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IN THIS ISSUE—

MINNESOTA FARM AND HOME Science

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New Research Publications

Following is a list of new research publications since the last issue of *Minnesota Farm and Home Science*. This feature will help keep you up-to-date on Experiment Station publications.

Tech. Bul. 238. *Policies for Expanding the Demand for Farm Food Products in the United States, Part II: Programs and Results.* Martin E. Abel and Willard Cochrane.

Sta. Bul. 453. *Regulation of Water Use in Minnesota Agriculture.* C. O. Nohre and R. M. Raup.

Sta. Bul. 454 (NCR 122). *Financing Farm Transfers with Land Contracts.* R. Verne Elefson and Philip M. Raup.

Misc. Rpt. 45. *Minnesota's People and Farms, 1950-1960.* Lee Taylor and Glenn Nelson.

Misc. Rpt. 46. *The Minnesota Landscape Arboretum—A Report of Progress.* Horticulture Department.

Sta. Misc. *A Half Century of Seed Testing—A History of the Minnesota State Seed Laboratory (1910-1960).* Dana W. Frear.

Sta. Misc. *Sixty-Seventh Annual Report of the Agricultural Experiment Station, University of Minnesota, July 1, 1959 to June 30, 1960.*

You can get these publications from your county agent or from the Bulletin Room, 3 Coffey Hall, Institute of Agriculture, University of Minnesota, St. Paul 1, Minnesota.

Superior Red Clover Varieties — DOLLARD AND LAKELAND

H. L. THOMAS and ROY D. WILCOXSON

FOR THE PAST 15 YEARS we have been saying that good homegrown commercial seed of medium red clover was just as good as any improved variety available.

We have now changed our position because of new information about the disease resistance of Dollard and Lakeland. Seed of Lakeland, a new variety, is now becoming available and Dollard has been on the market for some time.

Let's look at some of the information demonstrating the clear superiority of Dollard and Lakeland for Minnesota.

H. L. Thomas is an associate professor in the Department of Agronomy and Plant Genetics and Roy D. Wilcoxson is an assistant professor in the Department of Plant Pathology and Botany.

Disease Resistance and Yield

Red clover is subject to a number of damaging diseases. One or more may attack each plant. The most important diseases in Minnesota are: northern anthracnose, virus diseases, root rot, powdery mildew, and leaf spots. Figure 1 shows typical symptoms of these diseases.

Northern anthracnose kills the stems which, as they die, assume the shape of a shepherd's crook. Brown, diamond-shaped lesions also appear on the stems.

Powdery mildew appears as a white, powdery growth on the leaves.

Leaf spots are caused by a number of different pathogens but the spots are brown to black, occur on all the above ground parts, and may cause the early death of the foliage.

Virus diseases stunt the plants and cause leaf curling and disfiguring, but the most common symptom is a clearing of the veins and yellowing of the leaves.

Root rot is usually most severe during the second year after planting, and frequently the main root may be completely decayed.

These diseases have been found in all parts of the state, but they are usually most severe in the more humid portions. It is difficult to estimate disease losses because disease-free plants are not usually available for

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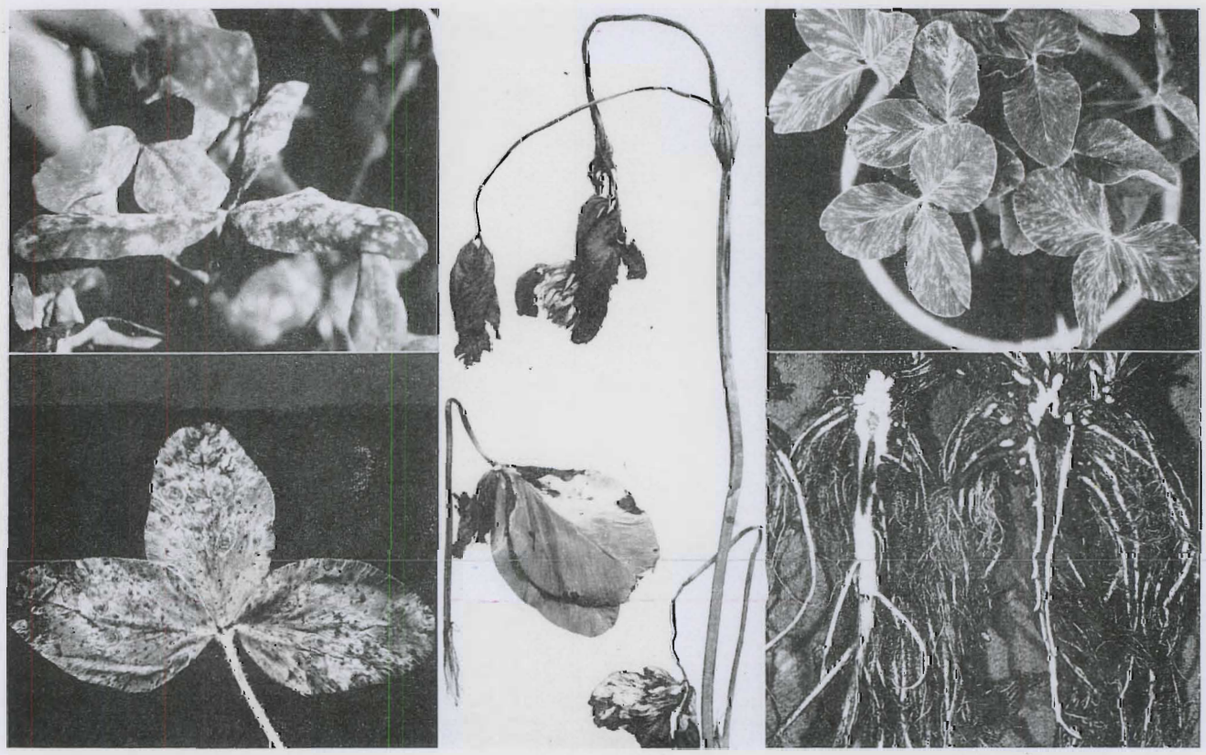


Top—Powdery mildew
Bottom—Leaf spots

Center—Northern Anthracnose

Top—Virus
Bottom—Root rot

Is Bovine Leukemia on the Increase?

JOHN K. KING, VAUGHN L. LARSON, and D. K. SORENSEN

THE NUMBER OF CASES OF LEUKEMIA, a type of cancer, in cattle may be increasing in the United States in recent years. In Germany, Denmark, and other parts of Europe, it has become an economically important disease and has caused concern among veterinarians.

Recognizing its possible importance, we in Veterinary Medicine at the University of Minnesota started a study of bovine leukemia, or malignant lymphoma, in 1960. We are studying several things including:

1. The occurrence and distribution of the disease in Minnesota for a period of years to see if this apparent increase is significant or if it is influenced by improved veterinary diagnostic services and other factors.

2. The clinical and other manifestations of the disease.

What Leukemia Is

Leukemia is essentially a type of cancer that causes an abnormal production of immature white blood cells of a cancerous nature. These leukemic white blood cells then form tumor masses in lymph nodes and lymph tissue which is widespread throughout the body. Leukemia in cattle resembles human leukemia in certain aspects, although a number of various types are seen in humans, while only one type is primarily seen in cattle.

Symptoms of Leukemia

Leukemia in cattle may resemble many other common diseases. Also, other disease conditions may occur at the same time as leukemia. Both of these situations present diagnostic problems.

Leukemia occurs more commonly in animals between 3 and 7 years of age although it is seen in any age group from young calves to older cows.

A progressive loss of weight and condition even though the animal has been eating well and appears bright and alert is the most common sign of bovine leukemia.

Enlargement of the lymph nodes is another common feature of the disease. The external lymph nodes which can be observed or palpated on the cow and are commonly involved are found near the base of the ear, at the angle of the jaw, along the side of the neck, just in front of the base of the shoulder, in the flank, and at the rear attachment of the udder. These nodes may range from the size of an orange to the size of a football or larger. Internal nodes may also be enlarged, or may be the only nodes enlarged.

Loss of control of rear limbs and tail happens in about 25 percent of the cattle with leukemia. Cattle go down and are unable to rise again although their fore legs may appear to be normal. This loss of control of the rear limbs may first be seen as a "knuckling over" of the rear feet and a difficulty in rising in the stall or stanchion. This gets progressively worse until the animal is finally unable to rise at all, although it still remains bright and alert and usually eats well. This is usually due to formation of tumor masses in and around the spinal cord that interfere with the proper function of the nerves to the rear legs.

Some form of digestive disorder, including chronic bloat, diarrhea, constipation, lack of appetite, or signs of hardware disease are other symptoms of the disease. These symptoms usually are attributable to the disease affecting the organs of the digestive tract.

Symptoms resembling pneumonia or heart trouble may be seen where the heart and lungs are affected by the disease.

Reproductive organs may be affected by the disease in some animals causing the cow to become unable to conceive or come into heat.

Eyes may be greatly bulged out or protruding in a small number of animals due to the formation of tumor masses behind the eyes.

Milk production gradually decreases as the disease progresses.

Duration of Disease

The duration of the disease, from the time it is first noticed until the animal succumbs, varies greatly. In some cases the animal may suddenly go down and die within 2 to 3 days, while in other cases it may have been noticed that the animal had been losing weight for 3 to 4 months. Generally, the disease has a rather prolonged course which becomes progressively more severe, but this course may be altered and shortened considerably if certain organs or systems of the animal's body are affected.

As the disease normally occurs, only one animal in a herd will be affected by it and other cases will probably not be seen in the herd until many years later, although a few herds have had three to four cases or more over a span of 2 to 3 years.

Noninfectious, Nontransmissible

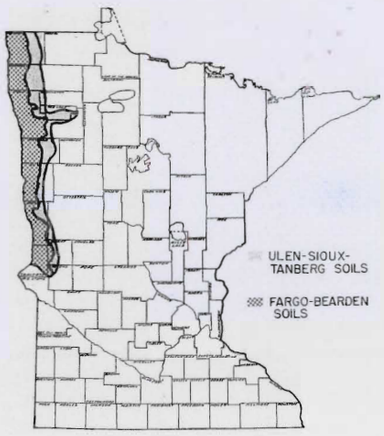
To the best of our knowledge the disease is not an infectious one and is not transmissable to humans or to other animals in the herd. To this date no one has been able to transmit the disease successfully from one animal to another, and no case is known to have occurred where leukemia has been transmitted from cows to a human being either by contact with the animal or by drinking the milk from animals with leukemia.

Animals with leukemia that go to slaughter are not used for human food. According to Meat Inspection Division Regulations of the United States Department of Agriculture, any animal that shows a cancerous condition (leukemia is one) is to be condemned as unfit for human consumption and is to be disposed of.

John K. King and Vaughn L. Larson are research fellows and D. K. Sorensen is a professor in the College of Veterinary Medicine.

Soils of the Red River Valley

H. F. ARNEMAN



ONE OF MINNESOTA'S MOST FAMOUS AGRICULTURAL AREAS is the Red River Valley. It has been prominent in Minnesota agriculture for some 80 years. In its early stages of development it was a wheat area but today it produces a wide variety of crops such as sugar beets, corn, potatoes, and all small grains. It is often thought of as the type of location for extensive midwest farming operations.

The Red River Valley is a lake plain rather than a river valley. It makes up the bed of what was formerly glacial Lake Agassiz. This famous lake came into being during the ice age some 8,000 or 9,000 years ago, when the glaciers obstructed the drainage to the north. This famous lake at one time extended nearly 700 miles northward from Big Stone Lake, and embraced an area larger than the combined areas of the present Great Lakes. Present evidences of this large lake are the materials on its bottom and along its margin.

