22.8 percent. Likewise, small grains have shown an average increase of 7.2 percent. Terraces have been of value in southeastern South Dakota when used in conjunction with contour farming. They have helped to control water erosion and to obtain crop yields. Field tests indicate this to be the only part of the state where extensive use of terraces is advisable. Contour pasture furrows have been a source of weeds during the first few years following construction. Small furrows have silted full before a grass sod covered them, but the larger ones have sodded over forming water catching basins resulting in increased grass yields.

**Sub-surface Tillage and Plowing Studied.** Increased crop yields have resulted from the use of sub-surface tillage in the drier parts of the state when small grains are combined and the straw left as surface protection. In the more humid portions of the state difficulty has been experienced with weeds and crop yields have been about equal to those from usual types of tillage. Highest crop yields on the Lemke farm at Huron have been obtained where the land has been plowed. Sub-surface tilled land has yielded nearly as much in most instances and about the same as discing. Considerable soil blowing has occurred in the plowed land while there has been no soil movement on the sub-surfaced or disced fields.

**Straw and Stubble Decrease Soil Blowing.** Soil losses by wind were lowest where all wheat straw was returned to the land and left on the soil surface. About 2,000 pounds of soil per acre were lost where all wheat straw had been returned and the land tilled by sub-surface sweeps. Where the wheat had been mowed and the land sub-surface tilled the loss was approximately 6,000 pounds per acre. Where small amounts of wheat straw were left and the land plowed, soil losses were as high as 7,500 pounds per acre. The soil surface on each plot show a decided increase in surface aggregation or clod formation where the larger amounts of straw were returned. Where all straw was returned the surface aggregation was increased regardless of the tillage method used, however, where smaller amounts of straw residue were returned surface aggregation was better on sub-surface tilled plots than on plowed or one-way tilled plots.

**Grass for Bindweed Control.** Crested wheat grass has been able to establish itself in old stands of field bindweed and then produce good forage yields. In areas of low rainfall the grass has nearly eliminated the bindweed where dense stands of grass are secured. In areas of higher rainfall crested wheatgrass has greatly reduced the creepers but has not been as effective as in drier areas.

2. **Proper Utilization of Seleniferous Land.** The results of this project are discussed on page 15. (Project C-11.)

3. **Conducting Soil Surveys and Mapping Related Physical Land Features.** The cooperating agencies have jointly considered problems pertaining to soil surveys and soil mapping within the state. A member of the Experiment Station staff assists in the field inspection and the correlating of soil types and series in order to maintain a uniform standard of soil classification in areas where soil surveys are in progress or about to be initiated. (Project C-23.)
Publications

Seven bulletins, six circulars, and the Annual Report for 1942-43 were published by the South Dakota Agricultural Experiment Station during the period from July 1, 1943 to June 30, 1944. Bulletins and circulars are listed below.

Bulletins


Circulars


Bloat in Dairy Cattle. Circular 52. By T. M. Olson.


Journal Articles by Staff Members

Animal Husbandry

J-184 L. E. Johnson. The Relationship of Feeder Grade, Initial Weight, Total Gains, Finished Grade and Carcass Grade in Lambs. Journal of Animal Science. 3 224-232. 1944

Chemistry


Poultry Science. 23 149-151. 1944

Turkeys. Poultry Science. 23 224-229. 1944

on Seleniferous Range. Journal of Animal Science. 3 299-310. 1944

Dairy

J-179  F. M. Skelton. The Combined Bacteriostatic Activity of Sulfanilamide 
and Azochloramide Upon Streptococci in Vitro and in Studies. Journal 
of Dairy Science.

J-181  G. C. Wallis. A Breed Comparison in the Vitamin D Content of Milk with 
Notes on a Modified Technique for the Vitamin D Assay of Low-Potency 
Fats and Oils.

Entomology

J-175  H. C. Severin. A Study of a Gynandromorph of Melanoplus Mexicanus 
Mexicanus (Sauss). (Orthopetera.) Journal New York Entomological 
Society. 51 179-183. 1943

Home Economics

J-183  E. L. Phelps, H. M. Ward, Delphine VanHouten, Barbara Bailey. A Com-
25 63-65. 1944

Horticulture

J-186  S. A. McCrory. Investigation of the Insecticidal Value of an Extract from 
Amorpha Fruticosa. South Dakota Academy of Science.

Experiment Station Staff

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HONORABLE A. R. FERGUSON .......... Watertown
HONORABLE FRANK CUNDILL .......... Isabel
HONORABLE M. E. HAPNER .......... Newell

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HONORABLE FRANK CUNDILL .......... Regent Member
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R. A. LARSON .......... Treasurer
EUDORA E. CROOK .......... Secretary

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C. R. HOGlund, M.S. .......... Assistant

Agricultural Engineering
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H. H. DeLONG, M.S. .......... Associate

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W. W. WORZELLA, Ph.D. .......... Agronomist
A. N. HUME, Ph.D. .......... Associate
LEO F. PUHR, Ph.D. .......... Associate
JOHN E. GRAFIUS, Ph.D. .......... Associate
E. L. ERICKSON, M.S. .......... Assistant
C. J. FRANZKE, B.S. .......... Assistant
KARL F. MANKE, M.S. .......... Assistant

Animal Husbandry
I. B. JOHNSON, M.AGR. ........ Animal Husbandman
J. W. WILSON, M.S., LL.D. ................ Animal Husbandman Emeritus

ASSOCIATE

[44]
Chemistry
A. L. Moxon, Ph.D. Chemist
Eugene I. Whitehead, M.S. Associate
George F. Gastler, B.S. Analyst
Twila M. Paulson, B.S. Asst. Analyst

