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South Dakota Farm and Home Research

SDSU Agricultural Experiment Station

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Fall 1964

# South Dakota Farm and Home Research: 77th Annual Report to South Dakotans

Agricultural Experiment Station

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South Dakota

# Farm and Home Research

Vol. XV

No. 4

Fall 1964

## 77th Annual Report to South Dakotans



Agricultural Experiment Station  
SOUTH DAKOTA STATE UNIVERSITY  
Brookings, South Dakota



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# From the Dean and Director

On behalf of the staff, it is a pleasure to present the 1963-64 annual report of the South Dakota Agricultural Experiment Station. The report is made up of four major parts: a narrative summary giving highlights of important research accomplishments by departments for the year, a listing of 168 titles by departments of active projects now under study by the staff, a listing of staff publications, and, finally, a brief financial statement giving expenditures and receipts by object classifications. We hope that this report conveys information concerning the total program of the Experiment Station and reflects the staff's genuine concern in meeting the research needs of agriculture and home economics in South Dakota.

## STATE OF THE ART

For research to serve agriculture and home economics in the mid-1960's, it must resort to the modern tools provided by the basic biological, physical, and social sciences, making full use of statistics and high-speed electronic computers, to generate new scientific knowledge needed to solve pressing problems in agriculture and the supporting services for this great industry. The long-range plans for the South Dakota Agricultural Experiment Station recognize the need for mobilizing new scientific techniques and equipment, as well as finding new methods for solving today's problems. Many of these techniques take the form of new and more sophisticated pieces of laboratory equipment. An excellent example is the new gas chromatograph which in the hands of a skilled operator can detect presence of insecticide chemicals at the levels of 1/10 to 1/100 parts per million, a



Orville G. Bentley, Dean of Agriculture and Director of Experiment Station

feat unheard of 10 years ago. Such minute amounts of material are almost impossible to comprehend. (For instance, 1 p.p.m. is equivalent to one inch in 16 miles or one minute in two years). Yet, in safeguarding the public food supply as well as providing answers to producers using pesticide chemicals, it is necessary to know whether or not these substances are present in amounts in the order of magnitude represented by the infinitesimally small measurements. These comments reflect what research scientists have always tried to do: they are constantly improving the technology for doing research which paradoxically is a process for creating new technology to be used by agriculture and the food processing industry. An old cliché is that change creates change, but the moral in it is up-to-date because a research organization must "run" to keep abreast.

## LOOKING AHEAD

All indications are that the demand for research on agricultural production will continue to increase.

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### SOUTH DAKOTA FARM AND HOME RESEARCH

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#### 77TH ANNUAL REPORT

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Orville G. Bentley, Dean of Agriculture and Director, Agricultural Experiment Station

Frank J. Shideler ..... Editor

Terry L. Khalili ..... Artist

Leland L. Sudlow ..... Photographer

Nathanial S. Cole ..... (Cover)

One has only to consider some of the present questions of immediate concern to predict that farmers and ranchers will be asking for more information on such problems as pesticides, product quality, disease and insect control, soils, animal nutrition, breeding and others. Research on social and economic policy questions are likely to be greater in the next decade than for the past 10 years. For example, resource development, water, recreational use of farm and ranch land, wildlife production, landscaping and forestry, and expanding educational and vocational opportunities for rural youth are all questions that will receive a great deal more attention in the future than in the past. The timely question for the Experiment Station is how will it plan to meet these new demands or, more appropriately, opportunities for service? The first requisite in the future will be the same as for the past—a dedicated and technically well-trained staff. Building a staff involves many factors. One factor of great importance is salary levels commensurate with those of competing institutions. The demand for manpower, brainpower if you will, continues to be keen.

Another factor is the need for new and renovated facilities. The Experiment Station has been requested by the Regents of Education through our University administration to project its facility needs for 10 years. These projections are a step in the direction of establishing a format for growth and for tooling up to meet research challenges of the next decade. The facility needs as now recognized are listed without priority:

- Relocate Poultry Science facilities.
- New Veterinary Research and Diagnostic Center for animal health.
- Agricultural land for Agronomy, Animal Science, Dairy Science, Plant Pathology, Horticulture and Forestry, and Entomology Departments.
- Relocation and additional Horticulture-Forestry facilities. Laboratory, office, classroom building (addition to Agricultural Hall).
- Expansion and renovation of Stock Pavilion, especially the meats laboratory.
- Addition to Plant Pathology Building.
- New greenhouses for plant science departments and entomology.
- Classroom, laboratory, office space for research facilities for biological sciences and agricultural sciences.

- Relocation of sheep research-production facilities.
- New swine farrowing-finishing unit.
- Renovate and modernize feed service unit.
- Nutrition research facilities for large animals.
- General improvement in facilities at Field Stations, especially in providing field laboratories for minimum technical support.

The descriptive titles for the buildings listed indicate the nature of the major research use of each new, relocated, or rejuvenated facility, however, some facilities will be used by several departments. Basically, though, these improvements provide support in depth to ongoing research programs and the opportunity to develop research excellence so essential to meeting the high demands of South Dakota's agriculture.

Concurrent strengthening of organizational patterns must accompany physical growth in the Station's program as new arrangements are tried in a continuing effort to make the most efficient use of resources available. Organizational changes will not be a panacea but new devices, such as institutes or the research team approach involving several disciplines, can be formed as a means of focusing attention on critical research problems. Likewise, the Experiment Stations of the future will draw increasingly upon technical competence in other colleges of the land-grant universities, the experience and knowledge in state and federal agencies, contacts with farmers, ranchers, and other businessmen whose experience will help shape the technology of tomorrow. Technological competence indigenous to a region or state is fast becoming a deciding competitive factor for a farming area engaged in the production of quality products demanded by the nation's food market. In their own self-interest South Dakotans must support agricultural research. The Agricultural Experiment Station to the extent of resources provided will strive to do the research and supply the technical services needed as we cooperatively build communities, schools, health services, churches, governmental units, financial and business institutions of the future that surround and encompass the farm and ranch: the family home and the major source of income to the state's economy.—

ORVILLE G. BENTLEY

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# agricultural engineering

- 75 Years of weather records
- Irrigation of speciality crops
- Drainage needs of certain crops
- Furrow for pastures
- Reducing minerals in water
- Improved silage storage
- Automating livestock feeding
- Nailed joints in construction
- Grain sorghum seed crackage

● South Dakota has up to 75 years of weather records which will be one main source of information in the increasing importance attached to climate and microclimate as it affects agriculture. (Microclimate is climate within a few feet of the ground which, to a certain extent, sometimes can be controlled). Many scientists believe relationship of soil moisture and temperature holds fascinating possibilities to help in determining planting-harvesting dates. Some time in the future, perhaps, planting, harvesting, irrigation, and cultivating may be accomplished on “signal” from an electronic computer which has digested thousands of weather data records. “Probability” factors, in addition to the customary “averages” of moisture and temperature, are finding increasing use. For instance, what is the probability of 1 inch of rain during a certain week, of 2 inches, of 0.1 inch.

A library of current weather records — plus a backlog extending into the late 1800's—is being compiled on IBM cards so that this information is rapidly available in usable form. Nearly 4 million IBM weather information cards have already been prepared from upwards of 100 observation points in South Dakota.

● Irrigation of speciality crops—including sugar beets and seed corn—in extreme southeastern South Dakota poses a somewhat unique problem: the land is too flat and level for furrow irrigation. The land has very little natural slope and consequently the slopes must be modified for successful furrow irrigation operation. Application-type of research underway in the area for the first year indicated a minimum practical furrow slope of about 0.20% and maximum practical furrow length from 600 to 660 feet. This means a furrow 600 feet long should have a slope of about 15 inches.

● In connection with drainage research, permeability of a Beotia silt loam measured in the field with a double tube apparatus was lower than the permeability measured in the laboratory using soil cores. At Redfield a 75x150-foot confined drainage plot with a plastic boundary to a depth of 8½ feet and drained by tile at 8 feet is used to determine soil permeability on a field basis and to control the water table under crops. The amount of drainage needed by certain crops to prevent damage is being sought. Grain sorghum was

planted on the plot to determine resistance to high water table conditions.

● Plans will be available soon for an improved furrow implement developed for soil and water conservation in pasture and rangeland. The implement is designed to be pulled by a farm-size tractor and can be made from commercially available parts. It makes a sodded furrow in one operation: lifting the sod, scattering or loosening soil in the base of the furrow, and re-laying the sod. This action helps eliminate erosion in the furrow and prevents killing of sod next to the furrow where a ridge of weeds might develop.

● “Residence-size” equipment has been developed and tested which reduces mineral content of water from 50% to 90%, a range considered within satisfactory limits. Investigations now are concerned with reducing equipment costs. A forced feed apparatus will replace gravity flow which was not satisfactory.

● More economical and better silage storage structures and methods were determined during a 10-year study just completed. New information on design has been incorporated into building plans for construction of bunker type silos. Summary results of the investigations in which other departments cooperated: A brome-alfalfa silage mixture wilted to 65%-72% moisture content is better and more palatable than the same forage direct cut. Exclusion of air from silage is essential to produce quality feed. Air exclusion is obtained with adequately packed finely-chopped forage and a plastic silo cover. Adequate packing and a proper cover over the exposed surface of the silage is more important than type of storage structure. Silage temperature-quality comparisons indicated 100°F. is the best. Forage moisture content and degree of air exclusion have a decided effect on silage temperatures. Least amount of weight loss and most desirable temperatures are obtained by covering silos immediately after filling. Covers had more effect on silage quality than addition of preserving chemicals. Greatest lateral pressures on a bunker silo were exerted during the filling operation—60 pounds per square foot on vertical walls and 73 pounds per square foot on walls with a 4-to-1 slope. Present cost and relatively short useful life made epoxy resins impractical as coating for interiors of concrete stave silos. Lack of durability

(mainly damage by the silo unloader) and labor required for surface preparation were two main drawbacks.

● Completely automatic mechanical handling of materials for farmstead livestock feeding is now available in commercially manufactured equipment developed through research completed this year. In a 5-year period the equipment was designed, developed, prototypes tested, practical applications made, and technical information released which has resulted in two concerns manufacturing the equipment for sale throughout the United States. At least five of the machines are in operation in South Dakota. The equipment essentially utilizes hours instead of horsepower and is completely automatic—even beyond the “push-button” stage. It can be modified or tailored to fit conditions on individual farms. By completely automating a livestock feeding system, accuracy is increased in the feeding operation itself. Economical advantages accrue from less power required for small horsepower, low volume equipment compared with



Some 4 million IBM cards containing coded information on South Dakota weather for periods as long as 75 years are kept in this bank of file drawers and others at Brookings. Detailed weather information can be quickly and accurately obtained by running selected sets of the cards through an electronic “brain.”

large material handling equipment. The comparatively small units, for instance, operate several times daily to obtain the necessary volume of a virtually 100% accurate feed mixture on lower voltage and about one-third less horsepower.

● Farmers who do their own building construction work generally favor nailed rather than glued joints. Nailed joints in light structural units were tested and met requirements. Joints made with  $\frac{3}{8}$ -inch plywood were as strong as those made with  $\frac{1}{2}$ -inch plywood when using 8d nails in double shear. Plain shank nails produced joints stronger than ring shank nails at proportional limits but as ultimate loads were approached joints made with ring shank nails were stronger. Moisture changes do not significantly affect strength of joints—nailed or glued.

● The most important factor affecting crackage in grain sorghum seed, a serious problem for the grower, is speed of the combine cylinder and clearance of the rubbing bar, according to field tests. At an impact speed of 3,500 f.p.m. (which is lower than the recommended peripheral combine cylinder speed for sorghum) the average impact damage (seed crackage) was more than 30%. Impact damage also varied with variety and moisture content. Greatest resistance to crackage was at moisture content of 15%–18%. Initial cracking of seed while maturing on the plant varied with variety from 6% to 27%. □

#### RESEARCH PROJECTS IN PROGRESS

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Irrigation Management Practices in Southeastern South Dakota, Hatch 398.

# agronomy

- Developing corn hybrids
- Drought tolerance in corn
- New corn hybrid SD-248
- Predicting yield increases
- Drill vs. broadcast fertilizing
- Using phosphate for corn
- Diseased alfalfa and coumestrol
- Reduce evaporation, save water
- Environment and flax yield

● The long, complicated, and continuous process of developing superior corn may soon give plant breeders new material for hybrids to help South Dakota farmers fight costly disease and insect enemies. Emphasis has been on high yield (grain or silage), high number of tillers, and resistance to root rot, drought, blight and root worm. Experiment Station scientists are carefully watching this year's developments which include investigations of a few inbreds containing stronger characteristics of tolerance or resistance to northern leaf blight, stalk rot, root rot and western corn rootworm. Of special interest is one of several inbreds which performed well in tests where western corn rootworm was severe. This inbred, if it performs as well this year as last, could become an important corn hybrid parent carrying rootworm resistance. Root rot resistance or tolerance may be available soon in inbreds which can be combined with other inbreds or crosses containing additional desirable agronomic characteristics to provide better hybrids for South Dakota conditions.

● Preliminary work is underway to investigate drought tolerance in corn. Attempts to evaluate corn inbred lines for ability to withstand drought pursues a phase of research about which little is known. Initially scientists are attempting to delve deeper into the basic processes and actions within the living plant which may have something to do with drought tolerance.

● The newest corn hybrid from the Experiment Station—SD-248—was released in early spring of 1964. It has higher yield potential than SD-250 and because of lower moisture percentage at harvest it may be adapted slightly farther north. While it performed as well as SD-250 at Brookings in the drier years it produced considerably more in the bumper crop year of 1962 and again in 1963. In 1962 it yielded 95.9 bushels an acre in test plots compared with 73 bushels for SD-250. A new inbred release, SD-15, was developed from a backcrossing program started 16 years ago and is used as the male parent in SD-248. It should also find a place in hybrids other than SD-248.