Several Types of Soils

Ulen, Sioux, and Tanberg soils—Along many miles of the shore line the waves heaped up loose gravelly materials into beach ridges. The soils of these beaches usually are droughty and crop yields are depressed by a lack of available moisture. These soils are known as the Sioux and Marquette soils.

Just inside the old beaches where the lake waters were shallow, and on the old deltas of streams entering the lake, fine sandy deposits were laid down. These formed the materials from which the Ulen and associated soils were developed. These soils are somewhat droughty and often present a wind erosion hazard.

Bearden and Fargo soils—As we pass farther into the floor of the old lake where the waters were deeper, fine textured deposits of silt and clay were deposited. The soils formed from these deposits are among the most productive in the Valley. The soils developed from the silty deposits are known as Bearden (figure 1) and associated soils, while those developed from the fine textured clays (Gumbo) are represented by the Fargo soils. Drainage is a problem on much of the land, especially in the spring. Numerous open ditches have been constructed to carry away the excess moisture as the snow melts. During the rest of the year rainfall is usually sufficient for crop production but not great enough to warrant elaborate drainage systems.

Fig. 1. This is a profile of a Bearden soil.

In this large level area (figure 2) devoid of trees except in farm windbreaks, air movements are great causing considerable evaporation. Along the borders of some of the poorly drained spots where water has been evaporating since glacial times, alkali salts are left behind forming areas of salt concentration. Some of these spots have a high enough salt concentration so that farm crops do not grow well, and careful and proper management is necessary to get good crop production.

Climate

The climate of the Red River Valley has been favorable for producing grassland native vegetation over most of the region. The average precipitation ranges from about 23 inches in

(Continued on pages 15 and 16)

Fig. 2. Notice the level lay of the land in the Red River Valley.

H. F. Arneman is an associate professor in the Department of Soils.

Plant Tissue Culture –

A Research Tool in Plant Pathology and Botany

RICHARD D. DURBIN and A. J. LINCK

TISSUE CULTURE, or the growing in test tubes of cells from different parts of a plant such as flowers, roots, or stems, is currently being used in plant research in the Department of Plant Pathology and Botany. This technique, for several reasons, is useful to agricultural scientists. It allows us to grow these plant cells in the laboratory. Thus, we can observe them in controlled environments and can vary such factors as temperature and nutrient supply at will.

Since only a small portion of the plant is used, one can study the development of a tissue or organ independent of the entire plant. In addition, the competition for nutrients among the various plant organs is eliminated and it is possible to study the nutritional requirements of the individual plant parts, an area in which relatively little is known.

We do know that tissue cultures require not only all the minerals that the entire plant needs but also sugar, vitamins, and many complex growth factors as well. However, providing the cells with the kind and quantity of foodstuffs that will allow them to grow is not a simple job. Although some cultures have been successfully grown for as long as 26 years, many other plant cells, we have discovered, will not grow at all in a tissue culture separated from the whole plant.

Even when a culture does begin to grow there is still no assurance that a small piece of this original culture, when transferred to a fresh medium, will continue to grow. Some tissues cannot be transferred at all and die in several days or weeks. Discovering the key to this difference in ability to survive is a vital link in helping us to understand the mechanism of cell multiplication and differentiation.

Richard D. Durbin is an assistant professor and A. J. Linck is an associate professor in the Department of Plant Pathology and Botany.

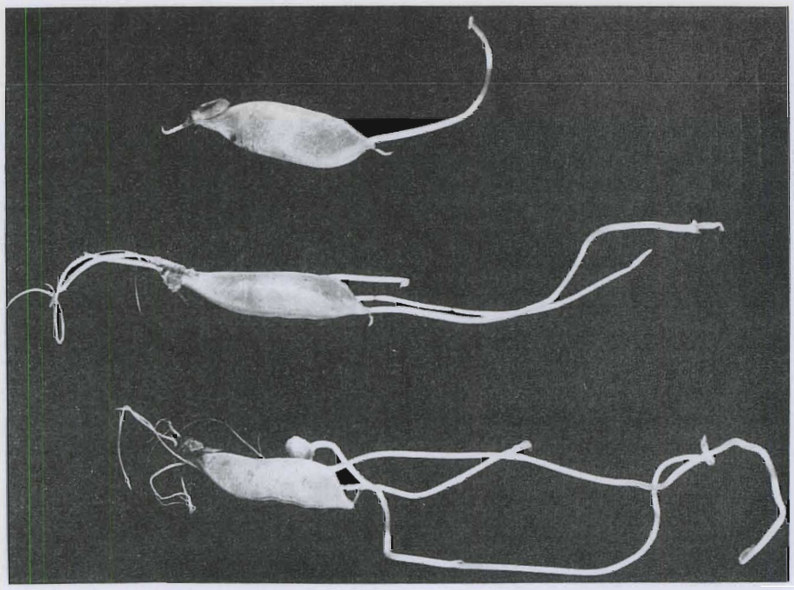


Fig. 2. This photograph shows the germination of pea ovaries removed from the plant 5 days after pollination, after growing in an artificial culture for 40 days.

Crown Gall

In this connection, one very interesting use of the technique has been in the study of crown gall. This disease, caused by a bacterium, is characterized by plant cells which multiply rapidly and produce tumor-like galls on the plant. Plant scientists have grown cells from the galls in tissue culture and found that they still retain this ability to multiply rapidly. Their nutritional requirements are also different from those of normal cells.

Through further study we hope to answer the question of just how the bacterium is able to convert a normal cell into a tumor cell. In many ways, crown gall resembles animal cancers and information gained in one area may very well benefit the other. It is well within the realm of possibility that a plant scientist, working with tissue cultures, may provide a clue in the fight against animal cancers.

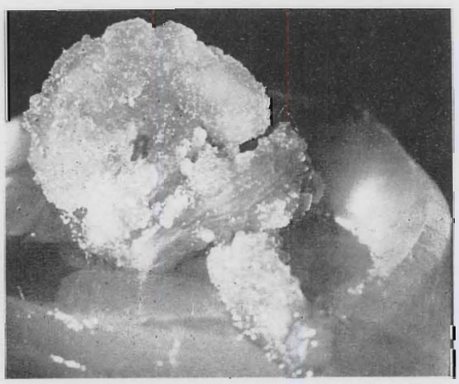


Fig. 1. This is a 4-week-old tissue culture started from a small piece of safflower leaf.

Obligate Parasites

One of the main values of tissue culture to plant pathology is its use in the study of obligate parasites, which include the rusts, mildews, some nematodes, and viruses. These can be

(Continued on page 22)

Subsoil Fertility and Soil Tests

JOHN GRAVA

OUR SUBSOILS MAY BE AN IMPORTANT SOURCE of plant nutrients. At the same time, the subsoil largely determines the amount of moisture available to plants. On some soils, corn might get at least as much of its phosphorus from the subsoil as from the plow layer. We now know that we can make lime recommendations more accurately if we have information on the lime status of both the surface and subsoil.

One way to get this information is through soil testing, but most soil samples are taken only from the top 6 inches, or plow layer. Since subsoil sampling is both time consuming and inconvenient, it is doubtful if farmers will make the practice an integral part of a soil testing program. However, if we know the nutrient levels in the subsoil of major soil series, sampling of the plow layer would be sufficient.

With this in mind we started a subsoil fertility study in 1956. Soil Conservation Service scientists have provided us with 600 profiles. The Soils Department made chemical soil analyses on these profiles.

In this article we report differences found in reaction (pH) and extractable phosphorus content in subsoils of four major soil series of southern Minnesota. The soils chosen belong to the Fayette, Hayden, Nicollet, and Barnes series.

Fayette silt loam is a light colored, well drained soil. It was formed from Peorian loess (silty, wind blown material) under mixed hardwood forest. This deeply leached acid soil is a prominent soil in southeastern Minnesota. Many areas have strongly sloping topography.

Hayden soils are light colored, well drained soils, developed from medium textured calcareous glacial till. They were formed in gently to strongly rolling areas under a mixed hardwood forest vegetation.

Nicollet soils are dark colored, moderately well drained grassland soils developed from calcareous loam glacial till. They are found in south central Minnesota.

Barnes soils are dark colored, well drained, grassland soils, developed from calcerous loam glacial till. They were formed in western Minnesota with somewhat limited rainfall.

Acidity of Subsoils

The reaction of a soil is indicated by pH value. A neutral soil will have a pH of 7. Soils having pH values of less than 6.3 are acid and require liming. On the other hand, pH values above 7 indicate an alkaline reaction or too much lime. The extent of acidity in a soil is determined mainly by the characteristics of its parent material, the intensity of leaching as influenced by the climate, and native vegetation. Figure 1 shows the average subsoil reaction for these four soil series.

Fayette soils are acid to a depth of more than 4 feet, well below the regular rooting zone of crops. High rainfall, great subsoil permeability, and forest vegetation have caused this excessive acidity. They represent subsoil characteristics of our most lime-deficient soils.

Hayden, Nicollet, and Barnes soils, all developed from similar parent material, show distinct differences in subsoil reaction. The pH values in subsoil of the Hayden series somewhat resemble those in the Fayette series. The subsoil is acid to a depth of 2 feet. They have been leached to 3½ feet where the lime-rich material is present. This lime-rich layer, however, may be out of reach for most farm crops.

Nicollet soils are slightly acid at the 1 foot depth, and the parent material is present at 3 feet. Judging from the pH values of the subsoil, obviously Nicollet soils have less need for lime than either Fayette or Hayden soils. Incorporating lime into the plow layer

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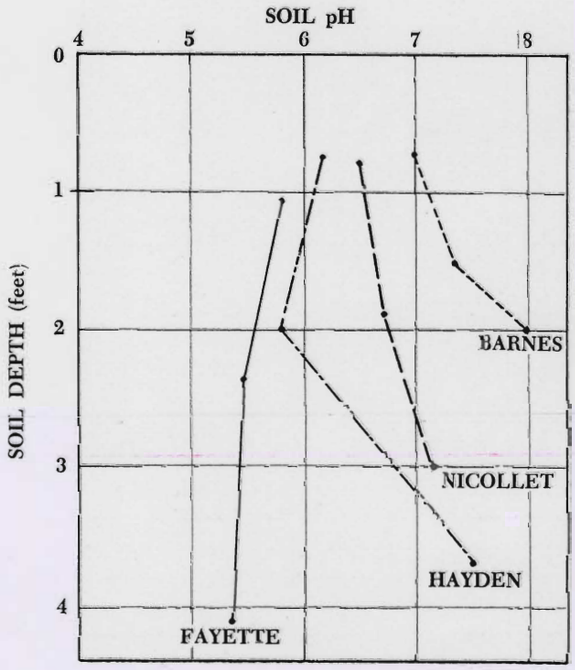

Fig. 1. This graph shows the subsoil pH values in four different soil series in Minnesota.

John Grava is an assistant professor in the Department of Soils and supervisor of the Soil Testing Laboratory.

Social Security Gives Farm People Independence

MARVIN J. TAVES and GARY D. HANSEN

SOCIAL SECURITY is having an important impact on rural living today. The consequences vary for different individuals. However, a large number of beneficiaries report increased independence and freedom, more participation in the community, and greater emotional and financial security because they received a regular monthly social security check.