Dairy Husbandry
T. M. Olson, M.S. Dairy Husbandman
D. F. Breazeale, Ph.D. Associate

Entomology
H. C. Severin, M.A. Entomologist

Home Economics
Edith M. Pierson, M.S. Home Economist
Minerva Kellogg, Ph.D. Associate
HeLEN M. Ward, M.S. Assistant

Horticulture
S. A. McCrory, M.A. Acting Horticulturist
N. E. Hansen, Sc.D. Horticulturist Emeritus
L. C. Snyder, Ph.D. Associate
Edward O. Olsen, M.S. Assistant

Pharmacy
Floyd J. LeBlanc, Ph.D. Pharmaceutical Chemist
R. P. Ahlquist, Ph.D. Pharmacologist

Plant Pathology
W. F. Buchholtz, Ph.D. Plant Pathologist
C. M. Nagle, Ph.D. Assistant

Poultry
W. O. Wilson, M.S. Acting Poultry Husbandman
F. R. Sampson, M.S. Assistant

Publications
Loren E. Donelson, M.S. Editor
Gene Harney, B.S. Assistant Editor

Rural Sociology
W. F. Kumljen, Ph.D. Rural Sociologist

Veterinary
G. S. Harshfield, D.V.M., M.S. Veterinarian
J. B. Taylor, V.M.D., Asst. Veterinarian

Appointments
Delbert F. Breazeale, Associate Dairyman May 15, 1944
Eudora E. Crook, Secretary April 24, 1944
G. S. Harshfield, Veterinarian September 1, 1943
Everett M. Jennewein, Asst. Economist August 20, 1943
Karl F. Manke, Assistant Agronomist June 1, 1944
C. M. Nagle, Asst. Plant Pathologist January 1, 1944
Phyllis L. Ney, Secretary February 1, 1944
Edward O. Olsen, Assistant Horticulturist February 10, 1944
Roy P. Wilkes, Associate Animal Husbandman September 1, 1943
W. W. Worzella, Agronomist October 1, 1943

Pharmacy
Floyd J. LeBlanc, Ph.D. Pharmaceutical Chemist
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G. S. Harshfield, D.V.M., M.S. Veterinarian
J. B. Taylor, V.M.D., Asst. Veterinarian

Resignations
N. J. Anderson, Associate Economist September 1, 1943
Forrest U. Fenn, Associate Animal Husbandman September 15, 1943
Russell J. Hilmoe, Asst. Analyst May 1, 1944
Everett M. Jennewein, Asst. Economist June 15, 1944
L. F. Larsen, Asst. Agricultural Engineer October 1, 1943
Phyllis L. Ney, Secretary May 1, 1944
Morris Rhian, Assistant Analyst November 30, 1943
F. M. Skelton, Assistant Dairyman March 1, 1944
Gerald B. Spawn, Assistant Entomologist June 9, 1944
G. C. Wallis, Associate Dairyman November 1, 1943
Phyllis C. Wendell, Secretary February 5, 1944
Roy P. Wilkes, Associate Animal Husbandman May 15, 1944
# Financial Statement--Agricultural Research Funds

**July 1, 1943, to June 30, 1944**

## RECEIPTS

<table>
<thead>
<tr>
<th>Hatch</th>
<th>Adams</th>
<th>Purnell</th>
<th>Bankhead-Jones</th>
<th>Bankhead-Jones Offset</th>
<th>Crops</th>
<th>Horticulture</th>
<th>Livestock</th>
<th>Substations</th>
<th>Sales*</th>
<th>Fund</th>
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<td>$15,000.00</td>
<td>$15,000.00</td>
<td>$60,000.00</td>
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<td>$20,986.60†</td>
<td>17,096.80†</td>
<td>4,007.91</td>
<td>$</td>
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</table>

* Sales fund represents the receipts for the sale of byproducts of experimental work that has been completed, and these funds must again be expended strictly for experimental purposes.

‡ Of the $20,986.60, $11,716.98 represents the balance on hand in the Newell Field Station fund at the beginning of the year.

§ Of the $16,806.69, $13,442.32 represents the produce sold from the Newell Field Station.

$ Of the $20,135.87, $9,217.60 represents balance on hand in the Newell Field Station fund at the close of the year.

## EXPENDITURES

<table>
<thead>
<tr>
<th>Hatch</th>
<th>Adams</th>
<th>Purnell</th>
<th>Bankhead-Jones</th>
<th>Bankhead-Jones Offset</th>
<th>Crops</th>
<th>Horticulture</th>
<th>Livestock</th>
<th>Substations</th>
<th>Sales*</th>
<th>Fund</th>
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<td>$1,177.93</td>
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## STATE FUNDS APPROPRIATED AND USED FOR SUBSTATION WORK

<table>
<thead>
<tr>
<th>Appropriations</th>
<th>Cottonwood</th>
<th>Eureka</th>
<th>Highmore</th>
<th>Vivian</th>
<th>Newell</th>
<th>Total</th>
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<td></td>
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### EXPENDITURES

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<th>Eureka</th>
<th>Highmore</th>
<th>Vivian</th>
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<td>Salaries</td>
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Called to the Colors

The following men and women from the South Dakota Agricultural Experiment Station staff were called to active duty with the armed forces of the United States during the past year:

Russell J. Hilmoe .......................................................... Chemistry
Everett M. Jennewein ....................................................... Economics
Phyllis L. Ney ................................................................. Executive
Gerald B. Spawn ............................................................. Entomology-Zoology
Roy P. Wilkes ................................................................. Animal Husbandry