● Small grain fertility experiments using rates and combinations of plant food elements were established on farms in the north half of South Dakota. Original soil fertility and past management greatly influence

the yield increase that can be expected from these added plant food elements. Samples from these experiments and others are being used to develop, through soil tests, methods of predicting the yield increase farmers can expect from added plant food elements. The small grain yield results in 1963 show that increases from added nitrogen can be expected where the organic matter content of the soil is medium to low unless a past management practice (such as fallow or growth of a legume) has caused an accumulation of nitrate nitrogen in the soil profile.

● A series of wheat experiments covering three years and designed to compare two methods (drill fertilizer attachment and broadcast) of phosphorus fertilizer application was completed in 1963. The results of these experiments on fallow show that applying the same rate of phosphorus with the drill attachment increased yield about 2 bushels an acre over broadcasting on the surface.

● Starter fertilizer experiments with corn revealed that 20 pounds of phosphate ( $P_2O_5$ ) applied in the row increased the yield more than a 40-pound application, except on soils testing very low in available phosphorus. Comparing growth of corn on fallow and non-fallow land indicated that the poor early growth of corn on fallowed land could be improved by applying phosphorus with a planter attachment.

● Damage from alfalfa leafspot diseases may not stop at merely lowering yield and quality of forage. Scientists have determined that leaf spot can cause high levels of coumestrol, a natural plant estrogen or female hormone. When diseased alfalfa is used as livestock feed an excessive amount of coumestrol could become a factor in reproductive problems.

The physiological effects of coumestrol on animals are similar to those of the well-known synthetic hormone stilbestrol. Stilbestrol is a source of several estrogens and is used to bring females into heat and to increase rate of gain in beef animals. But excessive amounts of stilbestrol can have adverse effects which cause reproductive problems. Presence of coumestrol in alfalfa may furnish clues to the causes of temporary sterility, premature calving or certain types of abortion.

Factors influencing the estrogenicity of alfalfa have been under investigation nearly 15 years. By 1961 it

was determined that at least 90% of the estrogenicity of alfalfa was due to coumestrol—a new compound isolated from alfalfa and ladino clover. However, much remains to be learned and applied toward control or regulation of coumestrol levels through alfalfa breeding or even management practices.

USDA and South Dakota State scientists are conducting intensive investigations of environmental factors influencing coumestrol content of alfalfa. They have found that under a wide range of controlled environmental conditions, normal alfalfa herbage contained very little (less than 2 parts per million) coumestrol while alfalfa with heavy disease infections had high levels. Specifically, every fungal disease organism the researchers used to successfully infect alfalfa dramatically increased coumestrol content—by as much as 50 p.p.m. to 200 p.p.m. Organisms which gave increased coumestrol levels included the fungi causing common leafspot, “pseudoplea” leafspot, the blackstem complex, and the fungus causing rust on alfalfa. Further investigation revealed that the coumestrol is concentrated in the lesion, or “spot”, itself, and at this point may reach concentrations greater than 1,000 p.p.m. This means that the greater the susceptibility of a plant to disease, the more lesions per area it will have and the greater the concentration of coumestrol. Use of and further development of disease-resistant alfalfa varieties will not only increase yields but also affect nutritional quality in ways not thought of just a few years ago.

● Reduce evaporation to retain more storage water in a reservoir, a large lake, or even in a stock tank—a long-sought hope now actually accomplished through cooperative research of the U. S. Bureau of Reclamation and South Dakota’s Agricultural Experiment Station. Reduction of water evaporation loss on a state or



Methods investigated to reduce water evaporation losses included spreading a powder to form a thin layer of chemical over a lake surface. A blower attachment (through tubes, as above) on a boat could cover about 800 acres of water surface in an hour under ideal conditions.

national scale could have a decided direct impact on agriculture, municipal or industrial water supplies, and recreational facilities. In some irrigation storage facilities, investigations have shown that annual water loss from evaporation was about equal to the amount of water needed for irrigation of the acreage served by the storage.

Water loss from evaporation totaled about 36 inches annually during the frost-free season at a free water surface (a large lake) near Newell in central western South Dakota, according to measurements taken the past 2 years. During the same period researchers cut evaporation losses as much as 46% by using chemical mono-layer films at Pactola Reservoir in the southwestern part of the state. The chemical film consisted of a mixture of hexadecanol and octadecanol, two high molecular weight alcohols which are solid at ordinary temperatures. Grinder-duster devices mounted on boats spread the chemical in a fine film on the water surface. The film rapidly thins out into a “cover” one molecule in depth and while intact greatly reduces water evaporation.

Although water saved was comparatively expensive, studies determined it cost less than water from some present municipal supplies. The fact that water can be “bought” through use of evaporation reduction techniques now available suggests that further research undoubtedly will mean improved efficiency and lower costs.

In the western South Dakota research investigators measured energy income and energy dissipation, of all sources, and checked energy budget procedures against evaporation measurements.

● How environmental factors, such as temperature and nutrients, affect flax yield and oil quality is being studied by using plant growth chambers, special devices which can be regulated to give controlled conditions. Temperature and soil nitrogen level both affected flax oil quality, but temperature was the most important factor. Temperatures of 20°C. or less favored development of heavy seed with high content of a high quality oil. Temperatures above 20°C. hastened all phases of seed development, accelerated maturity, and reduced seed weight, oil content, and oil quality. In both field and controlled environments, oil percent and oil quality were slightly reduced as the level of nitrogen was increased. Fatty acid determinations in both the temperature and the nutrient studies indicated that the greatest sensitivity of the fatty acid synthesis system to environment may occur at the point of desaturation of oleic acid to polyunsaturated acids. Seed yield was also affected by environment, but the greatest yield response per plant in controlled environments was to nitrogen level. Boll production was greatly increased by nitrogen. Number of seeds per boll was



little affected by environment. Number of tillers per plant was markedly increased as the level of nitrogen increased. □

#### RESEARCH PROJECTS IN PROGRESS

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Breeding and Testing of Oats, Flax and Rye for South Dakota Conditions, Hatch 25.

Weeds and Weed Control, Hatch 32.

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Breeding and Testing Forage and Grain Sorghums and Sudan Grass, Hatch 61.

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Physiological Investigations in Flax, State 367.

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Water Infiltration Into Soils, Hatch 379 (NC-40).

Nature and Extent of Competition Between Wild Buck-wheat and Small Grain, Hatch 387 (NC-61).

Crop Performance Testing, State 404.

Characterization of Range Soil Groups Used in the Range Site Classification, State 409.

Facilitating the Marketing of Grain Sorghum Seeds Through Improved Handling Procedures, Hatch 410.

Drought Injury and Resistance in Plants: Evaluation of Moisture Stress in Corn, Hatch 415.

The Development and Improvement of Laboratory Methods for Determining Forage Quality, Hatch 427 (NC-64)

The Efficiency of Beef Cattle Production in South Dakota with Various Methods of Land Use and Cattle Management, State 423

## animal science

- Using more homegrown feeds
- Choice cattle without grain
- Vitamin A in low carotene silage
- Flexible feeding system
- Using high moisture ear corn
- Value of cob portion of ear corn
- Storage of low moisture forage
- Grain for hay in winter rations
- Enough minerals from free choice
- Results vary using antibiotics
- Protein is most critical need
- Late-season treatment for grubs
- More calves from early breeding
- Growth rate, carcass condition
- Importance of weight traits
- Beef and pork quality studies
- NRC recommendations for SPF pigs
- Alfalfa meal for larger litters
- Amino acids in swine rations
- Marketing lambs as rams

● Investigations to help feeders plan for and use more home grown feeds to meet specific needs in fattening cattle are included in corn and forage sorghum silage experiments. Silage crops used for cattle feeding have relatively high production values but are low in protein. To balance the ration, these investigations used a rather high amount of linseed meal (2½ pounds per head daily) or an average of 6.83 pounds per head daily of low moisture alfalfa silage (haylage). Steers on corn silage made an average daily gain of 2.37 pounds per head compared with 2.03 pounds for forage sorghum. Cattle fed silage rations and linseed meal gained 2.26 pounds daily compared to a daily gain of 2.14 pounds when alfalfa haylage was fed with the silage. Corn silage fed steers dressed out 1½% higher than sorghum silage fed steers and therefore were valued at a higher price per pound on a live weight basis. Steers implanted with 36 mg. of stilbes-

trol gained an average of 2.35 pounds per head daily compared to 2.04 pounds for those without implants. This is a 15.2% increase in rate of gain for the implants.

● Corn silage research has shown that choice cattle can be produced from calves without grain feeding. Gain per acre is greater on high silage rations although grain feeding improves rate of gain and reduces feed requirements.

● Rate of gain was improved by adding vitamin A to 15 pounds of a low carotene corn silage but not when silage of a high carotene content was fed to cattle. Rations with 30 pounds or more of low carotene corn silage were not improved by addition of vitamin A. No benefits were noted with vitamin D supplementation.

● Either high corn grain or high corn silage rations, properly supplemented with protein and vitamin A,

offer advantages over "in-between" levels of corn silage and grain.

High concentrates (with only 5 pounds of silage) gave highest rate of gain on less feed. High roughage (silage full fed, no grain) gave most gain per acre. Either extreme produced gains at lower cost than intermediate levels of 15 or 30 pounds of silage. Steers on corn grain with only 5 pounds corn silage gained fastest—2.47 pounds daily. Daily gain rates decreased with increases in corn silage.

Highest per acre production was 1,302 pounds for full fed silage. But steers were fed 98 days longer, averaged 20 pounds less final weight and required most protein supplement. Feed costs per 100 pounds of gain ranged from \$15.79 for full fed corn silage to \$19.52 for 30 pounds corn silage. Carcass grade and degree of marbling were about equal with fat cover slightly less with full fed silage. Dressing percent favored high grain rations.

This system could provide flexibility to take advantage of feed, weather, price conditions. Large available supplies of roughage might mean steers fed out on silage plus supplement for highest per acre production. A period of high roughage, then selling for further finishing is another possibility. Or, a combination of high roughage initially followed by high grain for a somewhat controlled feedlot finishing by varying time on high roughage ration.

● Increasing use has been made of high moisture ear corn for feedlot rations. This permits earlier harvesting with a reduction in harvesting losses. Several experiments show improvement in feed efficiency for high moisture ear corn in comparison to dry ear corn. Rate of gain was greater when feeding high moisture ear corn alone or with 15 pounds daily of corn silage compared to corn silage for 154 days followed by high moisture ear corn or corn silage alone for the entire period. While corn silage without added ear corn resulted in lower rates of gain, the gain per acre was more than when feeding high moisture ear corn. Fifteen pounds of corn silage added to high moisture ear corn rations did not affect rate of gain but resulted in slight improvement in gain per acre. Per acre beef production was high, totaling 1,497, 855, 813, and 827 pounds, respectively, for corn silage, high moisture ear corn plus 15 pounds corn silage, high moisture ear corn, and corn silage for 154 days followed by high moisture ear corn. In the finishing phase, carcass grades and dressing percent were about the same for high moisture ear corn whether fed the entire trial, the last half, or with a limited feed of corn silage. When sold, cattle fed corn silage weighed an average of 46 pounds less, were about two-thirds of a grade lower, and dressed about 3% less than cattle fed high moisture ear corn.

● Value of the cob portion of ear corn is an important consideration not only in feeding cattle but also in harvesting corn which is to be fed. Value of the cob portion was investigated by comparing shelled and ear corn when fed with 4 and 8 pounds of hay. The cob portion showed little if any saving in grain and hay in feeding ear corn in place of shelled corn with 4 pounds of hay. Cobs appeared to have a higher value when fed with 8 pounds of hay. The 8 pounds of hay also had a greater feed replacement value when fed with ear corn rather than with shelled corn. In other experiments using high concentrates composed of barley, the rations were improved by adding 10% to 20% hay, with the 10% level being adequate.

● Storage losses and feeding value of a low moisture alfalfa-brome forage (haylage) were compared in a conventional concrete stave silo and an air-tight silo. A moisture level somewhere between that of direct-cut silage and that safe for storing as hay would offer definite advantages in harvesting, storing and feeding. The alfalfa-brome forage in this experiment was stored at about 30% moisture, lower than generally recommended. Proper moisture control is one of the problems in making low moisture forage. Storage losses amounted to 11.3% for 198 days in the concrete stave silo and 2.5% for 217 days in the air-tight silo. Based on total gain per ton of haylage dry matter stored and other feeds fed (three levels of corn grain were used), a ton of haylage dry matter stored in the air-tight silo was worth 13.4% more than a ton of forage dry matter stored in the concrete stave silo. (In the experiment this value amounted to \$3.16 more a ton calculated on estimated current feed prices, storage losses and nutritive value of rations). Feeding 10 pounds of haylage and no protein supplement resulted in a low value for haylage in terms of other feeds saved when compared to feeding at 5 pounds daily with a protein supplement. Feeding a full feed of haylage and increasing the amount of corn gradually resulted in greater value for haylage than when fed at 10 pounds daily.

● Wintering rations for beef calves are usually built around low-cost roughages, either winter range or hay. But when hay supplies are short and high in comparative price, grain may be substituted for hay. To investigate these possibilities experimental rations consisted of all hay, two-thirds hay and one-third barley, one-third hay and two-thirds barley, and all barley. The results show that barley, properly supplemented with vitamin A and minerals, can be substituted for any or all the hay in calf wintering rations on a net energy basis without detrimental effects. Considering only winter gains, replacement values of barley indicate that, under these conditions, it is worth



almost two times the value of a prairie hay-alfalfa hay mixture containing 40%-50% alfalfa. Average summer pasture gains were small but did not greatly affect economy of substituting grain for hay.