These are our conclusions as a result of a study we made with 300 men and women who earned at least part of their social security coverage through farming. One hundred each came from a grain producing county (Wilkin), a corn growing county (Watonwan), and a dairying county (Goodhue).

To background this report a little, we need to look back at the Federal Social Security program. It was established by legislation in 1935 and was designed to limit economic and social dependency. However, farm operators, landlords, and hired hands were not covered.

Twenty years later, about 6 million farm people became eligible to participate. This 20-year lag to some extent deprived a number of elderly farm people of economic and emotional security, independence, and opportunities for creativity, and social participation.

Marvin J. Taves is an associate professor and supervisor of rural sociology and Gary D. Hansen is a research assistant in the Department of Sociology.

Economic Benefits

Almost two-thirds of the 300 interviewed said that social security had not helped them to keep income producing property or to maintain property which would have otherwise been sold. Of the rest, 16 percent claimed it allowed them to keep land; 6 percent their cattle, poultry, or livestock; 5 percent their homes; and lesser proportions such things as machinery, car, and other personal property.

The majority, 69 percent, said social security did not enable them to purchase household and other personal property in addition to that which they would have bought anyway. About one-third were able to purchase household furnishings, appliances, or make improvements on the farm and house.

Perhaps the outstanding financial benefit reported was that two of every three individuals said that social security made it possible for them to remain self supporting. Less dramatic, but still of real importance, is that one in five said social security payments had freed them from depending on their children for support.

One in three said that social security had helped significantly in meeting current expenses. Smaller numbers said that it had helped them to pay medical expenses, buy extras, or have surplus cash.

Personal Freedom

Remaining self supporting implies freedom from family or agency support.

Other studies have shown that living with children or depending upon children for economic support is not preferred by either generation. Thus the happiness or satisfaction with life may not be as great among those who are dependent upon or living with their children. Therefore, the one in five who were freed from depending on their children for support probably were relieved and enjoyed this freedom.

Social security caused one in five to retire earlier than they would have otherwise, and 4 percent said it caused them to retire later. Thus, a total of one-fourth had their work and retirement patterns altered by social security. It is not known if or how much this increased or decreased their satisfaction. The 20 percent who retired earlier from farming created vacancies for younger farmers. Therefore, social security increased the opportunity and freedom of younger farmers to establish themselves in farming at an earlier age.

Undoubtedly, some freedoms were maintained by being able to keep

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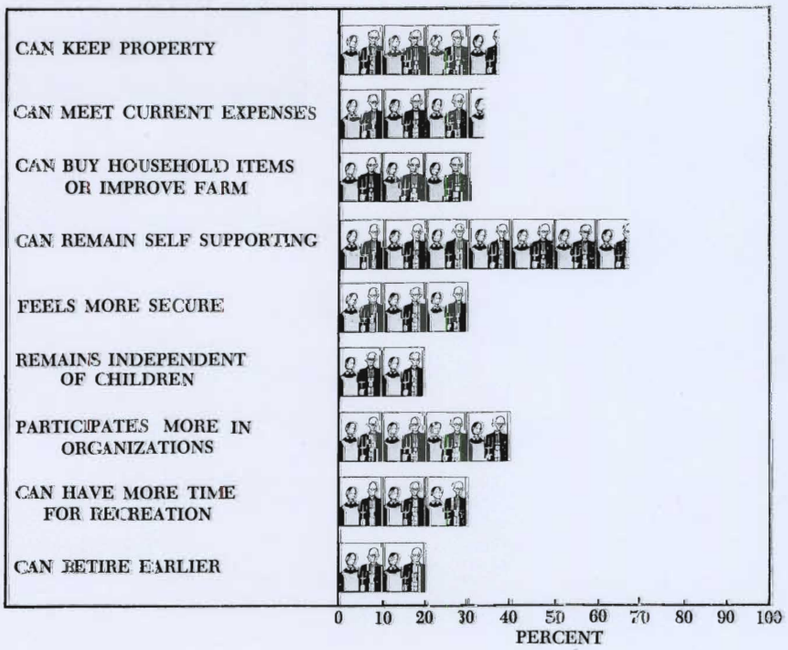
Beneficiaries felt that social security allowed them these things:



How Well Do Consumers Know Federal Beef Grades?

D. C. DAHL, W. J. AUNAN, and C. E. GATES

THE AVERAGE AMERICAN WILL EAT a near-record 85 pounds of beef in 1961. This is 20 pounds more than pork and nearly twice the expected per capita consumption of all other meats combined. This beef will vary by cut from hamburger to porterhouse steak. It will also vary by the quality characteristics it possesses. Beef quality is determined by federal standards for grading.

Beef grades are usually quoted in the following order: Prime, Choice, Good, Standard, Commercial, Utility, Cutter, and Canner.

Only the "top" six grades reach the consumer as fresh beef. Cutter and Canner grades are used primarily by food processors in canned and sausage meat products. The top six grades provide the consumers with a means for making intelligent quality choices when buying beef.

To buy beef intelligently, the consumer needs to know federal grades and the quality characteristics associated with each grade.

But do consumers know what the federal grades for beef are? What do they use as criteria in selecting the beef they purchase?

Test Yourself— USDA 'GRADE'

See if you can pick out which of the following terms are used in the federal grades of beef:

_____Standard
_____Quality
_____Choice
_____Utility
_____Economy
_____Extra Choice
_____Good
_____Grade A
_____Prime
_____Fancy

Read the accompanying article to check your answers.

The Study

The Departments of Animal Husbandry and Agricultural Economics, cooperating with the National Livestock and Meat Board, surveyed people attending the Minnesota State Fair in 1960 to find answers to these questions. Over 5,700 people visiting the Meat Booth filled out questionnaires to test their knowledge of beef.

We classified these persons by residence, income class, and by the market where they normally purchased their beef. About 55 percent lived in the Twin City metropolitan area and about 30 percent came from farms or small towns of less than 5,000 population.

Over one-third bought their beef pre-packaged at a self-service market while slightly less than one-third bought their beef cut and wrapped to order by a butcher. Self-service market purchasing was most predominant in larger cities, but city residents also used butcher service to a large extent.

The large number of people using the services of a butcher may mark an increased trend of self-service markets in providing butcher service to their customers.

Grade Identification

To test the extent of consumer knowledge of beef grades the form listed five USDA grade names but mixed them with these terms: quality, economy, extra choice, grade A, and fancy.

These participating were asked to identify which of these 10 terms were used in federal grades for beef. Seventy-four percent listed Choice as one grade; 45.1, Prime; 30.9, Good; 24.5, Utility; and 12.0, Standard.

Only 1 in 50 correctly identified all five terms as those used in federal grading. The largest group of the respondents identified only one term correctly, but nearly one-eighth of the group failed to correctly identify any of the terms as those used in federal beef grading.

Each federal grade listed, if randomly selected, had a 50 percent chance of being checked by the respondents. Significant differences from this percentage level would indicate either an important lack of knowledge concerning the grade or knowledge of the term. Only Choice was recognized as a federal grade by the respondents as a group, but a serious lack of knowledge was exhibited for Good, Utility, and Standard. This may be due, in part, to the lack of advertising of these grades at the retail level. Standard was only recently (1956) included in the grading system.

Choice and Good were identified relatively more frequently in larger cities and Choice was known more to those who made beef purchases in self-service markets. But there was no significant relationship between where people lived or where they bought their beef and the number correctly identified. Those with higher incomes, however, did identify more grades correctly than those from lower income groups.

This group of consumers lacked information concerning what the federal grades for beef are except for their knowledge of Choice as a USDA grade.

Selection Criteria Used

Since beef grades are generally unknown to these consumers, how do they determine what beef to buy? In this study the respondents were asked to check the single most important

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Dale C. Dahl is an instructor in the Department of Agricultural Economics. Woodrow I. Aunan is an associate professor in the Department of Animal Husbandry. Charles E. Gates is Agricultural Experiment Station statistician.

NEMATODES
Can Make Soil-Borne Diseases Worse

DONALD P. TAYLOR

The control of nematodes is even more important than we thought in assuring good crop yields. The studies reported indicate that nematodes alone severely damage crops, but they do even more harm when they team up with fungi, bacteria, and viruses.

MANY ORGANISMS JOIN FORCES in a costly underground attack on our farm and ornamental crops. Here we review the facts behind the attack and what our research is doing about it.

This attacking force includes soil-borne insects, nematodes, fungi, bacteria, and viruses. In the past, researchers have studied what a single organism, such as a root-rotting fungus, does to growth and yield of a particular crop. However, this situation does not occur in the field! Instead, roots are attacked by several different organisms at the same time.

Specifically our plant pathology department is studying how plant-parasitic nematodes and soil-borne fungi act when they come together.

Root-knot Nematodes and Soybeans

Most of our experiments have used one or more kinds of root-knot nematodes—nematodes that produce characteristic galls or knots on roots. One experiment studied the effect of these nematodes on a disease of soybeans caused by a common soil fungus called *Rhizoctonia solani*.

Here's what we did. We sterilized greenhouse soil, placed it in pots, and added the following: a southern root-knot nematode alone, the northern root-knot nematode alone, the fungus alone, fungus plus southern nematode, and fungus plus northern nematode. We left some pots untreated, adding neither fungus nor nematode. Next we planted soybean seeds and recorded emergence after 3 weeks. Figure 1 shows the emergence data.

Both nematodes reduced emergence only slightly when used alone. However, combining nematodes with the fungus reduced emergence most. In fact, the combined effects of the two organisms working together was greater than the sum of the effects of the organisms working separately.

It is also interesting that the effects of the northern root-knot nematode, which is found in some Minnesota fields, were greater than the southern form.

Minnesota researchers have also studied the importance of the northern root-knot nematode to Phytophthora root-rot of soybean.

In greenhouse tests we followed the same procedures as indicated earlier. Treatments consisted of noninoculated control pots, nematodes and fungus combined, and each organism alone. We then measured the effects of these organisms in plant height and weight and in post-emergence death of plants. At all temperatures studied, ranging from 64 to 91° F., poorest growth and highest mortality always occurred in the treatment containing the nematode and fungus combined.

In these tests the fungus had a greater effect on soybeans, and the addition of nematodes made the disease only slightly more severe than when the fungus was present alone. However, nematodes and fungi working together caused the most damage.

Root-knot Nematodes and Flax

Root-knot nematodes can also increase damage to flax caused by the flax wilt fungus. In greenhouse studies

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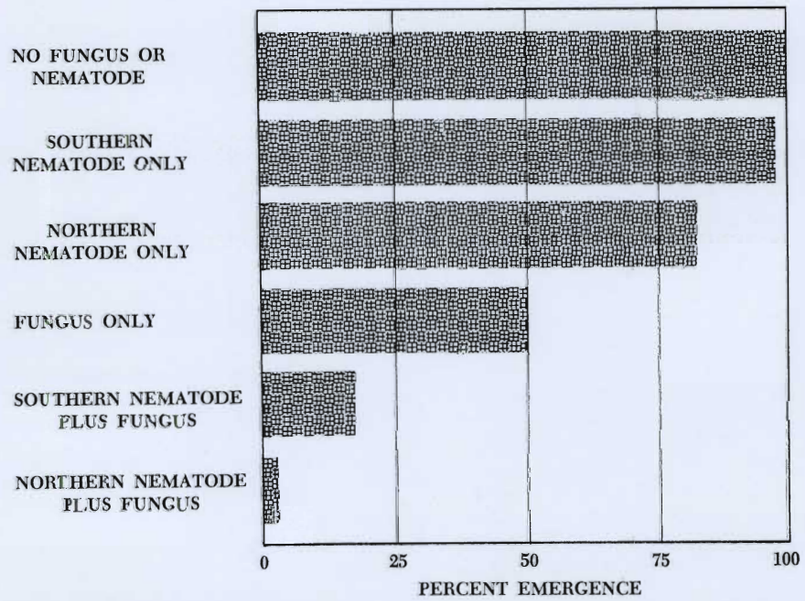

Fig. 1. This graph shows the emergence of soybeans as affected by the fungus *Rhizoctonia solani* alone, root-knot nematodes alone, and fungus and nematodes in combination.

