MINNESOTA
FARM AND HOME Science
Published by the Minnesota Agricultural Experiment Station

Vol. XVII, No. 1 October 1959

In This Issue . . .

October 1959

ON THE COVER — A dual-purpose combine picks and shells corn at the Rosemount Experiment Station. A grain combine is made dual-purpose by substituting a corn head for the grain header.

MINNESOTA FARM AND HOME Science

Published by the University of Minnesota Agricultural Experiment Station, Institute of Agriculture, St. Paul 1, Minnesota

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Dean of the Institute of Agriculture—H. Macy

Minnesota's Men of Science

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

Enthusiasm and a firm belief in Minnesota farmers and the productivity of Minnesota soils form a solid foundation for the tireless efforts of William P. Martin, head of the University's Soils Department. Add to this an extensive personal background of scientific know-how and a highly competent staff of professional colleagues. The result is assurance of a promising future of service from the University to Minnesota farmers as they work with one of the state's most valuable natural resources—the soil.

William P. Martin

Martin came to Minnesota to head the Soils Department in 1954. Since then research, service, and teaching in soils has continued to move ahead rapidly with expanded emphasis on soils physics, forest soils, soil climatology, and soil microbiology.

The Minnesota Legislature provided a new $1,000,000 soils building making possible improved service. Support for expanded soils work came from a wide variety of conservation, agricultural, and business groups. This support has constituted one of the many satisfactions of Martin's five years in Minnesota.

Martin feels that our whole economy and our agriculture must rest in substantial part on the fertility, protection, and conservation of our soils. He sees, too, a tremendous potential for even greater development of our soils for recreational, forestry, and agricultural uses.

A native of Utah, he was born on July 15, 1912 and attended Brigham Young University where he received his A.B. degree in 1934. He later went to Iowa State College where he earned his M.S. degree in 1936 and his Ph.D. in 1937.

Martin was a staff member at the University of Arizona from 1937-40, and from 1940-45 was a joint worker with the U. S. Soil Conservation Research Division and the University of Arizona.

He was chief of the division of Forest Influences of the U. S. Forest Service's Southwestern Forest and Range Experiment Station from 1945-48. He then went to Ohio State University, where he was a professor of agronomy and bacteriology until coming to Minnesota.

A specialist in soil microbiology, soil fertility, and soil conservation, Martin is author or co-author of more than 50 publications and scientific articles.

He is a member of several national professional organizations and societies, and was a chairman of the Joint Committee on Soil Conditioners for the American Society of Testing Materials and Association of Agricultural Chemists from 1953-55. In 1958 he was accorded the highest honor of the American Society of Agronomy when he was awarded the title of "Fellow" in the Society. He has been president of the Minnesota Chapter of the Soil Conservation Society of America.

Martin is a member of Sigma Xi, Soil Science Society of America, American Society of Agronomy, the Western Society of Soil Science, Phi Kappa Phi, and Phi Lambda Upsilon.

Grain Feeding Speeds Lamb Growth

R. M. JORDAN

DID YOU CASH in on the 25-dollar fat lamb market in mid-June? Some of your neighbors did, realizing an excellent return on their sheep. To have lambs ready for market at this time, Minnesota farmers find it almost essential that the lambs be born before February 20. And equally important, the lambs must be "pushed." To most sheepmen, "push" means to feed both the ewe and the lamb as well as possible. This involves feeding the ewe good quality roughage plus one to two pounds of grain daily and feeding the lambs a palatable and nutritious creep ration.

Two questions arise: First, does "pushing" actually increase lamb growth sufficiently to cover the added cost of production? Secondly, can this method be modified to reduce the cost but not decrease the lamb's growth? A progress report on some research currently being conducted by the University's Animal Husbandry Department may shed some light on the subject.

What Was Done

About two to three weeks after lambing, 40 Western yearling ewes and their lambs were divided into four comparable groups. All the ewes were housed in a barn with access to small outside lots. Fresh water and a salt and mineral mix consisting of two-thirds salt and one-third dicalcium phosphate were available to all the ewes. All the ewes received the same kind and amount of roughage, but other aspects of the feeding differed. This roughage consisted of approximately 4.1 pounds of average quality alfalfa-brome hay and 3.5 pounds of corn silage per ewe daily. The feeding experiment lasted 62 days. Here's how the different lots were handled:

Lot 1. The ewes were fed only the roughage in amounts and kind as described above. The lambs were not creep fed. Any hay or silage eaten

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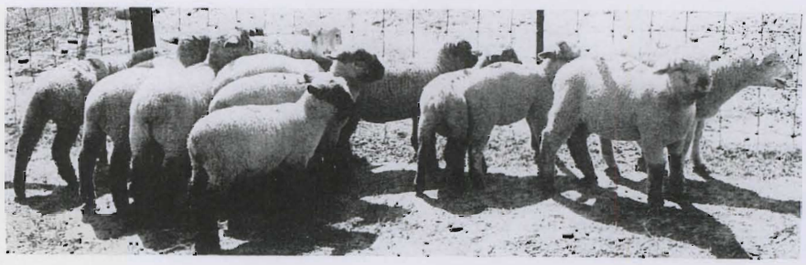

Fig. 1. Lot. 1. This group of lambs is thrifty, but the lambs lack finish and weight (41.2 pounds). Under this method of feeding, they will not be ready for market until October.

Fig. 2. Lot. 2. These lambs have enough finish and weight (57.4 pounds). If they are continued on grain, they should be ready for market in late June.

Fig. 3. Lot 3. Grain feeding the ewe and the lamb produced the heaviest lambs in the test (60.0 pounds). Continue grain feeding these lambs and they will be 90-95 pound choice lambs by late June. It is not recommended that the ewe continue receiving grain.