- Studies on mineral supplements have shown that cattle select satisfactory levels of minerals on a free choice basis. However, indications were that the calcium and phosphorus levels of free choice mineral supplements should be proper for the ration fed.

- Variable results were obtained in feeding antibiotics to cattle. Bacitracin was not effective in improving rate of gain when used in wintering or finishing rations. The effect of Aureomycin in finishing rations was variable. In high grain rations, both antibiotics were effective in reducing incidence of condemned livers from abscesses.

- Effect of amount of winter supplementation on daily gains for steer calves going on summer range indicated no advantage in feeding more than 1½ pounds of supplement if two-thirds of a pound total protein was provided. Although calves fed 3½ pounds of total supplement daily gained significantly more to greenup than those fed 2½ pounds or 1½ pounds, the differences were small (0.66-, 0.53-, and 0.49-pound gains per head daily, respectively). Indications were that while steers respond to supplements of both protein and energy, the most critical need is for protein. From greenup to summer pasture calves fed the intermediate amount of supplement gained significantly more (nearly one-half pound per head daily) than the high or low supplement groups. Consequently, winterlong gains of the intermediate group approached those of the high group and did not differ significantly. It appears that to get efficient winter gains of more than one-half to two-thirds of a pound per head daily from steer calves on winter range, more than two-thirds of a pound of total protein is needed in the supplement.

- Many producers securing calves late in the season, or for other reasons, find it convenient to treat cattle for grubs after the November 1 deadline recommended by many insecticide manufacturers. In late season (December 21 to January 17) cattle grub control experiments, treated calves outgained the untreated by 0.06 to 0.13 pounds per day which, taken as an average, represented an advantage of 11 to 24 pounds per calf over the 187-day period used. Grub reduction ranged up to 100% and horn fly control was impressive to excellent, depending on treatment. Treatments included pour-on, sprays, and with the insecticide (systemic) given to the animal in feed or in salt blocks. (Systemics are distributed inside the body of the animal by the circulatory system which carries the insecticide to the site where grubs occur). Pour-on treatments were made down the backline from the

shoulders for about 18 inches. Researchers noted that late season pour-on treatments might lose some effectiveness to control grubs because thick winter hair may prevent an adequate amount of insecticide to reach the skin.

Systemics are comparatively new and offer certain conveniences, but researchers list some precautions in their use. Only one treatment may be necessary but proper timing is important: as soon as possible after all heel fly activity has stopped. Early applications, ranging from August to November, are safer and more effective. Treatment with systemics must be completed at definite periods before slaughter to prevent residue in meat. Only one systemic should be used at a time. If a systemic is used as a feed additive another insecticide should not be used as a spray, dip or pour-on. Label instructions must be followed carefully in mixing and feeding.

- Early breeding (May as opposed to July) gave 22% more calves born and 20% more calves weaned, according to the first 5-year summary of season-of-breeding effect on reproduction of beef cattle grazing seleniferous range. Producers must be prepared to take care of the early born calves, however. The project concerning selenium problems has been expanded to include a middle group so that cows will be bred early, mid-way, and late in the season.

- The weight of the beef animal was the most accurate single factor in predicting pounds of edible portion in the carcass. Results show that live weight alone has an accuracy of 69% in prediction of edible portion and 44% in prediction of fat trim. Combining live weight, measurements of the animal, and live animal estimates by trained personnel, the predictive accuracy went up to 80% and 69%, for edible portion and fat trim, respectively. The measurements did not add sufficient accuracy to compensate for the trouble involved in obtaining them. Results indicate that selection for growth rate will result in improved carcass composition with very little additional improvement to be gained from live animal estimates or measurements.

- Beef cattle selection indexes which involve conformation scores and weight traits have been developed. Importance of weight traits in selection is emphasized. Preliminary analysis of single cross data involving only 59 calves indicates about 15% "hybrid vigor" in weight traits. Although these data are too few to yield trustworthy results, further investigation is warranted.

- The producer, processor and consumer alike are concerned with experiments dealing with differences in quality of beef and pork. Producers and processors will be able to more accurately evaluate market animals and the consumer will be aided in more satis-

factory selection and utilization of meats. A time-honored theory is that more flavorful meat comes from more mature beef animals. This may not be necessarily so, according to research which indicates youthful beef (most of present day block beef) is more palatable. The moderate marbling levels as compared to the slight amount levels appeared to give beef slightly more acceptable eating qualities. This characteristic was more pronounced in the more mature than in the younger beef. Thus the trend toward marketing younger beef may have slightly diminished the need for the emphasis on some of the higher marbling levels. Marbling increased juiciness of all beef and the more youthful carcasses produced the most tender steaks. Pigment content of beef muscle from ribs selected for maturity differences (which includes muscle color) did not differ as widely as would be expected. Thus muscle color is due to many factors in addition to pigment content. Beef with higher hemoglobin content tended to be the most flavorful which slightly relates muscle color and pigment content to palatability.

As the slaughter weight of barrows and gilts was increased (150, 180, 210, or 240 pounds) dressing percent increased, percent edible portion decreased only slightly, percent fat increased, percent bone decreased, and the quality indicators did not change appreciably. Gilts possessed a greater edible portion in the ham and loin which accounted for a significantly greater total edible portion than in barrows. Barrows had a greater amount of backfat, higher percentage of total fat and more feathering in the ribs than gilts.

● Levels of calcium and phosphorus as recommended by the National Research Council are adequate for normal daily gains and feed conversion in growing-finishing SPF (specific-pathogen-free) pigs. Some SPF pig producers have questioned calcium and phosphorus requirements after observing stiff legs and more trouble with feet and legs as compared with non-SPF pigs. Calcium and phosphorus were fed above, below and at NRC-recommended levels. Trials suggested high calcium and phosphorus levels in the ration will cause poorer feed utilization (efficiency).

● Sows reared and kept on concrete in confinement farrowed larger litters when fed dehydrated alfalfa meal in gestation rations. Experimental rations included no dehydrated alfalfa meal, 10% dehydrated alfalfa meal, 10% dehydrated alfalfa meal plus additional protein, minerals and vitamins, and 20% dehydrated alfalfa meal. Litter sizes at birth for these rations averaged 8.62, 9.57, 9.71, and 9.12 pigs, respectively. Treatments did not have much influence upon birth weight, litter size at weaning, weaning weight or number of stillborn pigs. After weaning the first litters and breeding for the second, eight of 21 sows

would not breed—seven of these eight being alfalfated. Underlying cause of this was not determined from this experiment.

● Better swine finishing rations are the aims of an experiment to determine lysine and methionine requirements (amino acid supplementation) of pigs weighing 100 to 200 pounds. Best level of methionine improved gain only 3% and did not improve feed efficiency. Lysine at 0.6% addition to the ration improved gains only 3% and did not improve feed efficiency. Lysine is the amino acid most likely to be deficient in most swine rations.

● Investigations show that if grown out rapidly to market weight, lambs may be marketed as rams without adverse effects on carcass quality or yield. Of 50 ram lambs marketed at 102 pounds, only seven were down-graded in carcass because of obvious "buckiness." No ram lambs marketed under 6 months of age were down-graded for buckiness. In carcass quality, lambs graded 12% prime, 66% choice, and 22% good. □

#### RESEARCH PROJECTS IN PROGRESS

Development of a High Producing Flock of Tailless Sheep, State 9.

Inbreeding, Linecrossing and Selection Within the Hampshire, Duroc and Yorkshire Breeds, Hatch 124.

The Improvement of Beef Cattle Through Breeding, Hatch 167 (NC-1).

Nutritional Requirements of Sows During Gestation and of Sows and Pigs During Lactation, State 212R.

Summer Grazing of Beef Cows for Calf Production, State 216.

Mineral Requirements and Mineral Supplements for Sheep and Cattle, State 218.

Pasture Investigations, State 225.

Investigations to Develop a Systemic Chemotherapeutic Method of Controlling Cattle Grubs, State 244.

Protein and Amino Acid Studies With Swine, State 251R.

Supplementation of Cereal Grains for Swine, State 268.

Corn and Sorghum Harvesting and Storage, Hatch 324.  
Protein and Energy Requirements of Beef Cattle, Hatch 325.

Effect of Some Management Practices on Sheep Production, State 329.

Reproductive Phenomena in Female Domestic Animals, Hatch 355.

The Carbohydrate Composition and In Vitro Digestibility of Prairie Grasses at Various Growth Stages, As Determined by Leaf Number, Plant Height and Cutting Date, Hatch 380 (NC-63).

Improvement of Reproductive Performance in Beef Cattle, Hatch 384.

The Influence of Carcass Maturity and Marbling on the Physical and Chemical Characteristics of Beef, Hatch 388 (NC-58).

Effects of Nutrition and Method of Feeding on Beef Cattle Performance, Hatch 392.

Pork Carcass Quantity and Quality Evaluation, Hatch 419.

Range Management and Range Nutrition Studies With Sheep, State 421.



# bacteriology

- Antibiotics in Rations
- Liver Abscess, Foot Rot
- Animal Waste Disposal
- Disease of White Tailed Deer

● Rate and manner of decomposition of chicken manure in lagoons and dropping pits apparently is effected by antibiotics fed as additives in the ration and passed through the intestinal tract. Information secured from this study may lead to recommendations on disposal of chicken manure, particularly from large scale commercial units of several thousand birds.

● More knowledge about liver abscess in cattle is being sought in research on the micro-organism *Spherophorus necrophorus*, which is a cause of the disease. As a result of South Dakota research, abscesses can now be produced in the laboratory white mouse which is used as a model in the study of liver abscesses in cattle. Scientists are looking toward the eventual elimination of the disease.

● Farm animal waste disposal is a problem nationwide in scope especially where large numbers of poultry, cattle or hogs are fed in a concentrated area. Lack of space, and low-priced, more concentrated, easier-applied commercial fertilizers are rapidly outmoding the traditional use of manure on land as fertilizer. Studies of hog feces and chicken manure, using con-

trolled conditions of oxygen, temperature, and dilution rate, are aimed at determining recommendations for construction of manure lagoons or other devices for handling animal wastes. By-products from animal wastes will be evaluated for possible use in addition to the nitrogen useable as fertilizer.

● An effort is being made to control transmission of the epizootic hemorrhagic disease of white tailed deer, a disease which has done great damage to the State's deer population. Initially the goal is to find what carries the disease virus—that is, what is the vector. It is thought the mule deer might be the reservoir from which white tailed deer become infected.

## RESEARCH PROJECTS IN PROGRESS

Studies on the Effect of Antibiotics on Microflora of Chickens, Hatch 257.

The Mechanism of Biological Nitrogen Fixation, State 376.

Studies of the Organism Causing Liver Abscess and Foot Rot in Feed Lot Cattle, State 377.

Farm Animal Waste Disposal, Hatch 411.

Studies of the Epizootic Hemorrhagic Diseases of White Tailed Deer, State 412.

# botany

- Inhibitor prevents red spider mite damage
- Basic studies in seed dormancy
- Amount of light and how it affects plant growth
- Seek second "crop" from flax by breaking lateral bud dormancy

● The common ragweed is being used as a tool to assay plant growth factors such as dormancy, inhibitors, and light. Red spider mites, a pest of ornamentals and agricultural crops, appear not to bother ragweed. The reason may be because of an inhibitor in ragweed which South Dakota botanists discovered, extracted and partially purified. The inhibitor, when painted on leaves of radish plants, prevented damage by red spider mites. Also, radish seeds did not germinate when planted in soil in which the inhibitor had been mixed. If studies are carried further a valuable plant growth inhibitor or insect repellent might result.

● Dormancy in seeds has been studied by scientists for years. If seed and/or bud dormancy could be broken or controlled, the results would have considerable effect on agriculture. For example, chips made from non-dormant potatoes (in which starches are being changed to sugars) are not as acceptable to consumers because of dark (although harmless) discoloration on the chip. Chips from dormant potatoes are

clear and free of such color changes. Another example of dormancy is in the ragweed seed. These ragweed seeds overwinter in the dormant stage. Cold weather followed by moist spring weather triggers them into germinating for the annual summer crop. Thus, when the ragweed plant winterkills in the fall it leaves behind a large supply of dormant seed.

The inhibitor extracted from ragweed was tested as a possible factor in seed dormancy but no conclusive evidence was obtained. Ragweed seed dormancy, however, was broken by 48 days of cold treatment or by using thiourea, a compound used in photography. Tests have shown that ragweed seed may remain dormant for as much as 40 years.

● Part of the hormonal mechanism of plants is controlled by the amount of light they receive. Plant abnormalities occur when amount of light is changed. With only 8 hours of light all ragweed plants in one experiment had female flowers. Fourteen hours of light produced all male flowers. No flowers were pro-

duced when plants were subjected to more than 16 hours of light. Abrupt changes in light periods caused other abnormalities: from snaggle-toothed leaf edges to smooth leaves and also formation of leafy type male flowers. Mexican fire weed (*Kochia*) grew only an inch during short light periods while long periods caused it to grow higher than a man's head. Lambs-quarters and pigweed with controlled light could be made to pop out of the ground and flower when about an inch high—up to five times faster than naturally. Changing amount of light probably would never serve as a practical method of controlling ragweed as a pest. However, this type of research gives another piece in a jigsaw of factors which control plant growth.

● If a practical way can be found to break lateral bud dormancy in flax it could increase the number of

branches and flowers on the plant for potential boosts in seed yield—a second “crop” from the lower part of the plant. One of several materials investigated did break lateral bud dormancy by preventing auxin, a hormone which is produced in the tip of the plant, from passing to lateral buds. Growth regulators or inhibitors are difficult to use and a practical method of application in the field has not been found. A new experimental chemical and use of electric current are to be tried in basic investigations as lateral bud dormancy studies continue. □

#### RESEARCH PROJECTS IN PROGRESS

The Relationship of Light, Particularly Red and Far Red, to the Flowering of *Kochia Scoparia* (L.) Roth, and Leaf Development on *Ambrosia artemisiifolia* (L.), State 363.