Donald P. Taylor is an assistant professor in the Department of Plant Pathology and Botany.

A Report of
Hay Treatment Studies and Feeding Trials

A. C. LINNERUD, J. D. DONKER, JOHN STRAIT, and A. M. FLIKKE

ONE OF THE RECENT SIGNIFICANT DEVELOPMENTS in haymaking has been the introduction of machines to crush or break the plant stems to speed up drying. As a result, stems and leaves dry more uniformly and a safe moisture content for baling and storage is more quickly reached for the total mass of hay.

Previous work at Minnesota as well as other institutions has proved that moisture is removed more rapidly from cracked or crushed stems. Furthermore, the various types of machines compared appeared to be equally effective in doing the job when properly operated.

We will refer to these machines as hay conditioners and the resultant hay as conditioned hay.

The question arises—is such conditioned hay any better than hay that was not conditioned as a ration for dairy animals? Since there is little information available, the Agricultural Engineering and Dairy Husbandry Departments cooperated in getting some answers to this question.

A. C. Linnerud is a research assistant and J. D. Donker is an associate professor in the Department of Dairy Husbandry; John Strait is an associate professor and A. M. Flikke is an associate professor in the Department of Agricultural Engineering.

The project of baling 12-inch bales is generally concerned with the desirability of the small bale.

During the summers of 1959 and 1960, hays were made for feeding trials to be conducted the following winters. In 1959 four machines were used:

- a bar-type crimper,
- a combination machine,
- a smooth steel roll crusher,
- a crusher with rolls made with tire carcass stamping.

In 1960 only the first and the last were used. In 1959, five batches of hay were produced for feeding trials and in 1960 two batches.

Hay conditioners are used experimentally to determine the influence of conditioning on the field-drying rates of hay.

In 1959 the hays within a batch were all baled when the conditioned hay appeared to be ready. In 1960 each hay was baled independently at a time when its moisture was favorable for baling and storage.

The feeding experiments had two objectives: To evaluate the hay, and to evaluate the technique of evaluating the hay. We will consider only the first objective here.

We fed the hay individually to identical twin (1959) and nonrelated (1960) growing dairy heifers. Each animal on a feeding trial consumed several hays and the evaluation was based on how much each animal consumed per 100 pounds of body weight per day. We did this because the animals were of different weights.

In 1959 the consumption, as expressed above, was set at 100 percent for the most palatable of the standard hays and the consumption of other hays was expressed as a percent of 100. Only one standard hay was used in 1960 and it was also expressed as 100 percent for comparison purposes.

The results of the feeding trials did not distinguish between the effectiveness of any one hay conditioner and so all conditioned hays will be considered as conditioned hay. The table shows that, in general, in 1959 the conditioned hay was drier when baled than the nonconditioned hay. This situation was true whether or not the hay had been rained on. From the work in 1959 it would appear to be

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ELECTRIC MOTORS for Farm Automation

ARNOLD M. FLIKKE and WILLIAM A. JUNNILA

IF YOU ARE BUYING EQUIPMENT to mechanize some of your farm chores, seriously consider the electrical aspects of these changes. Proper planning may make the difference between mediocre and top performance.

Many new machines are powered by relatively large motors in comparison to those now on farms. Rural service lines supply farms with single-phase service at 120/240 volts. This type of service limits the size of motor that you can use on a farmstead without the power supplier making changes in his equipment to provide more power. If you happen to have three-phase power on your farm, this problem is not as serious. Three-phase motors and equipment are simpler in construction, and the wiring problem is not so great when larger motors are put on the lines.

It is now possible to operate three-phase motors on a single-phase line by using a phase converter in conjunction with the motor. The cost of this arrangement usually equals the cost of a single-phase motor. As farmers continue to increase their use of electrical energy more three-phase lines will become economical, but this is some time in the future.

An Electric Motor's Job

An electric motor must start the machine to which it is connected, accelerate it to operating speed, and then maintain this speed. It must do this without blowing fuses or overheating the motor. In addition the motor may have to operate under adverse conditions of temperature, dust and dirt, poor lubrication, and often overloading. Thus, this motor must be selected on the basis of its design features not because it uses electricity.

Arnold M. Flikke is an associate professor in the Department of Agricultural Engineering and William A. Junnila is an Agricultural Engineer, Farm Electrification Research Branch, ARS, USDA.

People, however, are great shoppers. Often they replace standard motors with second-hand ones which do not match the needs of the piece of equipment. Farm jobs are difficult ones and an electric motor must be built with a lot of copper and good steel for laminations to handle it properly. In all cases you get what you pay for.

We measure the performance of an electric motor in terms of the following:

1. Starting torque—a measure of the ability of the motor to start a load from a standstill.

2. Pullup torque—an indication of the motor's ability to bring the machine up to operating speed.

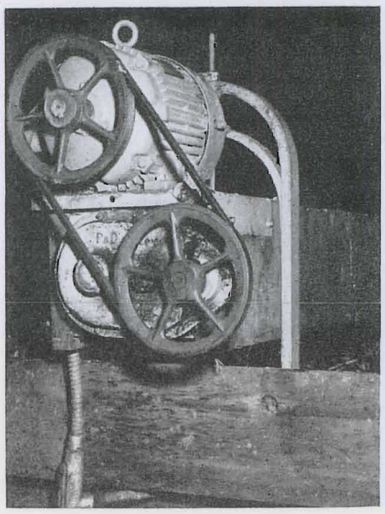
3. Breakdown torque—reflects the ability of a motor to handle an overload.

4. Maximum temperature rise—the motor insulation will not fail and it can be expected to operate normally when the warmest spot is at the temperature indicated by room temperature plus the degrees rise stamped on the nameplate.

5. Time rating—an indication of how long a motor can carry a full load without overheating. A motor marked "Cont" can carry its rated load continuously and not exceed the rated temperature rise.

6. Service factor is a statement of the motor's ability to withstand heating due to overloads and still give a satisfactory life. This factor permits periodic overload but should not be considered in selecting motor size, only type.

7. Bearings—two types are available, sleeve or ball bearings. In general, sleeve bearings work best when the shaft is parallel to the floor. If the motor is to be used in any other position, ball bearings able to take the thrust loads should be selected. Larger motors are usually equipped with ball bearings, but take care to learn the type of bearing and its method of lubrication when selecting a motor.



Selecting Motors for Specific Jobs

Silo Unloader

A high starting torque is needed if the auger or chain is imbeded in the silage. A high pullup torque is required to bring the mechanism up to speed, and a high breakdown torque is necessary to handle the overload conditions that frequently occur. The air temperatures are normally low which makes the lubricant stiff and the machine hard to turn over. The motor may be covered with snow or even ice and silage particles may be drawn into the motor if the ventilation openings are not covered. Well built repulsion start-induction run motors have performed satisfactorily for silo unloaders. Capacitor motors can do the job but require greater starting currents. The amount of silage handled each day determines the need for type of time rating.

Bunk Feeders

Here the load on the motor builds up as the bunk fills. Thus the starting requirements are not excessive. The capacitor motor has performed well in feeder uses. Heavy machinery or long service runs may warrant the use of a repulsion start-induction run motor.

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Minnesota's Contribution to the World Seed Year

W. M. MYERS and CARL BORGESON

1961 IS WORLD SEED YEAR, proclaimed by the Food and Agricultural Organization of the United Nations. This year all member governments with FAO, are sponsoring an intensified national program for the breeding, testing, multiplication, and distribution of high quality seed of superior varieties. The purpose is to increase the productivity and quality of agricultural, horticultural, and forestry products and thereby raise the standards of living through increased returns from the land.

The University of Minnesota has directly or indirectly made many contributions to a World Seed Year. Here we emphasize the research contributions of the University's Experiment Station especially through the Department of Agronomy and Plant Genetics. Later in this article we will tell about some of the other activities.

This room in the Agronomy Seedstocks Building is where the world collection of flax seed is stored. The temperature and humidity are artificially controlled to provide ideal storage conditions.

Research and Services

Planting materials supplies—The department, through the agronomy seedstocks project, sent seed this year for breeding, testing, and multiplication to 23 countries. These were: Albania, Argentina, Austria, Canada, Chile, Costa Rica, Czechoslovakia, England, France, Greece, Guatemala, Holland, Israel, Italy, India, Ivory Coast (West Africa), Korea, Norway, Pakistan, Rumania, Spain, Sudan (North Africa), Switzerland, and Yugoslavia.

World collections of seed—Verne Comstock, flax project leader, is responsible for maintaining a world collection of seed of flax strains.

Minnesota varieties reach around the world—Minnesota hard red spring wheat varieties have been used commercially in Kenya and as breeding material in Mexico, Colombia, Chile, and India. Thatcher wheat is still a prominent hard red spring wheat in Canada. Minhybrid corn hybrids and inbreds are being tested and used in many countries where corn is grown.

The Minnesota program model—The Minnesota improvement program has been used as a model in many countries. This involves:

1. Breeding in cooperation with other departments such as Plant Pathology, Biochemistry, Entomology, and the USDA.
2. Variety testing at branch stations and on farmers' fields and regional nurseries.
3. Varietal recommendations.
4. Increase, purification, and maintenance of breeder and foundation seedstocks.
5. Seed distribution.
6. Certification.
7. Crops extension program.

Other Activities

Foreign student training—131 students from 28 countries have obtained M.S. or Ph.D. degrees from the Department of Agronomy and Plant Genetics. Canada leads the list with 36 students, followed by China with 25 and India with 23. Other countries having graduates are: Mexico, Bolivia, Brazil, Chile, Colombia, Uruguay, Bulgaria, Denmark, England, Germany, Norway, Wales, Ireland, Egypt, Burma, Japan, Korea, Pakistan, West Africa, Iraq, Philippines.

Many of these graduates now hold positions of high responsibility in their own countries, largely in the fields of research and administration.

At present, the department has 22 students from India, Chile, Pakistan, Iraq, Korea, Paraguay, Ethiopia, Canada, Colombia, and China. Their presence makes teaching and research more meaningful to local students, who come to realize the world-wide implications of the work in this field and who gain from ideas presented by foreign students.

Foreign visitors—Hundreds of students and staff from foreign countries have spent from 1 day to a year or more observing and obtaining in-for-

(Continued on page 17)

W. M. Myers is Head of the Department and Carl Borgeson is an Associate Professor, Department of Agronomy and Plant Genetics.

Grain Preferences of Creep-Fed Beef Calves

JAY MEISKE

PROPERLY USED, CREEP FEEDING can increase the gain and finish of suckling beef calves. Sometimes, however, the added cost won't pay for the added gains. Here we consider some of our research in creep feeding.

In any feeding system, increased feed consumption usually results in increased gain. Therefore, one of the goals of creep feeding is to provide the calves with a palatable feed in addition to pasture and cow's milk. Creep feeding is more likely to show a profit during seasons of low rainfall (resulting in poorer pastures) or when calves are from 2-year-old heifers or poor milking cows.