Investigation of the Cause of Lateral Bud Dormancy in Flax by the Use of Growth Regulators, State 364.

## dairy science

- Large cows, more milk
- Close inbreeding poor practice
- Feed corn silage with haylage

- Improving butter flavor, quality
- Corn, corn-soybean silage equal
- More gain from barn-stored hay

- More silage and milk from using ammonium nitrate fertilizer
- Cheese: a method of milk storage

● Large cows excel in milk production over small cows in the State University experimental dairy herd. The relationship between a cow's body weight and her milk production during a 305-day lactation expressed in terms of how many times she exceeds her body weight in milk showed that for cows weighing 800 to 1,000 pounds, the milk produced amounted to 8.2 times their body weights; for cows weighing 1,000 to 1,300 pounds it amounted to 8.5 times their body weights; and for cows weighing 1,300 to 1,600 pounds it amounted to 8.6 times their body weights.

Effect of size on milk producing ability for first calf Holstein heifers entering the milking herd showed no real difference between small and large heifers. For the first 305-day lactation period, heifers 24 to 26 months old weighed 1,260 pounds at calving time, produced 11,903 pounds milk and 455 pounds fat. Heifers 26 to 28 months old weighed 1,277 pounds, produced 11,243 pounds milk and 423 pounds fat. Heifers 28 to 30 months old weighed 1,326 pounds, produced 12,413 pounds milk and 442 pounds fat.

● Research indicates that close inbreeding of Holstein-Friesian cattle should not generally be practiced by dairy farmers. This has been shown in an improvement-through-breeding project consisting of development and crossing of two inbred lines of Holstein-Friesian cattle. A third group is developed at the same time by outbreeding to sires in artificial insemination associations. Involved are 112 females and 11 males (in AI studs). The inbred line females, whose inbreeding is intensified by sire-daughter matings, are

producing 70.7% as much milk as the outbreds. The outbred group has shown improvement in production: currently 2,882 pounds of milk per cow per lactation higher than the starting group of cows 10 years ago. Type classification scores of the inbreds average one grade, or five percentage points, lower than the outbreds. Growth rates of the inbreds are significantly lower than the outbreds. Cumulative calf losses (406 total calves, 123 inbreds) indicate 30.9% loss in inbreds, 10.5% for outbreds.

● Under conditions of high alfalfa haylage (low moisture alfalfa) feeding, cows may not be able to efficiently use the calcium or phosphorus of the forage. Feeding corn silage with haylage decreases this problem. During trials cows fed low moisture alfalfa as their only roughage consumed abnormally high amounts of the mineral dicalcium phosphate—an average of 255 grams of the mineral per cow daily. When corn silage was fed at 42 pounds per cow daily with haylage, dicalcium phosphate consumption was much less. High levels of dicalcium phosphate for the haylage-fed cows had no marked effect on haylage consumption, milk production, or body weight changes. Corn silage feeding resulted in higher total roughage dry matter intake than when haylage was fed alone. When disodium phosphate replaced the dicalcium phosphate, 58 grams were consumed daily per cow. In summer trials, 20 cows on rye and later, sudan pasture consumed 36 grams of dicalcium phosphate per cow daily, compared to 101 grams for cows fed alfalfa haylage and hay in drylot. Addition of corn



silage to the ration of drylot cows reduced the dicalcium phosphate consumption to 16 grams per cow daily.

● Butter flavor and quality are important problems confronting the dairy industry. Butter quality has progressively improved in recent years due largely to a shift from the marketing of farm separated cream to whole milk and factory separation. This, however, has resulted in butter with a rather bland taste unlike butter made from cream in which natural souring had occurred.

Desirability of a high "cultured" flavor has been assessed among 25 students and staff at State University. Preliminary data indicate variable flavor preferences with a general preference for fairly high levels of flavor in butter. There was also evidence that lower than normal levels of salt were preferred with higher flavored butter. Much remains to be learned in this area.

Numerous chemical compounds blend together to give good "butter flavor." Generally considered most important is the compound diacetyl. An extensive study of a procedure for determining this compound has been made. This procedure has been used in the study of flavor characteristics of several cultures which are suitable for adding to butter to create a desirable flavor. The goal in this work is to be able to control the kind and most preferred level of flavor intensity in butter.

As per capita consumption of butter has tended to decline in recent years, it has seemed increasingly desirable to develop dairy products of lower milkfat content. Such low fat products should afford additional sales potential for milk constituents. Work was done to develop a dairy spread or spreads containing 30% to 50% milkfat and an appreciable content of non-fat milk solids. Investigations dealt largely with determination of the combination of kinds and amounts of ingredients which would give the most desirable end product. Simultaneously, studies were made on ways of instilling "culture" flavor and of the most desirable levels of flavor. Various procedures for blending ingredients, storage properties of the spreads, and temperature effects were also given attention. Study is needed on manufacturing and marketing costs, and on factors to extend the shelf life of the product.

● Little difference was noted in the nutrient value of corn and corn-soybean silages for dairy cows. In a 120-day winter feeding trial cows receiving corn silage produced 28.6 pounds of milk daily and consumed 50 pounds of silage. Cows receiving corn-soybean silage produced 28.5 pounds milk daily and ate 51 pounds of silage.

● Alfalfa hay baled and stored in the barn was utilized more efficiently by yearling dairy heifers than hay stacked loose in the field or baled and stacked in

the field. During a 240-day winter feeding trial, heifers fed baled hay stored in the barn ate 17.1 pounds of hay and gained 1.80 pounds daily; heifers receiving hay stacked loose in the field consumed 16.2 pounds and gained 1.14 pounds daily; heifers fed hay baled and stacked in the field ate 15.4 pounds and gained 0.51 pounds daily.

● Application of 175 pounds of ammonium nitrate per acre increased corn silage production by 2.5 tons and milk by 615 pounds compared to a corn-soybean silage production increase of 2.1 tons and 920 pounds of milk. Yields per acre amounted to 12 tons for the fertilized corn silage and 9.5 tons for silage crop not fertilized. For corn-soybean silage the yields for the fertilized crop amounted to 10.6 tons of silage, and 8.5 tons for crop not fertilized.

● Cheese, in its many forms, is basically a method for the storage of a portion of the nutrients of milk in a more concentrated form. This is accomplished by removing a portion of the water and some solids in the form of whey. To accomplish this the milk is coagulated with rennet. On disturbing the coagulum there is a rapid expulsion of whey (syneresis) from the curd. The cheesemaker may hasten this loss of whey by various treatments such as heating and stirring.

Syneresis of skim milk gels was much more rapid at 45°C. than at 32°C. and very little occurred at 5°C. When gels held at the lower temperatures were placed at 45°C., syneresis occurred at a rate similar to the gels originally held at 45°C. If given sufficient time, total syneresis was about the same at the various temperatures.

Previous studies with milk which had received various heat treatments showed that heating at 145°F. for 30 minutes had little effect on syneresis. Present experiments show that this treatment did hinder syneresis. However, heating the milk at 135°F. for 30 minutes had no apparent effect. Studies in which the solids content of milk were varied showed that with high total solids in the milk there was less syneresis than in milk with low total solids. □

#### RESEARCH PROJECTS IN PROGRESS

Growth Studies of Calves and Growing Heifers, State 153.

Improvement of Dairy Cattle Through Breeding, Hatch 184 (NC-2).

Effects of Preservation Methods on the Feeding Value of Alfalfa for Dairy Cattle, State 227.

Consumer Preferences, Demand and Potential Supply for Butter of Various Flavors and Qualities, Hatch 272.

Comparative Value of Forages for Dairy Cattle, State 350.

A Study of Some Physiological Phenomena Associated with Bloat in Ruminants, State 351.

A Study of Milk Gels As Related to Manufacture of Cheese, Hatch 414.

Residue Level, If Any, Which May Result From Feeding Co-Ral At Two Dose Levels, Chemagro Grant.

# economics

- Irrigated-dryland comparisons for the Oahe area share rental plan
- South Dakota's stake in international trade
- County share rental plan
- Ethical problems in business
- County

● Irrigated and dryland farming are compared for the proposed Oahe irrigated area of north-central South Dakota in a recently completed study. The comparison attempts to foresee both irrigated and dryland farming some 20 to 25 years in the future. Use is made of results of experimental work and experience of both dryland and irrigation farmers in estimating future yields of crops, production of livestock and methods of farming. Such information should help individuals and groups estimate the possibilities of water resource development for their own situation. Both on-farm and off-farm comparisons are made.

The studies show that an integrated dryland-irrigation farm in the Oahe area using its feed for fattening feeder cattle and hogs is more profitable than a comparable dryland farm of similar capital and labor requirements. A labor and management income of \$18,809 from a 672-acre dryland-irrigation farm compares with \$9,102 from an 800-acre dryland farm.

Community and commercial benefits from Oahe water resource development arise from larger business volume from farmers producing and selling more products and buying more supplies (\$26 million annual additional income estimated for Brown, Spink and Sully Counties). Other benefits include more stability of business volume; more support for better schools, roads, hospital-medical facilities and other community facilities and services; and improved municipal water supplies.

Perhaps the most important benefit from irrigation arises from leveling out high and low income and production periods—production and income variabilities are about three times greater on a dryland farm compared to an integrated dryland-irrigation farm. Other aspects of irrigation discussed in the study include: the time and effort involved in learning new methods, the additional expenses, labor and equipment, and the need for developing new methods of marketing additional or new products from irrigation farming.

● South Dakota's stake in international trade and marketing of agricultural products is being studied. One phase just completed estimated the impact of alternative European Common Market agricultural policies upon U. S. imports and exports of cattle and beef products. It was concluded that a liberal trade policy by the European Common Market would benefit United States and South Dakota cattlemen by furnishing an important market for feed grains and beef and veal. This export market would benefit both consumers and producers by improving price stabil-

ty through providing a market for their surpluses. The market for feed grains would tend to prevent low priced feed and likely gluts in fed cattle and hogs.

● An alternative share leasing system—the County Share rental plan—was developed. Under the County Share rental plan, rent varies with the county average yields of specified crops. Some tenants and landlords may prefer this to the conventional crop share plan because it rewards a tenant to a greater extent for a better job of farming, yet assures the landlord of a certain level of rent relative to a county average.

● A project on business ethics has resulted in some useful guides to decisions on ethical problems faced by men in business. Problems were identified by case studies of actual situations faced by selected operators of small businesses. □

## RESEARCH PROJECTS IN PROGRESS

Farm Tenancy Improvement in S. D., Hatch 147.

Agricultural Economic Trends in South Dakota, 1900-1950, Hatch 157.

Economics of Soil Conservation on South Dakota Farms and Ranches, Hatch 211.

Improving Rural Taxation and Assessments in South Dakota, State 262.

Farm Business Management Data-Practices, State 264.

Marketing Farm Seeds, Hatch 314.

Conflicts in Means and Ends in the Federal Commodity Price and Income Programs, Hatch 330.

Market Development for South Dakota Eggs, State 344.

Ethical Factors in Management Decisions, State 356.

Changing Market Structure and Organization of Midwest Dairy Industry, Hatch 357 (NCM-26).

Marketing Aspects of an Expanded Livestock Feeding Industry in South Dakota, Hatch 358 (NCM-25).

Varying Degrees of Problem Recognition Among South Dakota Farm Operators and Their Implications for Agricultural Adjustment, Hatch 361.

The Effects of the Soil Bank and Other Land Retirement Programs on the Business Conditions of Small Towns in South Dakota, Hatch 362.

Economic Factors Related to Whole Farm Participation in the Conservation Reserve and Their Relation to Vocational and Geographic Mobility of Farm Families in South Dakota, Hatch 365.

Economic Appraisal of Proposed Oahe Water Development in North Central South Dakota, Hatch 366.

Adjusting the Arrangements for Owning, Transferring, and Leasing Agricultural Land in a Rapidly Changing Agriculture, Hatch 371 (NC-53).

Livestock Production Potential and Limitations in Eastern South Dakota, Hatch 393 (NC-54).

Effects of Transportation on Market Structure, Conduct and Performance in Grain Industry, Hatch 394 (NCM-30).

The Influence of International Agricultural Trade on Marketing of Agricultural Products and the Economy in South Dakota, Hatch 397.

Ring Analysis of South Dakota Tree Samples, State 413.

# entomology-zoology

- Residue factors in insecticides
- Resistant weevil not found
- Alfalfa weevil spreads

- Biological control of alfalfa weevils investigated
- Continue fringed tapeworm study

- Attempt to "plant" wild bees for seed alfalfa
- Mosquito species survey

Cancellation during the past year of USDA registration of dieldrin and heptachlor for insect control treatment of alfalfa and clover to be used as feed for dairy or meat animals has stimulated research to find other insecticides or methods to prevent costly damage, especially from alfalfa weevil. Withdrawal of USDA recommendations was because of dieldrin and heptachlor residues found on treated alfalfa and clover.

● Research concern now is for alfalfa weevil control with short-time-residue insecticides which can be applied in winter and spring in granular form. However, a new short-time-residue insecticide as a substitute for heptachlor has not been found. (The best tested so far has 51% control compared to more than 98% for heptachlor). Investigations are underway to determine heptachlor and heptachlor-epoxide residue on alfalfa hay following winter and spring applications of granular heptachlor. Generally materials applied in granular form fall to the soil surface with little or none remaining on foliage. As alfalfa weevils overwinter in the adult stage—emerging from hiding on sunny, warm days—control by use of insecticide in winter prevents laying of eggs in early spring. Since farm field work is less pressing in winter, economy of labor is possible with winter application of insecticides in granular form even on as much as 4 inches of snow. Amount of and how long insecticide residues remain on corn and alfalfa crops is also being investigated. Pesticide residue and corn rootworm control research are being intensified either through present projects or new projects planned for next year.

● While Colorado and Wyoming report some resistance to heptachlor in alfalfa weevils, checks in heavily-infested South Dakota areas failed to find resistant weevils.

● Checks have shown the appearance of alfalfa weevil in five additional South Dakota Counties this year. They are: Haakon, Washabaugh, Jones, Mellette and Todd. The spread is not considered alarming.

● Natural or biological controls—which do not involve use of pesticides—are being investigated. Alfalfa weevils in the larva stage have as a natural parasite a tiny wasp which normally provides about 15% "control" although this varies from year to year. Larvae of the weevil collected in South Dakota were sent to a rearing laboratory in Nebraska to determine percentage naturally parasitized by the wasps. If scientists can find areas with high natural wasp parasitization

of weevils—and why—such information will be valuable in instituting biological controls.

● A missing link in the life history of the fringed tapeworm in sheep has been the objective of studies by scientists throughout the world for years. The tapeworms cause damage to sheep livers which, in addition to destruction of livers at slaughter, causes general weight and growth loss in the animal. The missing link concerns the aspect of reinfestation of sheep with tapeworm eggs: what carries the eggs from droppings of an infested sheep to grass or other food consumed by the animals? South Dakota studies are now mainly concerned with psocids, tiny insects commonly found in trash and decaying vegetation of soil. Certain species of psocids were infested experimentally with eggs of the fringed tapeworm in New Mexico several years ago. Through coordination with New Mexico investigations and taxonomists in Illinois, ef-



Demonstrations on control of corn rootworm show farmers how to reduce losses. The left two stalks of corn (above) illustrate rootworm damage while the stalk to the right is from an area in which control measures were taken.



forts have been intensified in South Dakota to find species of psocids which are susceptible to infection with the larval stages of fringed tapeworm.

● Putting insects to work to boost alfalfa seed yields is being attempted. Thousands of wild alkali bees and alfalfa leaf cutter bees have been imported in the pupa stage from Utah—mostly in soda straws—in attempts to get them established in South Dakota. These two species are specialists as pollinators and are credited for high alfalfa seed yields in Western States and Canada. They have been “planted” at Rapid City, Brookings, Hecla and Winner. Only those at Winner and Rapid City so far have survived the South Dakota winter and native predacious insects.

● One objective of an Experiment Station survey of South Dakota mosquito species is to investigate the possibility that certain immature wild birds are intermediate hosts of sleeping sickness. Of the 37 species

of mosquitoes now known in the State, seven have been discovered in recent surveys. □

#### RESEARCH PROJECTS IN PROGRESS

The Life History, Distribution and Control of the Fringed Tapeworm of Sheep in South Dakota, Hatch 260.

Investigations of the Alfalfa Insect Situation in South Dakota, Hatch 288.

Investigations of the Spotted Alfalfa Aphid in South Dakota, Hatch 311.

The Character, Magnitude and Persistence of Insecticides Used in Alfalfa Insect Control in the Northern Great Plains, Hatch 374 (NC-33).

Study of the Distribution of Mosquito Species in South Dakota With Special Reference to the Distribution, Ecology and Control of *Culex tarsalis* Coq., a Vector of Western Equine Encephalitis, Hatch 399.

Study of the Distribution of Phytophagous Mites in South Dakota with Special Reference to Species of Agricultural Importance, State 433.

Investigations in the Ecology and Control of the Western and Northern Corn Rootworms in South Dakota, State 434.

## home economics

- Studies of fatty acids
- Frozen storage of venison

- Reducing wool blanket shrinkage
- Carpets after wear and cleaning

- Evaluating foam laminated fabric
- Reaction of fabrics to abrasion

● Studies have been made on the relative proportion of fatty acids of meat fats including turkey, pork, beef, venison, and mountain sheep. A shift from mixed animal fat to corn oil in turkey rations resulted in an increase in linoleic acid, a polyunsaturated fatty acid, and a corresponding decrease in oleic acid. Patterns

for venison and mountain sheep were similar to that of beef fat.

● Continuing work on frozen storage of venison is investigating the effect of presence or absence of fat covering on palatability of lean cooked meat. Three roasts cut from the round of one side of each of 12 animals were stored without any trimming; those from the other side were well trimmed prior to storage. Panel evaluations were made on the cooked lean meat after 6 months storage. For two of the three types of roasts the panel indicated a definite preference for the untrimmed roasts. Similar comparisons of chops are being made after 6 and 9 months of storage.

● Six chemically treated and 2 untreated wool blankets were evaluated in the laboratory before and after laundering 1, 5, and 10 times. Appearance and hand (feel) of the chemically treated and untreated blankets remained much the same with progressive washings. Greatest change in dimensions of the treated blankets occurred after the first washing; but the small amount of change thereafter shows the effectiveness of chemical treatment. With progressive washings untreated blankets continued to shrink but other differences were not apparent.

● Two years of hard wear and periodic cleaning were completed on four carpets (two wool, one nylon and one acrylic) placed in the main corridor of the Administration building at State University. The carpets were evaluated as to general appearance,



A device designed and constructed by State University engineers for use in textile research to measure the effects of crushing pressure on carpets.

thickness, compressibility and weight. For each soiling period nylon carpeting exhibited the greatest and the acrylic blend the least apparent soiling with the all wool ranking between. The liquid cleaner used was the most effective in restoring original appearance. These studies on carpeting are a cooperative project with the Minnesota Experiment Station.

● Foam laminated fabrics are the subject of study by the South Dakota and Minnesota Experiment Stations. Fabrics at South Dakota are dry cleaned and those at Minnesota are laundered. Evaluation of physical characteristics is made before and after one, three, and five treatments.

● A study designed to measure the mechanisms by which fabrics of known fiber content and construction react to stresses of different types of abrasion

has been initiated as a part of the regional study. □

#### RESEARCH PROJECTS IN PROGRESS

Blanket Qualities, Hatch 319.

The Availability of Phenylalanine in Foods and the Effect of Different Tyrosine Levels on Phenylalanine Requirement, Hatch 327 (NC-49).

Study of Dietary Practices and Assessment of Nutritional Status of Indian School Children, State 336.

Evaluation of Certain Properties of Soft Floor Coverings, Hatch 337.

Care, Preparation and Cooking of South Dakota Wild Game, State 368.

Problems in Maintenance of Laminated Textile Products, Hatch 385.

Fatty Acid Content of Raw and Cooked Beef, Pork and Lamb, Hatch 396.

Mechanisms of Fabric Stress Absorption and Performance, Hatch 416 (NC-68).

## horticulture

- Three new tomato varieties
- Onion seedling age and bulb size
- Staked tomatoes survive hail best

- Testing two new pepper hybrids
- Selection of seedless grapes
- Early defoliation of grape vines

- Fast-growing shelterbelt and shade trees
- Gibson rose for understock

● Three new tomato varieties have been selected for extensive testing. One is a hybrid and another a standard variety for staking. The third is a large red pear-shaped tomato. If superior favorable characteristics—drought and disease resistance, high quality—continue for the third straight year of testing the varieties will be made available to growers.

● Onion seedlings ranging in age from 6 to 17 weeks showed no correlation between age of plants and size of bulb produced. About 92% of the onions in each plot were more than 2½ inches in diameter.

● Tomatoes properly staked and tied to a single stem system had up to 90% less damage from hail and wind storms than unstaked plants. Those properly tied had 5%–10% damaged fruit compared to 90%–95% for unstaked plants. The results were obtained after storms 3 weeks before first harvest.

● Two new pepper hybrids in preliminary trials appear promising. High yield and ample foliage for protection from sunburn are two of the outstanding characteristics of these hybrids.

● Grape seedlings producing seedless or nearly seedless grapes have been selected. Such vines may be used in breeding hardy seedless grapes.

● An unusually late frost-free fall in 1963 made it possible to observe natural defoliation of grape vines. Two progenies of wild grapes having Golden Muscat as the female parent showed marked differences. The progeny having a wild grape from Bismarck, N. Dak., as the male parent was completely defoliated several days earlier than the progeny having a wild grape from near Brookings, S. Dak., as the male parent. Early defoliation of the vines is one indication of

good preparation for winter. Less winter injury has been observed in progenies of the North Dakota wild grape than in progenies of the South Dakota wild grape following severe winters in previous years.

● Crosses between Siberian elm and slippery elm and backcrosses of this hybrid with each species were made last spring. Seeds from these crosses were germinated in the greenhouse and planted in the field late in July. Growth in terms of hybrid vigor and other characteristics of this first generation hybrid will be compared with the parents and the backcrosses. Objective is to obtain fast-growing, adapted trees desirable for shelterbelts or shade.

● The Lillian Gibson rose, a hardy introduction of the Experiment Station several years ago, is being tested as a possible understock for budding hybrid tea roses. Budding techniques will be studied. □

#### RESEARCH PROJECTS IN PROGRESS

Production and Breeding of Early, Drought and Disease Resistant, High Quality Tomatoes for Home Use, Hatch 49.

Modification of Wind and Temperature to Improve Vegetable Yields and Quality, Hatch 118.

Selection of Adapted Species and Strains of Trees and Shrubs for South Dakota Farms, Hatch 142.

Growth and Yield of Strawberries and Raspberries as Influenced by Cultural Practices, State 145.

The Collecting, Preserving, Cataloging, Propagating, and Testing of Fruit Plants Having Potential Genetic Value, Hatch 174 (NC-7).

The Effect of Spacing on the Survival, Growth and Effectiveness of Windbreaks, Hatch 239.

Breeding Small Fruits for South Dakota, Hatch 252.

Vegetative Propagation of Hardy Ornamental Plants, State 258.

Breeding Improved Varieties of Tree Fruits for South Dakota, Hatch 354.

# plant pathology

- Root rot resistant corn inbreds
- Spray controls for wheat rust
- Sugar beet leaf spot control
- Downy mildew throughout State
- More new vigor and growth for deteriorated range
- Nematode control investigations
- Viruses susceptible to inhibitors
- Stalk rot in sorghums

● Resistance of certain inbreds to corn root rot and stalk rot is being evaluated in an experiment at Highmore (central South Dakota) where several hundred 3-way hybrids were grown under field conditions. Frequently, in the case of susceptible hybrids, the roots become rotted and large portions are killed by soil-borne diseases following ear set. In each of the experimental hybrids grown the past 6 years, one of the three parents was an inbred line under investigation for root and stalk rot resistance. Commercial hybrids best adapted to the area were used for comparison. The experimental hybrids with the greatest degrees of root and stalk rot resistance have performed well under difficult growing conditions including low rainfall at Highmore. Certain of the superior hybrids consistently out-performed the adapted commercial hybrids. Some experimental hybrids yielded about 15 bushels per acre more than the commercial hybrids. Evaluations based on acre yield indicate that for all 6 years enough grain would have been produced to provide a reasonably good quality silage and in the wetter seasons excellent silage would result for feeding cattle or the production of ear corn.

● Stem rust resistant spring wheats have been grown successfully in South Dakota for years. Plant scientists have now developed winter wheats with some resistance to current races of stem rust. In spite of these advances, stem rust will remain a threat to the wheat grower due to the almost incredible ability of the rust fungus to change and produce new types (races) which can attack previously resistant varieties of wheat. One of the more promising methods to meet the problem of a new rust race attacking previously resistant varieties is the use of rust control chemicals. Experiments with such chemicals have shown that wheat yields can be doubled in severe rust years. However, critical problems must be solved before chemical rust control will be practical. For example, it is not yet possible to accurately predict if rust will be severe enough in any particular year to warrant spraying. The best time for spraying has not been thoroughly established. Effect of rain on a recently sprayed field is not well understood. A suitable "sticker" must be found for incorporating into the spray. These are

some of the problems Experiment Station personnel are investigating.

● Leaf spot continues as the most serious disease problem in eastern South Dakota's sugar beet areas, now in the fourth year of production. The disease is caused by a fungus which produces spots about the size of a match head on leaves of the sugar beet plant. As these spots become numerous and increase in size, the older leaves die and new leaves are produced. This production of new leaves, which depletes the stored sugars in the beet roots, results in a loss in tonnage and sugar yield.

Leaf spot can be controlled by fungicides, three of which are now cleared by the Food and Drug Administration and USDA for use on sugar beets. Additional new fungicides are being tested to observe their efficiency in disease control and effect on yield. Five of 14 chemicals tested reduced sugar beet leaf spot severity more than 50%, increased beet yields 2 to 7 tons per acre, and boosted sugar yields 1,200 to 3,000 pounds per acre. Three of these five fungicides are presently recommended for use while the other two are experimental chemicals. Correct timing of applications, proper dosages of fungicides, and gallonage of water to be used per acre are being studied further. Preliminary results indicate that leaf spot infection takes place during and within 1 to 2 days after a rain or after overhead irrigation has been used. This points up the need for continuous fungicide coverage throughout the growing season.

● In the past 5 years the organism (*Sclerophthora macrospora*) causing downy mildew or crazy top disease of corn and sorghum has been found affecting wheat, oats, barley and proso millet, as well as eight annual and eight perennial grasses. It has been found throughout South Dakota on one or more of these plants in cropland as well as in rangeland areas. Source of the organism for infecting cereals appears to be the infected perennial grasses, mainly smooth brome, bluegrass and reed canarygrass present in roadside ditches, grassy draws and low-lying pastures immediately adjacent to the cereals. Rain runoff that simultaneously floods such grasses and the cereal seedlings serves as a medium to transmit infection to the



cereals. The organism fruits under water on the surface of grass leaves and liberates motile spores. The motile spores spread to the cereals through flood water. Downy mildew or crazy top can be controlled by avoiding the planting of cereals in portions of fields that tend to become flooded.