What grains do calves like best? For the past two summers (1959-1960) at the Rosemount Station, we have allowed suckling beef calves free-choice access to three rolled grains—corn, barley, and oats. Each grain was available individually from a creep feeder divided into three compartments. During 1959, 26 Hereford calves and 22 Angus calves were used, and in 1960, 27 Hereford calves and 23 Angus calves. When the calves were about 55 days old, the average weight of the calves was 143 pounds and creep feeding was started. Half the steer calves of each breed were implanted with 12 mg. stilbestrol, an estrogenic material, to determine whether this low level implant would affect weight gains, feeder grade, and subsequent feed lot performance.

Results of Trials

The results of the two trials were very similar. The calves preferred shelled corn and barley, apparently caring little for oats. Average daily consumption per calf was: shelled corn, 1.93 pounds; barley, 0.91 pound; oats, 0.04 pound. By the end of the trial the calves were steadily increasing their consumption of corn.

A clearer picture of the calves' early grain preference can be found in the consumption figures during the first 60 days. In 1959, average daily consumption during the first 60 days was as follows: Hereford calves, 0.43 pound corn, 0.40 pound barley, 0.01 pound oats; Angus calves, 0.35 pound corn, 0.48 pound barley, 0.05 pound oats. In 1960, average daily grain consumption during the first 60 days was: Hereford calves, 0.28 pound corn, 0.46 pound barley, 0.13 pound oats; Angus calves, 1.03 pound corn, 0.40 pound barley, 0.09 pound oats.

A summary of both years shows the average daily consumption was 0.51 pound corn, 0.44 pound barley, and 0.07 pound oats.

No real preference was shown between barley or corn though either was preferred over oats as an early creep feed.

Implanting half the steer calves with 12 mg. stilbestrol at about 1 to 2 months of age resulted in increasing average daily gains approximately 0.13 pound. When the data of both years were combined, the increase in average daily gain due to implanting was statistically significant. The average feeder grade was not lowered nor was post-weaning feedlot performance affected.

Conclusions

For the past 2 years, studies on grain preference by creep fed suckling beef calves have shown that calves definitely prefer rolled corn or rolled barley over rolled oats. And, the older the calves became the more they preferred the corn. Implanting steer calves with 12 mg. stilbestrol significantly improved their pre-weaning gain without affecting feeder grade at weaning or feedlot gain after weaning.

Future trials will be designed to study effects of grain preparation on palatability, the use of mixed grains and other concentrates, and the use of certain feed additives in creep rations in an attempt to build a palatable low-cost creep ration for suckling calves.

Jay Meiske is an assistant professor in the Department of Animal Husbandry.

Restricting "Production" Research Would Be Disastrous

RESTRICTING "PRODUCTION" RESEARCH in the plant sciences as a means of combating agricultural surpluses would be disastrous to both farmers and nonfarmers, several University scientists have pointed out.

W. M. Myers, head of the Department of Agronomy and Plant Genetics, says the attitude that this research is responsible for over-production and depressed farm prices is a "doctrine of inefficiency." To restrict further advances in agricultural technology by shutting off research is just as logical as preventing farmers from using improved seeds, fertilizers, insecticides, and machinery.

Myers pointed out that plant science research has three major objectives:

1. Reducing the cost of production per unit of product. This may mean more production per acre. It also means lower seeding rates, more certain stand establishment, adaptation to mechanical harvesting, less expensive weed control, and other advances.

2. Increased reliability of production by reducing crop losses by such things as winterkilling, drought, storms, diseases, insects, and weeds.

3. Improving market prices by better quality.

E. R. Ausemus, professor and USDA agronomist at the University, says that breeding and growing of improved

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RED RIVER VALLEY—

(Continued from page 5)

the south to slightly under 20 inches in the northwest with about 80 percent occurring during the frost-free period from April to September. The average number of days without killing frost varies from 100 days in the north to 135 days in the south.

Soil Characteristics

Fertility—Most of the soils in the Valley are very fertile. They can be classed among the best soils in the world. Even with this high native fertility, many of the soils now respond to the addition of plant nutrients. Soil tests have shown the general fertilizer needs as well as the general properties of the soils in the Valley. Soil test summaries for the Ulen-Sioux-Tanberg area (figure 3) and the Fargo-Bearden area (figure 4) reveal the properties of the soils quite well.

Texture — The texture diagrams show that the Fargo-Bearden area is made up of about 80 percent fine textured soils while the Ulen-Sioux-Tanberg area has about 80 percent coarse to medium textured soils. Texture has a profound effect upon both water-holding capacity of the soils and the maintenance of soil structure. The fine textured soils are not as droughty as the sandy soils but great care must be taken to protect the granular structure of the fine textured soils so infiltration is not impaired.

pH—About 90 percent of the soils of both associations have a pH above 7.0 and 70 to 80 percent are above 7.4. In these soils high alkalinity is often a problem because there is a tendency for applied phosphate to revert to an unavailable form. Many areas showing chlorosis (lack of green color) in crops such as flax, soybeans, and ornamental shrubs appear to be brought about by unavailability of iron induced by the high pH.

Phosphorus—Available phosphorus is low or medium in 59 percent of the Fargo-Bearden soils and 70 percent of the Ulen-Sioux-Tanberg areas. This means that over one-half of the soils of the Valley will benefit from applications of phosphate. Phosphorus is the most universally used single fertilizer nutrient in the Valley and field fertilizer trials have shown widespread profitable responses to phosphate.

Potassium—The two soil areas differ in availability of potassium. About 90 percent of the Fargo-Bearden soils are high or very high in potassium, while only 36 percent of the Ulen-Sioux-Tanberg soils are high or very high. Very few of the Fargo-Bearden soils need potassium, while over 50 percent of the sandy Ulen-Sioux-Tanberg soils show the need for potassium.

Nitrogen—Most of the Valley soils have a high content of organic matter but this does not indicate plenty of available nitrogen. The response to nitrogen will depend on a number of factors such as cropping history, past management, and cultural practices.

A common practice in growing sugar beets is to plow under a stand of clover in June and keep the land black for the rest of the year. This

(Continued on page 16)

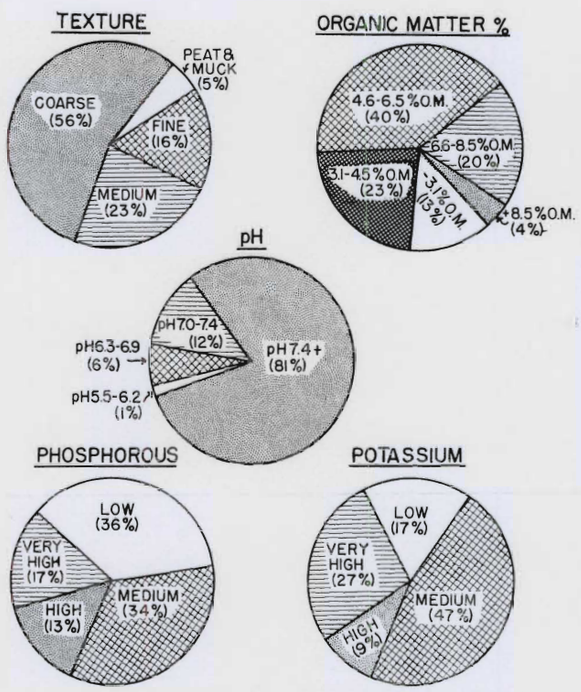

Fig. 3. Here is a soil test summary of the Ulen-Sioux-Tanberg soil association with the percent of samples tested falling in each class.

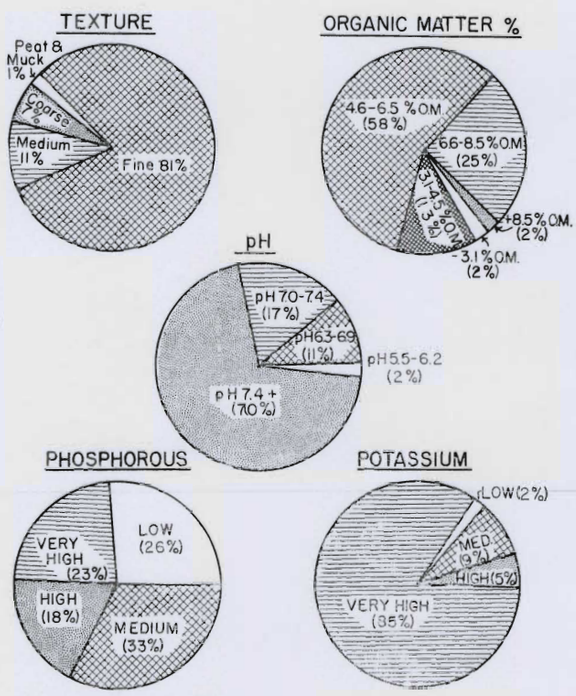

Fig. 4. Here is a soil test summary of Fargo-Bearden soil association with the percent of samples tested falling in each class.

ELECTRIC MOTORS—

(Continued from page 12)

Drying Fans

The load builds up as the fan speed increases and is fairly constant when running at rated speed. Again the capacitor motor works well. A continuous duty cycle is needed, since the motor will operate for long periods of time.

Feed Grinding

This is a load similar to drying fans, and capacitor motors will work well. Be sure to select a motor that is dustproof and has ample cooling surfaces.

Wiring for Electric Motors

A farm tractor comes as a complete package from one manufacturer who is responsible for its performance. The operation of an electric motor, however, depends on the equipment and services of many people and companies.

The power supplier is concerned with the operation of electric equipment that places greater loads on their lines and transformers. Notify them when you add large power units. Often they are last to be notified and then only when trouble occurs. The rural power use adviser can judge the condition of your entire farm service and suggest changes in their equipment as well as in the farmstead wiring. Little or nothing is said about required wire sizes at the time of purchasing the motor. Wire sizes are selected on the basis of allowable voltage drop, current, and length of wire. Proper voltage is very important. A 20 percent voltage drop decreases the torque of a motor 36 percent. The way to control voltage drop is to select the proper wire size. The table will help you select the correct wire size.

Local electricians do most of the rewiring for new installations. Show or provide them with the nameplate data from the motor before selecting the wire sizes. There are many types and makes of motors on the market today and their operating and starting currents vary.

Overload Protection

A great advantage of electric power is its ability to carry an overload. However, the more one demands from a motor, the more current it requires. Increased currents cause heating of the motor. Since overheating is a motor's greatest enemy, protective devices must be provided to prevent continuous overloading. A motor will always try to handle the imposed load, so current limiting devices work best. These devices are selected to limit the maximum current to 1.25 times the nameplate rating. Single-phase motors require high starting currents, thus time-delay features must be supplied. These devices will permit the motor to start, but will open the circuit on continuous overloads.

The selection of overload protection depends on the horsepower rating of the motor and the manner in which the operation is to be controlled. The best source of information is the dealer or local power supplier. Remember that circuit protection will not protect a motor.

The rigorous demands of farm jobs require the selection of a good motor carefully matched to the load. This motor is a valuable servant and should be used with care and proper maintenance.

Wire sizes for outdoor feeders for electric motors

Line amps	HP*	With this overhead distance (feet) 0-50	50-100	100-150	150-200	200-250	250-300	300-350
		Select this wire size (gauge) Type WP						
120 V.								
5.8	¼	10	10	10	10	10	10	10
9.8	½	10	10	10	10	10	8	8
13.8	¾	10	10	10	10	8	8	8
16	1	10	10	10	8	8	6	6
240 V.								
2.9	¼	10	10	10	10	10	10	10
4.9	½	10	10	10	10	10	10	10
6.9	¾	10	10	10	10	10	10	10
8	1	10	10	10	10	10	10	10
10	1½	10	10	10	10	10	8	8
12	2	10	10	10	10	8	8	6
17	3	10	10	10	8	8	6	6
28	5	10	10	8	6	6	4	4
40	7½	10	8	6	4	4	2	2
50	10	10	8	4	4	2	2	1

* Consult nameplate for current rating of motor. Some models draw more current than horsepower rating indicates.

NOTE: Conductors in unsupported overhead spans greater than 50 feet should not be less than No. 8 wire.

RED RIVER VALLEY—

(Continued from page 15)

tends to build up the supply of available nitrogen by incorporating a high nitrogen legume like sweet clover into the soils. Then, by fallowing, conditions are made favorable for microorganisms which act on soil organic matter liberating nitrogen. Under these conditions little or no additional nitrogen is necessary.

In contrast to this, a cropping system involving continuous grain growing will deplete the nitrogen reserves in the soil and make nitrogen fertilization essential for top production.

The fact that the soils of the Valley are productive should not induce us to be complacent. Soil depleting forces such as cropping, cultivation, and erosion are forever at work and we must continually be conscious of this fact. In recognizing it, we must take necessary measures to maintain the fertility, organic matter content, and structure of these soils that they may still be productive for generations to come.

NEMATODES—

(Continued from page 10)

at St. Paul, lowest survival of flax occurred in the treatment in which northern root-knot nematodes and the wilt fungus were added to the soil. Flax plants from this treatment were the most stunted and produced the fewest bolls per plant.

Other Nematodes and Fungus Diseases

Other nematodes also increase severity of soil-borne fungus diseases of plants. In field and greenhouse trials in Minnesota, soil fumigation was used to separate the effects of fungi from nematode damage in the development of root-rot of canning peas. Although fungi are believed to be the more important organisms involved, control of only nematodes increased pea yield and reduced the amount of root-rot. Nematode control gave an average of more than a 20 percent increase of shelled peas per acre in the three fields fumigated.

Additional greenhouse tests showed that when a highly pathogenic race of root-rotting fungus was used, severity of root-rot increased as the number of nematodes used was increased.

Work in Other States

Work in other states has shown that nematodes can increase the severity of diseases caused by bacteria and several other fungi, and that in at least one case, nematodes act as a vector for a plant virus.

The How of Interaction

The exact way that nematodes and other microorganisms interact to increase plant disease severity is not understood.

In some cases nematode feeding wounds are believed to serve as entrances for fungi or bacteria. However, experiments have shown that mechanically wounding roots does not always increase disease severity, nor do all nematode parasites of a crop increase disease severity. In a few instances certain nematodes have caused resistant crop varieties to become susceptible, indicating that the relationship between crop, nematode, and other pathogenic organisms may be very complex.

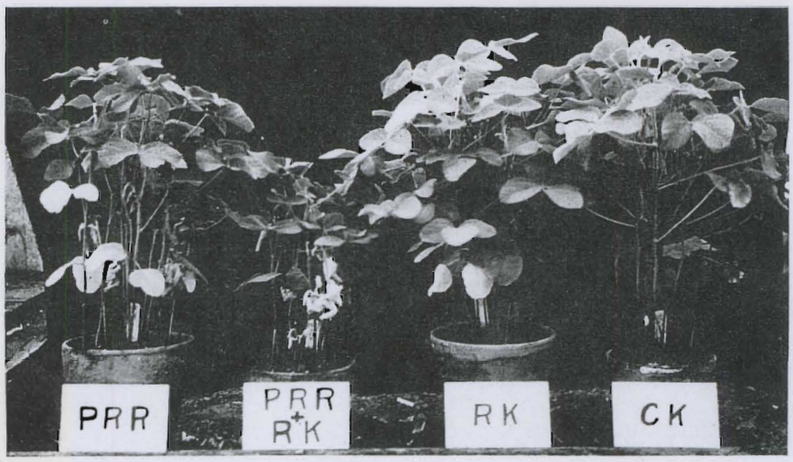

Fig. 2. These plants show the interaction between fungus causing Phytophthora root rot and root-knot nematode on soybeans. From left to right: fungus alone, fungus plus nematode, nematode alone, and neither organism present.

Even though the how governing nematode-fungus and nematode-bacterium interactions is unknown, the interrelationships have been well demonstrated at this and other experiment stations. In nature, where nematodes and other organisms are closely associated, this phenomenon is undoubtedly of great importance.

We have known for years that insects often play an important role in the development of some plant diseases. Now we realize nematodes may also be important in disease development.

In the future many other examples of nematode-pathogen interaction will be discovered. Although nematodes alone can cause severe losses to crops, they probably cause even greater damage when working together with fungi, bacteria, and viruses.

WORLD SEED YEAR—

(Continued from page 13)

mation and training in this one department alone.

Foreign visitation—A number of the staff visited various countries serving as advisors to local staff, institutions, and governments on crops research, teaching, and extension programs.

H. K. Hayes, professor emeritus, served in China and the Philippines aiding in the establishment and coordination of plant breeding programs and the initiation of uniform variety trials.

W. M. Myers, head of the department, has advised in the development of agricultural programs in Mexico, Colombia, and Chile, and in a program for the development of breeding, production, and distribution of improved seeds in India.

E. H. Rinke, professor, worked for the Food and Agriculture Organization of the United Nations on agronomic programs in 13 countries including Tunisia, Egypt, Italy, Angola, Union South Africa, and Southern Rhodesia.

Former professors E. L. Pinnell and R. F. Crim aided with the development of coordinated programs for improved hybrid corn in Yugoslavia.

Leadership in international organizations—W. M. Myers was Chairman of the Executive Committee and the Program Committee and Secretary-General of the Sixth International Grassland Congress and has been active in the 7th and 8th Congresses.

R. S. Caldecott, professor, was a member of the U. S. delegation to the International Conference on Peaceful Use of Atomic Energy held in 1955 in Geneva.

RED CLOVER—

(Continued from page 3)

comparisons. Now with Dollard and Lakeland available, we are able to work along these lines. Both varieties are resistant to northern anthracnose and virus diseases and, in addition, Lakeland is resistant to powdery mildew.

We can study the relation of diseases to yield and performance of crop varieties best in areas where natural disease epidemics occur. This was true at our experimental farms at Duluth and Grand Rapids. Here a great deal of red clover is grown in the neighborhood and northern anthracnose and virus diseases were unusually severe the past 3 years. At experiment stations located in Waseca, Morris, and Crookston, there was little disease on the red clover variety trial plots, probably because red clover is not widely grown in the surrounding areas.

Lakeland and Dollard are consistently less injured by northern anthracnose and virus diseases when these diseases are prevalent (tables 1 and 2). Lakeland has the additional advantage of being resistant to powdery mildew.

Lakeland and Dollard also yielded consistently better on the same plots (table 3), and have shown a .2 to .3 increase in tons per acre over the commercial checks. On a state-wide basis this could mean an additional 200,000 to 300,000 tons of livestock feed. The small additional cost for the best available seed is fully justified.

Regional Adaptation

Red clover variety trials for a territory representing all of Minnesota north of St. Paul, approximately the northern half of Michigan, Wisconsin, and South Dakota, and all of North Dakota show the superiority of Lakeland and Dollard, especially in the second crop year.[1]

Table 4 shows the superiority of Lakeland and Dollard in the data from 21 variety tests each with 3 or 4 replications.

Based on data collected throughout the North Central Region, the classi-

(Continued on page 21)

[1] Varietal Trials of Medium Red Clover. Misc. Rpt. 41 (NCR 117), Minn. Agri. Expt. Sta.

Table 1. Comparison of infection with northern anthracnose on different varieties,* 1958-1960, at Duluth and Grand Rapids

	Grand Rapids			3-year average	Duluth
	1958	1959	1960		1959
Lakeland	1.3	1.5	1.7	1.5	2.5
Dollard	1.3	1.5	1.0	1.3	1.7
Commercial	4.0	2.5	4.0	3.5	3.9
Pennscott	5.0	2.7	3.3	3.7	4.2
Kenland	5.0	3.7	4.0	4.2	4.7

* Notes on a scale of 1 to 5 with 1 the least infection and 5 the most.

Table 2. Comparison of infection with virus on different varieties,* 1959-1960, at Duluth and Grand Rapids

	Grand Rapids		2-year average	Duluth
	1959	1960		1959
Lakeland	1.5	.3	.9	1.5
Dollard	1.2	1.0	1.1	1.0
Commercial	3.0	1.7	2.4	2.5
Pennscott	2.5	1.0	1.8	2.2
Kenland	2.0	2.3	2.2	2.2

* Notes on a scale of 1 to 5 with 1 the least infection and 5 the most.

Table 3. Forage yield in tons per acre, 1958-1960, at Duluth and Grand Rapids

	Grand Rapids			3-year average	Duluth
	1958	1959	1960		1959
Lakeland	3.19	4.00	3.95	3.71	2.80
Dollard	3.60	3.78	4.01	3.80	2.73
Commercial	2.79	3.82	4.11	3.57	2.43
Pennscott	2.70	3.44	3.60	3.24	2.68
Kenland	2.51	3.71	3.44	3.22	2.50

Table 4. Forage yield in tons per acre, regional data 1956 to 1959

	21 experiments in first crop year	7 experiments carried into second crop year
	average	
Lakeland	2.98	2.30
Dollard	2.96	2.33
Pennscott	2.78	1.81
Kenland	2.76	1.74

Table 5. Disease severity on different varieties from field tests in the North Central Region*

	Northern anthracnose	Powdery mildew	Viruses
Lakeland	0.2	0.3	2.3
Dollard	0.6	4.2	2.4
Pennscott	3.6	5.0	2.8
Kenland	3.2	4.9	2.6

* 0 = no disease to 9 = very severe.

SOCIAL SECURITY—

(Continued from page 8)

one's land, home, car, and other property. About 1 in 10 indicated that social security payments enabled them to travel.

Participation in the Community

When the elderly remain active participants or leaders in church, social, and civic organizations one would expect some mutual respect, understanding, and integration between the several generations. Individuals with adequate incomes during retirement continue to stimulate the economy through their demand for goods and services.

Four in ten beneficiaries said that social security made it possible for them to be more active in the social organizations, activities, and community affairs.

Three in ten persons said it made more time available for recreational and creative activities. Recreational and creative activities are often commercial, for example woodworking, sewing, gardening, etc. Many older people watch television, listen to the radio, and read newspapers and magazines, so these services should be available to them.

Freedom From Worry

Growing old is accompanied by many changes that create fear, worry, and insecurity. Some of the changes are in: physical strength and vigor, mental alertness and memory, and earning power. External changes such as inflation also contribute to the difficulties.

Savings and investments that once were adequate may now fail to provide the bare essentials. The greatest fear is that a medical or other emergency might take their savings, insurance, and income or plunge them into debt or dependency. Human needs are much the same throughout life, but in old age, problems may multiply when resources are failing. This points up the need for a social security program and partly explains why it is so highly valued by beneficiaries.

One in five said social security had definitely increased their feelings of security. They now had a regular monthly income which could be depended upon and was not subject to the ups and downs of other resources. The check was something to count on and plan accordingly.

One person in ten said that social security had reduced their worries or had made life more comfortable and pleasant for them.