● Plots of deteriorated range grass were treated in early spring with a fungicide and a nematocide alone and in combination. A late spring inspection showed a large population of parasitic nematodes to be present. Plots treated with a combination of the fungicide and nematocide showed more vigor and more new growth than untreated plots or those with either material used alone. Reason for the single applications of fungicide and nematocide being less effective is not clear at this stage of the tests. No particularly virulent fungi have been found among those isolated from deteriorated range grasses. Investigations tend to support the apparent relationships of seasonal moisture and the decline of western wheatgrass in the field.

● Soil samples from various localities have shown that the American dagger nematode (*Xiphinema americanum*) is prevalent. This indigenous species has moved from native vegetation to cultivated crops. It feeds on roots in much the same manner that aphids feed on stems by puncturing cells, withdrawing the contents and leaving minute openings through which fungi and bacteria may enter and join in producing lesions that can damage or kill the roots. The dagger nematode is frequently associated with root rots of various crops. Hosts range from grasses and cereals to vegetables, shrubs, orchard trees and windbreak plantings. Injury to the shrubs and trees frequently is indicated by decline and dieback of twigs and limbs, often resulting in severe stunting and death of the plant. Isolated infestations of other plant-infesting forms have been found but damage from these usually is limited to comparatively small areas. They include: root lesion (*Pratylenchus brachyurus*) and related species; root knot (*Meloidogyne hapla*); and stunt (*Tylenchorhynchus*) species. Most South Dakota soils are clays too heavy to justify expense of applying nematocides which are adapted to sandy or light clay loams. Standard applications of the well-known nematocides D-D (Dichlorobromopropene) and EDB (Ethylene dibromide) control nematodes in tomatoes, canteloupes, strawberries and other high value crops grown on lighter soils. Bare fallow of dry farm grain fields gives excellent control of all plant parasitic nematodes.

● Virus diseases of plants are presently controlled most efficiently by breeding disease resistant varieties.

Another approach to virus disease control attempts to eliminate viruses by treating the host plants with certain chemicals. Experiments at State University have demonstrated that several plant viruses respond to treatment with chemical inhibitors. Ribonucleic acid—the most important component of a plant virus—was found to have especially high susceptibility to these inhibitors. Experiments continue to investigate the mode of action of virus inhibitors and to explore their use in practical disease control.

● Four varieties of sorghum differing in susceptibility to stalk rot when inoculated in the usual manner, were inoculated with two isolates of fusarium under different conditions in an attempt to alter the reaction of the varieties and determine some conditions which predispose a given variety to attack by species of fusarium. The amount of dead tissue in the stalk is being determined throughout the season and related to extent of invasion by stalk rot organisms. The condition of the invaded tissues (whether living or dead) is being studied. Source of natural infection is being sought through detailed examination of infected plants and by following the path of the invading fungi through the stalk. Inoculation techniques which will produce infection more nearly like natural infection are being explored. Once these techniques have been worked out it should be possible to proceed with greater effectiveness in developing a stalk rot resistant sorghum variety. □

#### RESEARCH PROJECTS IN PROGRESS

- Corn Diseases and Their Control, State 185.
- Investigations and Control of Alfalfa and Other Forage Legume Diseases, Hatch 230.
- The Biology and Control of Important Grass Diseases, State 250.
- Flax Diseases and Their Control, State 276.
- Diseases of Oats and Barley and Their Control, State 283.
- Control of Diseases Affecting Shelterbelt, Forest, and Shade Trees in South Dakota, State 292.
- Seed Treatment and Soil Amendments for the Control of Seed Rot and Seedling Blight, Hatch 296.
- The Selection of Superior Virus-Free or Virus-Tolerant Plum Rootstocks, Hatch 343.
- Pythium and Ophiobolus Graminis Root Rots of Cereals, Hatch 352.
- Diseases of Spring, Winter and Durum Wheats and Their Control, Hatch 353.
- Nematode Diseases of Plants and Their Control, State 375.
- Pathogenicity and Control of Common Scab and Bacterial Ring Rot of Potato, Hatch 386.
- Epiphytology and Control of Cereal and Legume Viruses, Hatch 389.
- The Role of Fungus Diseases in the Lodging of Sorghum, Hatch 390.

# poultry science

- Supplementation in poultry diets
- Unidentified growth factors

- Reserpine may reduce growth
- Sorghum and corn range

- Hormones in sex-reversal studies
- Developing and testing inbreds

Suitable diets tailored to even more specific needs of chickens and turkeys continue to be goals of several related research projects. Protein (amino acid) supplements make up one of the major items in cost of poultry rations. Therefore the more precisely their needs in the diet can be determined the more economically they can be fed.

Scientists explain, for example, if soybean oil meal is fed as a source of protein, comparatively large amounts may be necessary so that enough of certain amino acids are consumed. To get the proper amount of some one amino acid may mean an excess amount of another is consumed. If requirements can be determined to provide more exactly all needs, savings in production costs may result. On large flocks—10,000 birds, for example—this could amount to as much as several thousand dollars.

- Lysine supplementation of normal protein diets for turkeys gave small but significant growth responses with no improvement in efficiency. These turkeys also carried more finish. Poult gave no growth responses from glycine additions to a 20% protein diet supplemented with lysine and methionine. However, an undetermined variable, which at times accentuated the need for glycine, seemed to be involved.

For chickens, normal 16% protein diets appear adequate as used but lysine and methionine are both limiting in 11% protein diets. Such supplemented diets were inferior to the 16% protein diets. Increased egg production and improved feed efficiency were obtained with a combination of methionine, lysine, and tryptophane as compared with the 11% protein diet alone.

- Soybean oil meal—or even a water extract from it—contains at least two unidentified factors of great importance in turkey diets. One factor decidedly boosts growth rate while presence of the other causes rickets. These factors have been demonstrated at various experiment stations. Needed now is research to find out what they are. A new project starts next year aimed at identifying more accurately the nature of these factors.

- Breeding toms, given a basal diet including reserpine, produced poult with a reduced rate of growth compared with poult sired by toms not fed the tranquilizer. (Reserpine is successfully used to prevent internal hemorrhaging). These results from only the

first year are preliminary and further investigations are necessary to learn of possible side effects of reserpine. No significant difference was noted in growth rate of poult from hens fed diets with and without reserpine. Reserpine in the diet at 0.2 parts per million had no significant effect on egg production, fertility, and hatchability.

- Sorghum range and corn range are of equal value with respect to final weights and consumption of concentrate feeds by growing turkeys. Poult placed on drilled sorghum or drilled corn interplanted with rape during a 12-week growing period were fed standard grower diet, oats and oystershell, free choice. Final weights of toms on both ranges were identical (24.4 pounds). Hens on sorghum range averaged 15.9 pounds and those on corn range 15.6 pounds, a non-significant difference.

- Depo-testosterone, a synthetic hormone, was injected into eggs and induced persistent right oviducts in a high percentage of pullet chicks during studies of sex-reversal in fowl. Female chickens normally have one functional oviduct, the left. The effects of gamma irradiation is also being investigated in connection with sex reversal in chicks. Predetermined or controlled sex ratios could mean savings where all male (broiler) or all female (layer) types of chickens are desired.

- Development and testing continued on inbreds from 12 lines from Regional Control Leghorns. While differences have been noted in "select" and "random" inbred pullets, the work has not progressed far enough to show that selection itself of inbreds yields more rapid progress than does random choice of inbreds. □

## RESEARCH PROJECTS IN PROGRESS

The Comparative Value of Rape, Sudan Grass, and Other Forages for Growing and Finishing Turkeys, State 79.  
Effects of Inbreeding Upon Economic Qualities of Chickens, Hatch 179 (NC-47).

Mineral Requirements of Turkeys, State 221.

Factors Affecting Quality and Fatty Acid Composition of Turkey Meat in Market Channels, Hatch 261 (NCM-7).

Performance Testing of Poultry, State 287.

Sex-Reversal Studies of the Fowl, State 289.

Coordinating Egg Production and Marketing in South Dakota, Hatch 372 (NCM-31).

Amino Acid Requirements of Turkeys, Hatch 381.

The Effects of Feed Additives in Diets for Poultry, Hatch 382.

Amino Acid Requirements of Laying Hens, Hatch 383.

# rural sociology

- Bibliography prepared on South Dakota Hutterite communal farms
- School system adjustments in a rural county
- Appraisal of farmer's attitudes toward retirement

● A comprehensive annotated bibliography of published information on the Hutterian Brethren and their communal farms will be published in early 1965. Requests for information on published material on South Dakota's communal farms are received every year and this bibliography will be as complete and up-to-date as possible. In its final form the bibliography will contain these features:

1—A listing of over 300 entries of sources of information on the Hutterite Brethren and their colonies. Almost all are in English with a few basic sources in German.

2—Each entry is annotated so the reader can ascertain the nature of the material. Books, journals, periodicals and newspaper articles are covered.

3—Although the major focus of the bibliography is on South Dakota colonies, basic sources referring to colonies elsewhere are included.

4—Sources are classified into 16 categories according to the nature of the subject matter. Included are such topics as history, religious beliefs, social organization, agriculture, legal aspects, and social change.

5—In addition to the annotation and classification, sources are cross referenced because many have a bearing on more than one subject area.

● Findings from an investigation of the nature and extent of adjustment made by the school system in a rural South Dakota County (Marshall) which has experienced considerable out-migration and population loss are summarized as follows:

Population of the county declined 30% from 1930 to 1960.

Number of common schools declined from 72 in 1930 to 33 in 1960, a reduction of 54%.

Number of independent schools declined from eight in 1930 to five in 1960.

Common school enrollment declined by 66%, but independent school enrollment increased by 5% during the 30-year period.

Threat of enrollment loss brought about an increase in size of "tuition enrollment areas" for independent districts, usually at the expense of smaller independent and common schools.

Characteristics of the sample of county residents

who responded to a questionnaire found to be associated with attitudes toward their present school system and school reorganization are:

Respondents over 45 years of age were more favorable to their present school system than those under 45.

Respondents most familiar with the reorganized school were more favorable toward it than those who were most familiar with the two un-reorganized schools.

A larger proportion of those respondents in the younger age groups were favorable to school reorganization than in the older ages.

A larger proportion of those individuals familiar with the reorganized school favored reorganization than those more familiar with the unorganized schools.

Knowledge of present school was related to attitude toward reorganization. This suggests that as people become more aware of present conditions the more favorable they are toward reorganizing the school to remedy the problems.

Knowledge of the proposed reorganization plan was also found to be significantly associated with attitudes toward reorganization, and those respondents most knowledgeable of the plan were most favorable.

● Opinions of a random sample of farmers from three eastern South Dakota counties were analyzed to appraise the meaning of retirement for those now actively engaged in agriculture.

Of farm operators interviewed in the spring of 1962, 85% planned to retire, preferably after age 62, although less than a third had made definite plans for retirement years.

In describing what retirement means, most farmers anticipated it would involve a change in location, preferably in the rural area near the farm where they had spent most of their lives. They hoped to live with their spouse in their own home. Sixty-five percent felt retirement would bring a considerable reduction in amount of physical farm labor; 21% expected this labor would be reduced completely. At the same time, only 38% expected management would be reduced considerably and 43% felt it would be reduced completely.

These farmers thought Social Security benefits and



income from the farm were the "best" sources of retirement income and expected both would be their most important sources for financing retirement. Most favored provisions of the 1960 Social Security program and more than half favored adding medical and hospitalization benefits.

They expected the most important factor for happiness during retirement would be their state of health. Access to friends and sufficient income were also considered important to enjoyment of retirement.

Operators who planned to retire and those who expected retirement to change their labor and management habits as well as their residence, indicated more favorable attitudes toward retirement. Other characteristics associated with more favorable retire-

ment attitudes were: more formal education, conceiving health as "good," high morale, preference for management, anticipation of adequate retirement income, more participation in nonfarm organizations, and being a younger farmer. □

#### RESEARCH PROJECTS IN PROGRESS

The Impact of Population Changes Upon Rural Communities in South Dakota, Hatch 222 (NC-18).

The Socio-Economic Influences of the Communal Type Farm on the Rural Community in South Dakota, Hatch 255.

Concepts of Retirement, Attitudes Toward Retirement and Retirement Plans of South Dakota Farmers, Hatch 279-R.

Evaluation of the Extension of Farm and Home Development Program in Deuel County, Hatch 332.

Cultural and Social Factors Related to Food Practices Among the Sioux Indians of South Dakota, State 369.

## station biochemistry

- Reducing urinary calculi incidence by controlling phosphorus
- Nitrates in water not toxic to swine
- Selenium poisoning studies continue

● Phosphorus has been shown by a number of investigators to be somehow involved in causing urinary calculi. Rations high in phosphorus increase calculi incidence. Increasing the calcium level of the ration gives some protection. Studies conducted during the year have shown that by controlling phosphorus level and calcium:phosphorus ratio urinary calculi incidence is greatly decreased. The chemical form of these elements used in rations may also be of some importance. While phosphorus level contributes to the incidence of this disease, other unknown factors are probably more important in causing it. The search for these factors is in progress.

● Nitrogen and sulfur are important constituents of proteins. Studies on sulfur metabolism have been aimed at finding how important inorganic sulfate is to protein synthesis in the rumen. These studies have been basic in nature, since much more must be known about the biochemistry of sulfate fixation in the rumen before a satisfactory approach to large animal studies can be designed. In the case of nitrogen, studies on nitrate had in the past yielded much valuable information concerning its effect on cattle and sheep. It was suggested from the field that nitrate in water was

more toxic to swine than to ruminants. Research has indicated, however, that nitrates in water should cause no difficulties for swine, even at the highest levels they might be encountered in wells of South Dakota.

● Basic research on toxicity of selenium to animals continues. Studies include efforts to establish how selenium is transported in the animal body, whether it is metabolized in a manner similar to that by which sulfur is metabolized, whether long-term feeding at sub-toxic levels is harmful to animals, and what chemical form of selenium is most toxic. Some evidence has indicated that the element can be deposited in certain tissues without causing harm. This is of interest because it suggests that the toxicity of selenium does not result from its substitution for sulfur in certain amino acids. Other data indicate that selenium may have its own unique metabolic pathway, the knowledge of which may eventually aid in the prevention of selenium poisoning. □

#### RESEARCH PROJECTS IN PROGRESS

Selenium Poisoning, Hatch 19.

Urinary Calculi, Hatch 309.

Protein Metabolism in the Rumen, Hatch 349.

# veterinary

- Some protection from SBE virus
- Leptospirosis investigations

- Diarrhea-mucosal disease costly
- Oil emulsion bacterins best

- Diagnostic lab receives 27,184 specimens during year

● Immunizing agents are not available commercially against infections caused by the psittacosis-lymphogranuloma (P-L) group of viruses. In an immunization trial using guinea pigs, some protection against infection with the virus causing sporadic bovine encephalomyelitis was afforded by vaccines prepared from two of the P-L viruses. Some experimental vaccines provided no protection.

● Vaccination against leptospirosis results in the development of low titer reactions in a high percentage of animals. One fourth of 40 vaccinated animals had detectable antibody at 1 week and 90% at 1 month. After 8 months only 25% still retained low titers. No differences were noted in results from two types of bacterins used. Of two calves given a single injection of bacterin, one became infected following an injection (challenge) with virulent leptospira 3 months later. Two other calves which had received two bacterin injections resisted a virulent, or challenge, infection.

● Reports from veterinarians and field investigations indicate that the virus diarrhea-mucosal disease complex is a cause of considerable loss in South Dakota. Viral agents recovered from field cases remained infective for calves after several passages in tissue cultures. Only a mild infection was produced in inoculated calves with either the isolated virus strains or tissue suspensions from field cases.

● In fowl cholera immunization trials in turkeys, bacterins of an oil emulsion type provided better protection than was obtained with a saline suspension bacterin. Two immunologic types of *Pasteurella* causing fowl cholera were demonstrated and these were correlated with different biochemic reactions. A bacterin which contains the two immunologic types of *Pasteurella* should provide a more dependable immunizing agent.

● The 27,184 specimens received by the animal disease diagnostic laboratory during the year was 3,900 greater than during the previous year and more than 10,000 greater than 4 years ago. The constantly increasing demands for diagnostic services indicates the greater concern of South Dakota livestock producers for control of diseases to cut financial losses. More than 23,000 blood samples were received for serologi-

cal tests for brucellosis, leptospirosis, vibriosis or pullorum and paratyphoid. Necropsies (post mortem examinations) were performed in 833 cases (161 more than the previous year) and 563 examinations for rabies were conducted (117 more than last year). Other tests included bacteriological, pathological or examinations for parasites on various specimens submitted. A small part of the financial support of the animal disease diagnostic laboratory is provided by moderate fees charged for services.

Diagnostic work at the Animal Health Laboratory at State University from July 1, 1963 to June 30, 1964 is summarized as follows:

Serological		
Brucellosis		7,053
Cattle	5,145	
Swine	1,908	
Leptospirosis		3,880
Cattle	2,993	
Swine	887	
Vibriosis		415
Pullorum-Paratyphoid		13,801
Necropsies (cases)		833
Cattle	111	
Swine	195	
Sheep	98	
Fowl	421	
Small Animals	8	
Rabies Examinations		563
Positive	146	
Negative	417	
Organs and Parts		297
Milk		98
Water		16
Physician and Hospital		97
Unclassified		131
<b>Total</b>		<b>27,184</b>

## RESEARCH PROJECTS IN PROGRESS

- Sporadic Bovine Encephalomyelitis (SBE), Hatch 171.
- Virus Diarrhea (Mucosal Disease) of Cattle, Hatch 253.
- Leptospirosis of Farm Animals in South Dakota, Hatch 270.
- Nature and Control of Fowl Cholera, Hatch 391 (NC-65).
- Animal Health Laboratory (Diagnostic Service), State 408.

# wildlife

## ● Growing commercial bait fish in farm ponds

● A study of farm fish ponds started at midyear to measure primary production of farm pond waters in various soil regions, determine population dynamics so as to establish maximum production and utilization of fish, and develop methods of spawning, rearing, harvesting, and marketing the more desirable commercial bait fish in farm ponds. During the spring spawning season more than 100,000 suckers were hatched in experimental facilities. These were planted at the rate of 50,000 per surface acre in two study ponds. One pond is being fertilized bi-weekly while the second serves as the unfertilized control. Successful natural reproduction was attained by planting adult suckers in a pond containing numerous springs. The bi-weekly water analyses should indicate proper

## ● Food and movement patterns of raccoons

chemical conditions necessary for successful production of commercial bait fish.

● In an economic study of raccoons, the local travels of individual animals in relation to food habits and crop depredation have been observed. A telemetry system for radio-tracking a limited number of individuals has been developed to learn the day to day movement patterns. Relatively little damage to field crops or poultry was done by raccoons during the year because of the availability of natural foods such as frogs and crayfish which became plentiful when the prolonged drought was broken. □

### RESEARCH PROJECTS IN PROGRESS

The Economic Importance and Life History of the Raccoon (*Procyon lotor*) in South Dakota, State 308.  
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- Wells, D. G. See Albrechtsen, R. S.
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- . See Weichenthal, B. A.
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- Wiesner, L. E. See Kinch, R. C.
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- Young, H. G. See Whetzal, F. W.
- and H. Winterfeld. Beef Research Unit Feeding System, *3rd An. Prog. Rept. SESD Res. Farm*. Dec. 1963.
- . See Winterfeld, H.
- Zimmerman, D. C. See Dybing, C. D.

# Agricultural Advisory Groups

## Agricultural Division

Ed Bailey ..... Lucas  
 A. J. Barta ..... Buffalo Gap  
 Mrs. Alfred Behrends ..... Madison  
 Henry Bieber ..... Timber Lake  
 Louis Bober ..... Rapid City  
 Alan Bogue ..... Beresford  
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 Ingebert Fauske ..... Quinn  
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 Carl Hamm ..... Caputa  
 Eric Hermanson ..... Garretson  
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 Fred Holscher ..... Faulkton  
 Hagen Kelsey ..... Fedora  
 Wesley Larson ..... Beresford  
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 Harry Martens ..... Wessington  
 Harold Millett ..... Reva  
 Stan Morrill ..... Sioux Falls  
 Donald Naddy ..... Britton  
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## Antelope Range Buffalo

Benny Dollarhide ..... Timber Lake  
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 Harold Millett ..... Reva  
 Ole Drageset ..... Isabel  
 Harold Hernsen ..... Lodgepole  
 Arnold Lee ..... Isabel  
 Henry Meyer ..... Timber Lake

## Central Substation Highmore

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 Art Hibbison ..... Miller  
 Keith Kleppin ..... Wessington Springs  
 Francis Martens ..... Wessington  
 O. K. Peterson ..... Holabird  
 C. B. Sloat ..... Hoven

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 Keith Crew ..... Interior  
 Francis Guptill ..... Interior  
 Bob Hlavka ..... Plainview  
 Orville Keil ..... Cottonwood  
 Ingebert Fauske ..... Cottonwood  
 Clifford Fees ..... Cottonwood  
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 Ohmar Cook ..... Cottonwood  
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 H. G. Ehlers ..... Presho  
 John Fernen ..... Mission  
 George Fluharty ..... Fort Pierre  
 John Glaus ..... Chamberlain  
 Allan Kime ..... Burke  
 Andrew Dice ..... Witten

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# STAFF

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Ass't. Professor  
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R. J. WALSTROM, Ph.D. Professor  
W. E. BOUNDY, (USDA).....  
Administrative Assistant  
B. W. GEORGE, Ph.D. (USDA) Ass't. Professor  
R. W. GERHARD, Ph.D. Assoc. Professor  
RALPH GUSTIN, M.S. (USDA).....Instructor

E. W. HAMILTON, Ph.D. (USDA).....  
Ass't. Professor  
S. D. HINTZ, B.S. Survey Entomologist  
W. L. HOWE, Ph.D. (USDA) Ass't. Professor  
E. J. HUGHINS, Ph.D. Professor  
R. W. KIECKHEFER, Ph.D. (USDA).....  
Ass't. Professor  
J. W. MATTESON, Ph.D. (USDA).....  
Ass't. Professor  
E. E. ORTMAN, Ph.D. (USDA) Ass't. Professor  
\*H. C. SEVERIN, M.A. Professor Emeritus  
W. N. STONER, Ph.D. (USDA) Assoc. Professor  
LELAND WHITE, M.S. Ass't. Professor

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JOAN ASPELIN, B.S. Ass't. in Home Economics  
LIDA M. BURRILL, Ph.D. Professor  
DOROTHY DEETHARDT, B.S. Ass't. in Home Economics  
EVELYN HOLLEN, Ph.D. Professor  
LILLIAN O. LUND, M.S. Professor  
CECILIA SCHUCK, Ph.D. Professor  
CORRUE R. SIVERS, M.S. Ass't. Professor

## HORTICULTURE

\*S. A. McCORRY, M.A. Professor and Head  
R. M. PETERSON, Ph.D. Assoc. Professor and Acting Head  
P. E. COLLINS, M.S. Assoc. Professor  
NORMAN EVERS, B.S. Ass't. in Horticulture  
D. P. PRASHAR, Ph.D. Ass't. Professor  
J. W. RAWSON, Ph.D. Assoc. Professor  
J. R. WAPLES, B.S. Ass't. in Horticulture

## PLANT PATHOLOGY

C. M. NAGEL, Ph.D. Professor and Head  
GEORGE BUCHENAU, Ph.D. Assoc. Professor  
L. W. CARLSON, Ph.D. Ass't. Professor  
STANLEY G. JENSEN, Ph.D. (USDA).....  
Ass't. Professor  
C. J. MANKIN, Ph.D. Assoc. Professor  
G. B. ORLOB, Ph.D. Ass't. Professor  
V. D. PEDERSON, Ph.D. Ass't. Professor  
GEORGE SEMENIUK, Ph.D. Professor

## POULTRY SCIENCE

WM. KOHLMAYER, M.S. Professor and Head  
C. W. CARLSON, Ph.D. Professor  
EDMUND GÜENTHNER, M.S. Instructor  
W. C. MORGAN, Ph.D. Professor  
P. E. PLUMART, M.S. Ass't. Professor

## PUBLICATIONS

E. W. METCALF, M.S. Agricultural Editor  
R. E. ROSS, B.S. Ass't. Publications Editor  
FRANK J. SHIDELER, B.S. Ass't. Publications Editor

## RURAL SOCIOLOGY

H. M. SAUER, M.A. Professor and Head  
JEANNE BIGGAR, M.S. Instructor  
B. J. GORROW, Ph.D. Assoc. Professor  
V. D. MALAN, Ph.D. Professor  
M. P. RILEY, M.A. Assoc. Professor

## STATION BIOCHEMISTRY

O. E. OLSON, Ph.D. Professor and Head  
A. G. BEDNEKOFF, Ph.D. Ass't. Professor  
R. F. DERR, Ph.D. (USDA) Ass't. Professor  
R. J. EMERICK, Ph.D. Assoc. Professor  
GEORGE F. GASTLER, M.S. Assoc. Professor  
A. W. HALVERSON, Ph.D. Professor  
I. S. PALMER, Ph.D. Ass't. Professor  
E. I. WHITEHEAD, M.S. Assoc. Professor

## STATISTICS

W. L. TUCKER, Ph.D. Station Statistician

## VETERINARY

G. S. HARSHFIELD, D.V.M., M.S.	Professor and Head
T. A. DORSEY, D.V.M.	Assoc. Professor
JOHN McADARAGH, M.S.	Ass't. Professor
J. B. TAYLOR, D.V.M.	Professor
D. R. WENGER, D.V.M., B.S.	Ass't. Professor

## WILDLIFE MANAGEMENT

*GERALD B. SPAWN, Ph.D.	Professor and Head
D. R. PROGULSKE, Ph.D.	Assoc. Professor and Head
NORMAN SCHOENTHAL, M.S.	Ass't. Professor
PAUL F. SPRINGER, Ph.D. (USI)	Assoc. Professor

## SUBSTATIONS

ALBERT DITTMAN, B.S.	Superintendent	North Central Substation, Eureka
FRANK HOLMES	Acting Superintendent	Central Substation, Highmore
JOHN NESVOLD, B.S.	Superintendent	Range Field Station, Cottonwood
PHILIP SEVERIN	Superintendent	Reed Ranch Field Station, Presho
W. R. TREVILLYAN, B.S.	Superintendent	Antelope Range Field Station, Buffalo
CARL ERICKSON, M.S. (USDA)	Superintendent	U. S. Irrigation and Dryland Field Station, Newell
J. F. FREDRIKSON, B.S.	Superintendent	Southeast South Dakota Experiment Farm, Beresford
LLOYD B. DYE	Superintendent	Development and Irrigation Substation, Redfield

## APPOINTMENTS

### Agricultural Engineering

Thomas Klosterman,	Assistant in Mechanized Agriculture	7/1/63
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### Agronomy

Maurice L. Horton,	Associate Professor	6/22/64
Roger Poff,	Assistant in Agronomy	7/1/63

### Animal Science

David E. Schafer,	Assistant in Animal Science	7/1/63
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### Dairy Science

Burdell Alfke,	Assistant in Dairy Science	7/1/63
Susan A. Cooper,	Assistant in Dairy Science	9/3/63

### Economics

Herbert Allen,	Assistant in Economics	9/1/63
Harlan J. Dirks,	Assistant Professor	8/1/63
Donald Erickson,	Assistant Professor	10/20/63
Kenneth Krause,	Assistant Professor	2/1/64

### Entomology-Zoology

Leland White,	Assistant Professor	9/3/63
Ralph Gustin,	Instructor	9/1/63

### Home Economics

Cora Rude Siviers,	Assistant Professor	9/1/63
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### Plant Pathology

Lester W. Carlson,	Assistant Professor	7/1/63
--------------------	---------------------	--------

### Statistics

W. Lee Tucker,	Assistant Professor	9/1/63
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## Wildlife Management

Norman Schoenthal,	Assistant Professor	9/1/63
Paul F. Springer,	Associate Professor	9/1/63

## Publications

Frank J. Shideler,	Assistant Publications Editor	2/1/64
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## Substations

Frank Holmes,	Acting Superintendent, Highmore	7/1/63
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## RESIGNATIONS

### Agronomy

Wilfred McMurphy,	Assistant Professor	2/29/64
J. R. Runkles,	Professor	12/31/63
Lloyd C. Warner,	Assistant Professor	3/31/64

### Dairy Science

Susan A. Cooper,	Assistant in Dairy Science	5/31/64
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### Wildlife Management

Marvin Allum,	Assistant Professor	8/1/63
---------------	---------------------	--------

### Publications

Ronald E. Ross,	Assistant Publications Editor	10/14/63
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## \*DECEASED

G. B. Spawn,	Head of Wildlife Management	8/31/63
S. A. McCrory,	Head of Horticulture-Forestry	3/5/64
H. C. Severin,	Professor Emeritus	Entomology-Zoology 8/19/64

The eight permanent substations of the South Dakota Agricultural Experiment Station provide sites for conducting research geared to specific needs of the areas in which they are situated.