Some Problems and Suggestions

Ninety-three percent of the beneficiaries did not know, prior to qualifying for benefits, just how much these benefits would be. Some beneficiaries stated that benefits should be higher and others felt that it was unfair for the poorest farmers, who need it most, to not be covered while the richest farmers, who didn't need it, were covered.

Many younger farmers, not yet beneficiaries, suggested that the age for receiving retirement benefits should be lowered to about 60. Some younger farmers felt that current beneficiaries were on a "gravy train" being paid for by their taxes and were disturbed that older farmers so rapidly and inexpensively became beneficiaries. However, for themselves, they wanted to retire earlier and wanted higher social security benefits.

Dutch Elm Disease Fungus Isolated in Minnesota

The fungus that causes Dutch Elm disease in Minnesota has been isolated in Minnesota for the first time, but this does not mean that all elm trees are doomed. On the contrary, losses can be held to a minimum if adequate control measures are established, says D. W. French, associate professor of plant pathology.

French reports that the fungus (Ceratocystis ulmi) was isolated from an American elm in St. Paul. The tree died last summer, but was not sampled for the fungus until this spring. It has been removed by the City of St. Paul and completely destroyed.

The tree had been invaded by the native elm bark beetle, which can spread the fungus, but the smaller European elm bark beetle, which is more effective in spreading the fungus, was not present.

In areas where the elm is of value, said French, sanitation measures should be initiated. If already started, they should be intensified. He passed along these tips:

Cleaning out dead elm material is a major step in reducing losses. In places where the fungus is present, spray programs should be planned for March and April next year.

In other areas, wilting elms should be checked to see if the Dutch Elm disease fungus is involved. Positive identification can be made only by culturing samples from the suspect tree in the laboratory. Branch samples 6-10 inches long and about ½-inch in diameter should be sent to the Department of Plant Pathology and Botany, Institute of Agriculture, University of Minnesota, St. Paul 1.

In recent years, Dutch Elm disease has been moving toward Minnesota from both Iowa and Wisconsin. According to French, experience has shown that the fungus often follows major highways. "Thus it is not surprising to find the fungus in the

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BRANCH EXPERIMENT STATION FIELD DAYS

Following is a list of dates set for Experiment Station Field Days and other events.

July 8—Lamberton, Southwest Field Day

July 11—Rosemount, Agricultural Field Day

July 12—Waseca, Southern Field Day

July 13—Morris, West Central Field Day

July 18—Crookston, Northwest Field Day

July 20—Grand Rapids, North Central Field Day

July 21—Duluth, Northeast Field Day

November 21—St. Paul, Varietal Recommendation Conference

February 13-14, 1962—St. Paul, Crops and Soils Planning Conference

HAY TREATMENT STUDIES—

(Continued from page 11)

important to consider moisture of the hay at bailing time as a factor affecting the acceptability of hay based on its free choice consumption. Except when hays were rained on quite heavily, the conditioned hay was consumed as readily or more readily than nonconditioned hay.

In the case of the hay which was rained on quite heavily before being baled, the nonconditioned hay appeared to be more acceptable.

In 1960, in which the hays were baled independently of each other, the palatability of the nonconditioned hays improved and these were quite comparable to the conditioned hays.

It was apparent that factors other than conditioning and rainfall after cutting were important from an animal acceptability standpoint. Also very important is the maturity of the hay at the time of cutting. As hay matures the value drops.

In 1960, the animal acceptability closely paralleled the calculated TDN (total digestable nutrient) value which was based on the crude protein and fiber contents of the hays. In evaluating the results of any feeding trials and these in particular, we would have to consider how often there would be similar conditioned and nonconditioned hays.

The results of these trials depended on uncontrolled external factors as much as on the controlled conditions. It would be important to know how many times in a season that the extra day saved by using a hay conditioner would mean higher quality hay because of rain damage to nonconditioned hays.

Treatment and evaluation of hays used in feeding trials

Hay batch 1959	Treatment	Drying treatment	Cutting date	Rain after cutting	Baling date	Moisture at bailing	Performance rating of hay
Control†	Conditioned	Artificial	8/17	0	8/18	.....	100.00
Control°	Conditioned	Field	6/16	.13	6/20	24.8	83.56
1st Batch°	Conditioned	Field	6/22	0	6/23	20.05	78.49
	Nonconditioned	Field	6/22	Trace	6/24	.....	67.06
2nd Batch°	Conditioned	Field	6/24	5.34	7/2	17.7	63.64
	Nonconditioned	Field	6/24	5.34	7/2	.....	71.09
3rd Batch°	Conditioned	Field	7/1	.13	7/3	11.8	84.40
	Nonconditioned	Field	7/1	.13	7/3	23.5	86.92
Control°	Conditioned	Field	7/3	0	7/6	6.6	81.34
4th Batch†	Conditioned	Field	7/29	0	7/30	12.5	89.76
	Nonconditioned	Field	7/29	0	7/30	15.1	86.27
Control†	Conditioned	Field	8/4	0	8/5	18.8	87.39
5th Batch†	Conditioned	Field	8/10	.23	8/12	22.2	91.49
	Nonconditioned	Field	8/10	.23	8/12	30.6	74.62
1960							
Control†	Conditioned	Artificial	8/1	.01	8/2	30.0	100.00
1st Batch†	Conditioned	Field	8/8	.01	8/9	26.5	87.94
	Nonconditioned	Field	8/8	.01	8/9	26.9	92.99
2nd Batch†	Conditioned	Field	8/29	0	9/1	13.5	87.97
	Nonconditioned	Field	8/29	0	9/1	17.0	89.97

° 1st crop.
† 2nd crop.

Summary

1. Conditioning hay speeds hay drying under almost all weather conditions.

2. In good haymaking weather, conditioned hay may be put up 1 day earlier.

3. Conditioned hay when put up at similar moisture content is usually as palatable or more palatable than nonconditioned hay.

4. Conditioned hay may become more unpalatable than nonconditioned hay after a heavy rain although the conditioned hay may be ready to bale several hours sooner.

5. An average of all trials over the 2 years showed that animals consumed about 4 percent more conditioned hay than nonconditioned hay.

6. Protein analysis revealed that protein analysis was related to consumption of a hay within a feeding trial.

7. Calculated TDN value of hay was found to be related to consumption.

8. Palatability of hay from different machines was found to be about equal.

The experimental baler makes 12-inch cubic bales and moves the bales mechanically with an elevator into a trailing wagon.

Do Our Soils Need Trace Elements?

J. M. MACGREGOR

DO MINNESOTA SOILS need trace elements?

Actually the instances of a proven need for adding trace elements—boron, copper, molybdenum, zinc, iron, manganese, or chlorine—to Minnesota soils have been comparatively few.

Our suggestion is that farmers experiment on small field areas to determine whether or not such nutrient elements are desirable. However, weather conditions during each growing season may greatly affect results obtained in such experiments.

It isn't possible for the University of Minnesota Agricultural Experiment Station to locate experiments or to test soils on every field in all parts of the state—and soil nutrient needs vary widely, even within each field. Therefore, it is impossible to make definite statements on the exact nutrient needs of each soil for each crop grown, and only generalizations are justified.

Here's a review of some of the known facts about each of the trace elements:

Boron—Sprays have been beneficial on rutabagas grown in Pine County for at least 30 years. While isolated alfalfa plants in several locations of the state have indicated possible boron defiency, it was not until 1960 that considerable areas of alfalfa in Aitkin, Mille Lacs, and Kanabec Counties began to show some boron deficiency symptoms.

A wet spring followed by a dry summer was especially favorable for this development in 1960. Transverse (crosswise) cracking of celery stems growing on some peat soils—characteristic of boron deficiency—has been observed occasionally.

On most Minnesota soils, however, applying boron has been of little advantage in crop production.

Copper has not been noticeably beneficial to crops on Minnesota soils.

Molybdenum, used in limited field or greenhouse experiments on alfalfa has failed to produce beneficial growth effects.

Zinc—Treatments on corn, oats, alfalfa, and some horticultural crops have shown no noticeable effect on plant growth.

Iron deficiency is frequently observed in late June on some varieties of soybeans and on flax growing in spotted areas of high lime soils in western Minnesota. Many horticultural species and trees and shrubs are also affected with this yellowing (chlorosis) of the foliage. This may be corrected with repeated dilute iron sulfate sprays. The application of some forms of chelated iron to the soil adjacent to the affected plant roots has also been highly effective.

Manganese deficiency has been reported in one experiment with onions growing on peat soils near Hollandale in Freeborn County.

Chlorine—No deficiency of this element has been reported, and it is added as a constituent of most potash fertilizer sold in Minnesota.

J. M. MacGregor is a professor in the Department of Soils.

RED CLOVER—

(Continued from page 18)

fication of these varieties for resistance to three important diseases is given in table 5. Again the disease resistance of Lakeland and Dollard is shown.

Seed Supplies

1960 was a good seed year for red clover. Minnesota seed production of 4,180,000 pounds was up 16 percent over last year and the national trend was similar. In the U.S. much seed was carried over from 1959; and nationally the available supply of 126,410,000 pounds is 19 percent more than in 1959 and 10-12 percent above the 1949-58 average. Thus the retail price will favor the consumer and in the past this has led to an increase in red clover acreage.

Visible supply of certified Dollard seed is around 300,000 pounds. A like amount supplied all the demand last year but this was before farmers were fully informed of the distinct advantages of Dollard. There will be enough foundation Lakeland for seed growers in 1961, but it will probably be 1962 or 1963 before any quantity of Lakeland appears on the retail market.

PRODUCTION RESEARCH—

(Continued from page 14)

varieties of farm crops helps relieve the cost-price squeeze.

A principal objective of such breeding is to develop varieties that will help stabilize production, thus helping get the highest returns possible per unit of production.

J. J. Christensen, head of the Department of Plant Pathology, points out that although there is an overproduction of agricultural crops in the U.S., the problem of profitable production on the individual farm is still with us and always will be.

"Because of the rapidly increasing population of the world—about 45 million per year—the need for basic research in agriculture was never greater than now. Actually, there is no world surplus of agricultural products. Statistics indicate that over two-thirds of the human population of the world suffer from lack of adequate nourishment," Christensen added.

He points out that a single experiment may involve years of both basic and practical investigations.

DUTCH ELM DISEASE—

(Continued from page 19)

Minneapolis-St. Paul metropolitan area first.

"In Wisconsin it was estimated that the fungus had been present for about 3 years prior to its discovery in the Milwaukee area. It is possible that the fungus has been in Minnesota before being found this spring in St. Paul."

PLANT TISSUE CULTURE—

(Continued from page 6)

grown only when associated with living cells. By growing tissue cultures of the host infected with these parasites, it has become possible to study the effect of the parasite on cells from different plant parts, and thus determine what and how plant functions are altered.

We hope some day to grow some of these obligate parasites on an artificial medium in the absence of living plant cells so that they may be studied even more fully. There already have been reports that this approach has been successful with some rusts.

Applications of Tissue Culture

One practical application of tissue culture is in the elimination of viruses from plants. Plant pathologists have found that the stem tips are usually not infected, so in order to stop the buildup of viruses, they culture the tips, from which grow new plants. These can then be propagated, starting a new virus-free stock.

The use of tissue culture in agricultural botany has been mainly to study the relationship of nutrition to the structural development of plant organs.