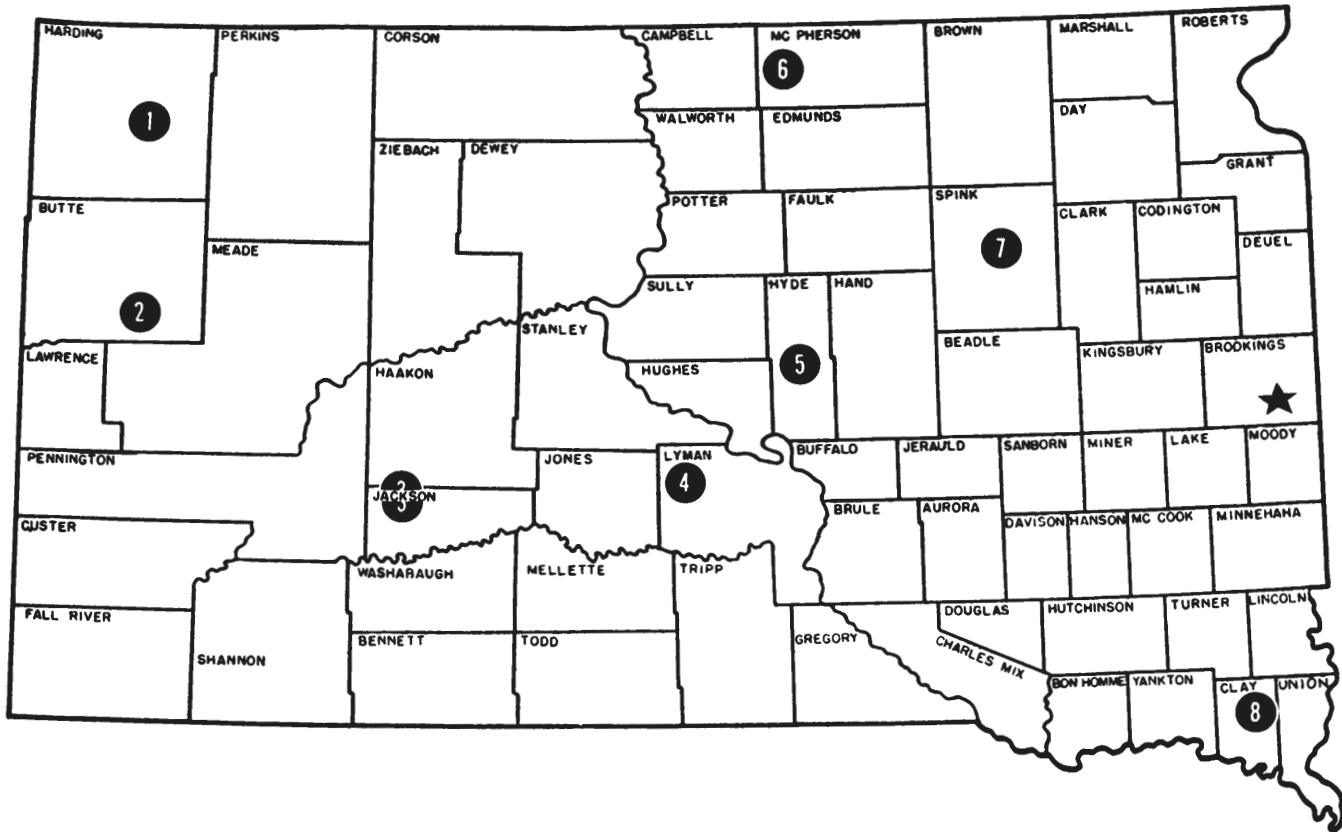
General problems common throughout the state usually are investigated at the main station at Brookings. But because of South Dakota's variety of climate, terrain and types of agriculture the substations are established to conduct research on more localized problems.

Each substation has a resident superintendent who works closely with people of the community. The substation "system" is 2-way: while results of scientific investigations are made available for local use, the success of the program depends greatly on the interest and suggestions of ranchers and farmers in areas involved. In addition to eight permanent substations, several other research locations are maintained for special experiments in field crops, plant diseases, and soil and water problems.

South Dakota's experiment station network consists of:

# PERMANENT

- 1 ANTELOPE RANGE FIELD STATION, Harding County. Established in 1948. Consists of 8,000 acres. Includes beef cattle improvement and development of inbred lines, sheep range and measurement of lifetime production of ewes.
- 2 U. S. IRRIGATION AND DRYLAND FIELD STATION, Newell. Cooperative with USDA, 360 acres. Soil and water research under irrigated and dryland conditions. Livestock (beef and sheep) and range improvement and utilization.
- 3 RANGE FIELD STATION, Cottonwood. Consists of 2,640 acres with greater variety of experiments than any other station. Investigations of small grains, grasses, corn and sorghums, legumes, beef



# SUBSTATIONS

cattle breeding and grazing, watershed runoff, pesticides.

**4 REED RANCH FIELD STATION**, north of Presho. Established as a field laboratory to study selenium poisoning in cattle.

**5 CENTRAL SUBSTATION**, Highmore. Oldest substation, established about 1900, and consists of 117 acres. Investigations include crops research, forage preservation, calf feeding, poultry research to compare inbred and top crossed lines, has fruit trees and woody ornamentals in the experimental orchard.

**6 NORTH CENTRAL SUBSTATION**, Eureka. Established in 1907, consists of 240 acres for testing

crop varieties and influence of plant diseases, rotational cross breeding of swine, feeding and wintering beef cattle.

**7 REDFIELD IRRIGATION DEVELOPMENT FARM**, Redfield. Cooperative with Bureau of Reclamation. Crop and livestock production under irrigation, drainage and infiltration studies.

**8 SOUTHEAST SOUTH DAKOTA EXPERIMENT FARM**, Centerville. Newest substation, established in 1961, consists of 320 acres. The farm has been made possible through the cooperation of the people of the local 9-county area. Research includes soils studies, variety trials of corn and sorghum, sugar beet investigations, fertilizer and rotation trials, swine management and cattle feeding, insect control, and energy use in the all-electric farmstead.

**★ SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION**, Headquarters at South Dakota State University, Brookings. Established 1888. Research work in the important phases of South Dakota agriculture, home economics, and biological sciences.

**SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION  
STATEMENT OF RECEIPTS, DISBURSEMENTS AND BALANCES  
FOR THE YEAR ENDED JUNE 30, 1964**

Receipts:	Grand Total	Hatch	Research Marketing	Regional Research	Experiment Substation	Special Construction	Experiment Station
Balance July 1, 1963 .....	\$ 229,611.20	\$ —	\$ 2,061.81	\$ —	\$ 217,549.39	\$ 10,000.00†	—
Receipts & Appropriations .....	2,329,046.83	396,402.13*	—	117,555.00	475,607.00	225,000.00	\$1,114,482.70
<b>GRAND TOTAL .....</b>	<b>\$2,558,658.03</b>	<b>\$ 396,402.13</b>	<b>\$ 2,061.81</b>	<b>\$ 117,555.00</b>	<b>\$ 693,156.39</b>	<b>\$ 235,000.00</b>	<b>\$1,114,482.70</b>
<b>Expenditures:</b>							
Personal Services .....	\$1,328,603.18	\$ 382,335.09	\$ 2,061.81	\$ 102,867.88	\$ 122,445.85	\$ —	\$ 718,892.55
Travel .....	42,999.53	237.25	—	—	4,045.15	—	38,717.13
Interdepartmental Charges .....	4,987.25	—	—	—	—	—	4,987.25
Transportation of Things .....	3,196.61	—	—	—	1,080.85	—	2,115.76
Communication Service .....	3,700.71	—	—	—	2,499.97	—	1,200.74
Rents & Utility Service .....	36,542.80	—	—	78.12	19,887.74	—	16,576.94
Printing & Binding .....	1,570.55	—	—	8.55	1,126.15	—	435.85
Other Contractual Service .....	48,816.93	866.47	—	828.69	20,705.76	—	26,416.01
Supplies & Materials .....	300,983.69	356.84	—	1,588.49	142,819.27	—	156,219.09
Interdepartmental Charges .....	56,753.55	3,501.54	—	2,521.35	24,482.54	—	26,248.12
Equipment .....	236,569.84	—	—	9,661.92	104,234.66	—	122,673.26
Buildings .....	1,355.25	—	—	—	—	1,355.25	—
<b>TOTAL .....</b>	<b>\$2,066,079.89</b>	<b>\$ 387,297.19</b>	<b>\$ 2,061.81</b>	<b>\$ 117,555.00</b>	<b>\$ 443,327.94</b>	<b>\$ 1,355.25</b>	<b>\$1,114,482.70</b>
Balance June 30, 1964 .....	492,578.14	9,104.94	—	—	249,828.45	233,644.75	—
<b>GRAND TOTAL .....</b>	<b>\$2,558,658.03</b>	<b>\$ 396,402.13</b>	<b>\$ 2,061.81</b>	<b>\$ 117,555.00</b>	<b>\$ 693,156.39</b>	<b>\$ 235,000.00</b>	<b>\$1,114,482.70</b>
<b>(as above)</b>							

\*Includes \$5.13 cancelled warrant from a previous fiscal year.  
†Balance June 30, 1963 reappropriated for Swine Research Facility.

**South Dakota Agricultural Experiment Station  
Statement of Receipts, Disbursements and Balances  
For Year Ended June 30, 1964**

**CURRENT RESTRICTED FUNDS**

	Cooperative Forestry Research Program	Regional Research Program Travel
<b>Receipts:</b>		
Balance July 1, 1963 .....	0	0
Receipts .....	\$12,781.00	\$5,000.00
<b>TOTAL .....</b>	<b>\$12,781.00</b>	<b>\$5,000.00</b>
<b>Expenditures:</b>		
Personal Services .....	425.00	—
Travel .....	353.86	5,000.00
Contractual Services .....	15.41	—
Supplies and Materials .....	1.53	—
Equipment .....	2,999.25	—
<b>TOTAL .....</b>	<b>\$ 3,795.05</b>	<b>\$5,000.00</b>
Balance June 30, 1964 .....	\$ 8,985.95	0
<b>GRAND TOTAL .....</b>	<b>\$12,781.00</b>	<b>\$5,000.00</b>



# Eminent Farmers and Homemakers



Mr. Holscher . . . leadership . . . president, chairman, vice chairman or director in at least 16 county, state-wide or regional organizations.



Mrs. Rice . . . educator, civic worker, musician . . . a pioneer in improving library facilities . . . instrumental in bringing cultural attractions to rural communities.



Mrs. Wilson . . . community service . . . 26 years of Extension Club membership . . . leader of one of South Dakota's most successful 4-H clubs.



Mr. Anderson . . . Homesteader, sticking through bad years and good . . . a never-give-up attitude . . . success as a farmer and community leader.

South Dakota's 1964 Eminent Farmers and Homemakers were honored at the 36th annual recognition banquet on the South Dakota State University campus in October. They are:

**Fred H. Holscher, Faulkton.  
Mrs. Donald Rice, Tuthill  
Mrs. Allan Wilson, Mansfield  
Carl A. Anderson, Dupree.**

The four were selected by a special State University committee for community leadership, community service, and individual success. Their portraits now are a part of the South Dakota Eminent Farmer and Homemaker Hall of Fame.



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Agricultural Experiment Station  
**SOUTH DAKOTA STATE UNIVERSITY**  
University Station, Brookings, S. D. 57007  
O. G. Beasley, Director

Publication --- Free

*to*

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New facilities on the South Dakota State University campus include a greenhouse and walk-in size growth chamber used for wheat research. The greenhouse (above, top), a 23x96-foot plastic covered structure, cost about \$20,000. Dr. Darrell G. Wells, professor of agronomy, checks wheat growing inside the greenhouse (above, left).

The \$10,000 growth chamber (above, right) can provide August conditions in mid-January or winter conditions in July. A seed-to-seed winter wheat "crop" can be grown within 4 months at any time of year.

The facilities were provided by funds from the South Dakota Wheat Commission. About half the cost of the greenhouse was from federal funds available to the Experiment Station.