Not only have vegetative organs, such as root and stem tips, been cultured on artificial media, but attempts have also been made to grow reproductive structures in this manner. The embryos of many plants, when removed from the fruit bearing them, will grow on artificial media into young seedlings if the embryos have passed a certain stage of development. Scientists have not yet been able to grow very young embryos from all plants.

In the case of tomatoes we have succeeded in growing the young fruit (containing the embryos) in a test tube through all stages from fertilization to ripe fruit.

On the other hand, we have had less success with the pods of certain legumes, such as pea. Although it is possible to remove pea flowers from plants before pollination occurs and obtain young pods from them on an artificial medium, growth usually stops after about 1 week, unless the plant hormones, indoleacetic acid, gibberellic acid, and kinetin, are added. These substances may maintain the life of the pod for as long as 3 weeks. Some times embryos, although only partially developed, will begin to grow into seedlings while still attached to the wall of the pod. This is shown in figure 2.

To make possible a longer "life span" on artificial media we must discover other, presently unknown, growth factors which would allow the pod to reach maturity. The discovery of these "growth factors" should help solve some of the riddles of why the growth and yield of peas is often less than maximum in the field.

There are many and varied experiments being made and being planned which depend upon tissue cultures. This technique is an essential tool in solving perplexing fundamental questions. In addition, knowledge that scientists gain from its use can also be applied to current problems in agriculture, resulting in practical benefits to the farmer in the future.

SUBSOIL FERTILITY—

(Continued from page 7)

of Nicollet soils will benefit legume stands and the roots eventually will reach the lime-rich subsoil.

Barnes subsoils are neutral to alkaline. Free lime may be present in the rooting zone. Liming is not recommended on Barnes soils.

Phosphorus Content

The distribution of extractable phosphorus content in the subsoils of these four soil series (figure 2) illustrates the importance of subsoil fertility. It seems that much of the difference between these soils in phosphorus status is related to soil pH. At high pH values, calcium is apparently fixing phosphorus, thus making it less extractable as indicated by the Barnes and Nicollet series. On the other hand, at low pH values more phosphorus is extracted from the subsoil. The Fayette and Hayden soils are in this category.

Finally

Crops may not give yield increases when fertilized because of high subsoil fertility, even though soil test values on samples from the plow layer are low. In other cases, nutrient content of some subsoils may be so low that plants have to draw the nutrients exclusively from the surface soil. Information on subsoil fertility assures better recommendations by considering the entire soil instead of just the plow layer.

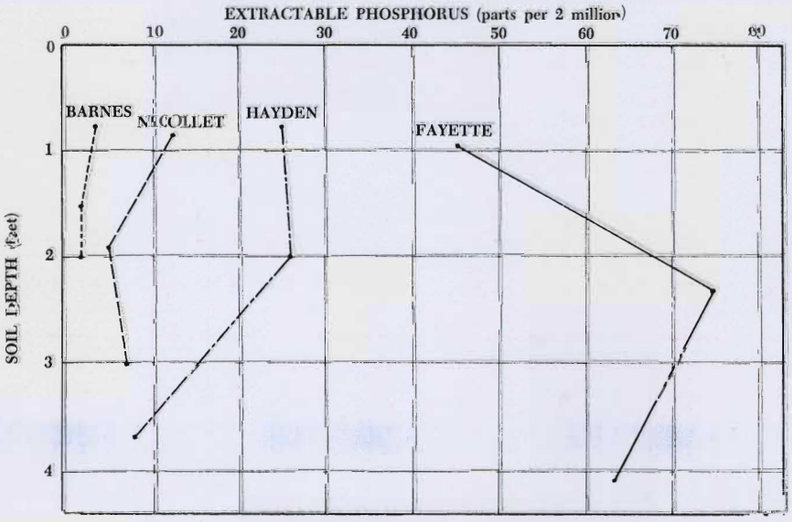

Fig. 2. This graph shows the distribution of extractable phosphorus in the subsoils of different soil series in Minnesota (determined by Bray's No. 1 method).

FEDERAL BEEF GRADES—

(Continued from page 9)

factor they consider when selecting beef. The list follows:

Selection factor	Percent checking
Price	4.4
Color	6.3
Recommendation of butcher	11.9
Degree of fat	20.3
Bone content	1.5
Grade	33.5
Reputation of store	8.9
Marbling	13.2
	100.0

Those using **grades** as a purchasing criteria correctly identified proportionately more federal grades than those using other selection factors (except marbling). About 12 percent of those using grades as the criteria, however, could not identify any of the federal grades and 30 percent were able to identify only one grade, usually Choice.

In general, those using color, price, bone content, and degree of fat as choice criteria were predominantly from lower income brackets. Marbling, grade, recommendation of butcher, and reputation of the store were used as selection factors mostly by people with higher incomes.

Conclusion

The people responding to this survey had a serious lack of knowledge concerning federal beef grades. Part of the reason may be that meat processors and retailers provide their own brand names on beef of varying quality characteristics. These terms tend to confuse consumers.

Most of the responsibility for this lack of knowledge is on the consumers themselves. There are extensive educational materials available on federal grades for food products. Efforts are periodically made through news media to inform the consumer of federal gradings. Perhaps these educational efforts should be expanded.

As long as the language of federal grades is unknown to the consumers, they must rely on retailers and wholesalers to translate their desires into the language of grading. Much of the flavor, however, may be lost in the translation.

Minnesota's Men of Science

Editor's Note—This is the thirty-fifth in a series of articles introducing scientists of the University of Minnesota Institute of Agriculture.

For the information it needs to operate on a scientific basis, Minnesota's rapidly changing poultry industry relies on the research and teaching carried on by Elton L. Johnson and his staff at the University of Minnesota.

Johnson has been head of the poultry husbandry department at the University since June 1953.

ELTON L. JOHNSON

He came to Minnesota from Iowa State University, where he served as a staff member for 5 years. At Iowa he became well known in his field as a result of his supervision of poultry nutrition research.

Under Johnson's direction, the University of Minnesota poultry husbandry department has grown to be one of the top 10 such departments in the United States in staff and facilities.

Minnesota was one of the first stations in the U. S. to work on inbreeding in poultry, and its effects on production traits continue to be among the primary objectives of the poultry genetics research program.

The Minnesota poultry department was one of the first in the nation to initiate a research program in poultry products technology with a full-time staff member in charge.

Outstanding at Minnesota has been protein and amino acid work with turkeys and work on the nutritional and physiological aspects of aortic rupture in turkeys.

Practical turkey feeding experiments at the Northwest Experiment Station, Crookston, have attracted national attention. It was discovered in the St. Paul Campus laboratories that feeding arasan-treated corn resulted in a disease similar to a condition that causes tremendous losses to Minnesota poultrymen.

Poultry nutrition research projects at St. Paul, Rosemount, and Crookston include studies with starting, growing, laying, and breeding chickens and turkeys.

A native of Colorado, Johnson received his B.S. degree in 1940 from Oklahoma State College, his M.S. in 1942, and his Ph.D. in 1948, both from Purdue University. He has also served as federal-state egg inspector at Tulsa, Oklahoma, and as an assistant in poultry and agricultural chemistry at Purdue.

During World War II, Johnson served 4 years in the U. S. Army, primarily as an administrative officer in the medical service corps.

He has contributed more than 100 papers to technical journals and semi-technical and other industry publications. Most of the papers deal with nutrition and feeding. He has been active in several professional societies, including the Poultry Science Association, American Institute of Nutrition, Sigma Xi, Gamma Sigma Delta, the American Society of Animal Production, and the Iowa Academy of Science. Since joining the University of Minnesota staff, he has served as president of both the Minnesota Poultry Improvement Board and the Minnesota Poultry Industry Council.

Johnson is a popular speaker on poultry nutrition and management problems. In June-July 1960, he went on a 6-weeks mission for the Soybean Council of America, speaking in Italy, Israel, and Spain.

Problems of Testing Chemically Treated Foods and Feeds

M. O. SCHULTZE

Agriculture today is trying to attain an ideal in producing its commodities. This ideal is usually more a concept than a tangible reality. Usually this concept is expressed in such terms as maximum yield, usefulness of the product, nutritional value, appearance, flavor, keeping quality, cost of production, and a variety of other attributes.

To attain this ideal the producer and the processor are using ever-increasing amounts and varieties of chemicals during production, processing, and storage. The purpose of such chemical treatment is two-fold:

1. To prevent loss or undesirable changes in the products;
2. To induce desirable changes.

The success of this practice can perhaps be visualized best if we consider what would happen to the quantity and quality of our agricultural production if we would suddenly stop using all weed killers, pesticides, fertilizers, antioxidants, flavoring compounds, sanitizers, and chemical feed supplements, to mention but a few. The use of chemicals in agriculture is here to stay; it will expand.

Along with success and expansion in the use of agricultural chemicals have come serious and vexing problems which must be evaluated rationally and without prejudice. Many of the chemicals we have used and now use frequently have unsuspected and unknown but great biological activity —otherwise they could not do the job they do. If these chemicals come into contact with agricultural products they will likely also come into contact with man and his animals. What protection do we have against possible harmful effects caused by chemical residues in, chemical additives to, or chemical processing of food for man and animals?

Congress; the Food and Drug Administration; Public Health authorities; the food, pharmaceutical, and chemical industries; and many scientists in and outside these organizations have struggled with this problem for many years. Here, too, an ideal situation, which everyone surely would support, has been used as the desired goal. This is that no food or feed shall contain enough of an added chemical compound to cause harm or injury to man or animals. If we accept this idea, then we must, in turn, define what we mean by "enough" and by "harm or injury."

For many chemicals, some preservatives and spray-residues for instance, maximum values of permissible concentration in foods have been promulgated on the premise that more than these amounts might be harmful. Realistic enforcement of such regulations implies that there are valid chemical or other tests. In many instances we have such tests; in others the available tests are not sensitive or specific enough to give meaningful results.

If chemical tests are not reliable indices of safety of chemically treated foods, should we use biological tests in which the wholesomeness of a product is tested by feeding it to animals? Although the biological test for safety may appear to be the ultimate criterion of judgment and is extensively used, its results are not foolproof and they often raise more questions than they answer. What should be used as an index of harmfulness, poor growth, death of the animal, development of specific abnormalities, or lesions?

Congress amended the Federal Food, Drug and Cosmetic Act in 1958 to provide that "No additive shall be deemed safe if it is found to induce cancer when ingested by man or animals . . ." There is no tolerance here; any amount, huge or minute that will cause cancer is disqualifying. Does the choice of malignant growth as an index of harm really have its intended usefulness?

How much of a chemical must we feed for how long to how many animals of which species before we have reasonable assurance that it will not cause cancer? Perhaps it will cause death for other reasons before cancer becomes apparent! Are we justified in applying observations made on a rat or a dog to man or the cow? We know of some striking differences in response of various species. What is the relationship between the amounts of a chemical compound required to produce a toxic effect and the amounts actually consumed with a food to which this chemical has been added during processing?

In many instances we have no satisfactory answer for these questions. We seldom know why a certain chemical compound is actually toxic, how it interferes with the chemistry of a living cell, and what a living organism, in turn, can do with the toxic compound. We lack, in other words, the fundamental knowledge needed to arrive at sound decisions. As in many other affairs, we must for the time being continue to accept, with chemically treated foods, "calculated risks" without having a basis for making the calculations. This is not a comfortable nor a sound situation. Through support of more fundamental research, not of "more testing" we can provide a sound foundation from which valid conclusions can be drawn. Broad understanding and support of this problem are prerequisites for its solution.

M. O. Schultze is a professor in the Department of Agricultural Biochemistry.