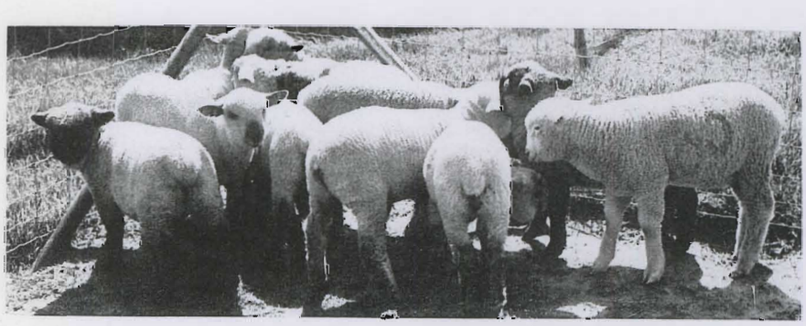

Fig. 4. Lot 4. These lambs lack finish and weight (49.5 pounds) so they will not be ready for market in July. Do not continue grain feeding the ewes, as they will become too fat.

R. M. Jordan is associate professor, Department of Animal Husbandry.

The Rocksbury Soil Series of Northwestern Minnesota

F. M. SCILLEY, DON BARRON, and R. H. RUST

The agricultural potential of the Rocksbury soils is greater than most people realize. The soil and climatic conditions are suited to the production of high quality grass and legume seeds, small grains, flax, feed crops, and pastures. Some farmers have established very successful dairy and beef enterprises that utilize the high quality feed that can be produced. Barley pelletizing may increase the numbers of hogs raised in the area. Some operators, using a high level of management, have been able to double—even triple—yields over reported present-day averages. Soils as extensive as the Rocksbury series are very important in the present economy of Northwestern Minnesota and, as operation management improves, will become even more important.

SOIL SURVEYS in Northwestern Minnesota during the past 12 years have shown that certain series of mineral soils are much more extensive than we thought. One of these is Rocksbury loam and clay loam, a member of the Kittson family of soils. Another soil type, Barnett, is also closely related, and in addition there are many small areas of peat in the region. This article discusses the characteristics and potentials of Rocksbury soils. Much of this is based on soil surveys by the Soil Conservation Service and the University of Minnesota.

Soil Covers Large Area

Rocksbury soils occur in all of our northwestern counties but principally in Polk, Marshall, Kittson, Roseau, Pennington, and Red Lake Counties (figure 1). These soils cover about 646,000 acres and make up 13 percent of the total land area in these six counties. Although this soil has good agricultural value, only about 60 percent is farmed. However, it is being gradually cleared and utilized.

Rocksbury is found on about 40 percent of the farms in these counties, and many fields are composed primarily of this one soil. This soil can grow any of the small grains and legumes commonly grown in this area.

F. M. Scilley and Donald Barron are soil scientists of the Soil Conservation Service at Thief River Falls. R. H. Rust is assistant professor, Department of Soil Science.

Glacial Action Formed Soils

Glacial action formed all of the soils in this general area. The huge glacial Lake Agassiz formed along the front of the ice sheet as the ice melted and receded. Lake Agassiz had beaches, islands, bays, and deep and shallow water. In addition, as chunks of the ice sheet broke off, many ice floes carrying soil materials, rocks, and other debris were common.

As the glacier slowly receded, the lake became larger eventually covering an area about 700 miles long and 250 miles wide. Finally the ice melted back past the outlet to the Hudson Bay and the water from the lake drained northward through the Red River.

The Rocksbury soils occupy parts of the old lake bed that were not covered very deeply with water. Consequently only relatively shallow amounts of sediments were deposited over the original lake bottom. These sediments are not as well sorted as the deeper deposits since the amount of water action and the length of time of sorting was not as great. The original vegetation under which these soils were formed was mainly prairie grass with a few scattered groves of aspen.

Physical Characteristics of Area

There are extreme temperature variations. The average July temperature is 69° F. and the average January temperature is 4° F. The average growing season varies from 100 days to 120 days. However, frost is a hazard with susceptible crops during most of the year. Rainfall averages 20-22 inches annually, most of which falls from May through September.

The Rocksbury soils occur on level or very nearly level land, and surface runoff (external drainage) is slow. The downward movement of water through the soil (internal drainage) is slow due to the moderately fine texture and lack of structural development in the subsoil. Also, during the spring or periods of high rainfall, the water table may be within 8-14 inches of the surface.

These soils have black loam or clay loam surface layers 7-9 inches thick over very thin grayish brown layers of silty clay loam (figure 2). A gray clay loam material, many feet thick and high in lime content, is found below the surface layers. This is the material that originally was the bottom of the lake. Some water sorting, or stratification, may be noticed in the upper part of this material.

The dull mottled gray colors of the subsoil indicate the poorly drained condition of Rocksbury soils. The Kittson soil is better drained and occupies the small knobs or short gentle slopes of the lake plain. The Barnett soil is very poorly drained and occurs in low areas.

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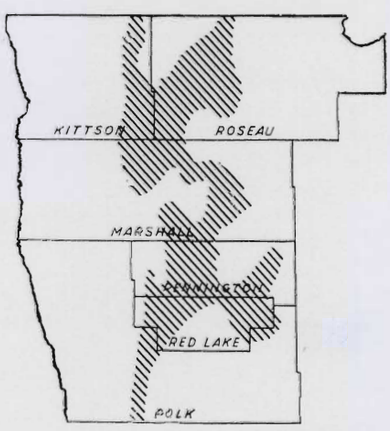

Fig. 1. Approximate area and location of the major portion of the Rocksbury soils. There are minor portions outside the shaded area.

A New Step Toward Improving Proteins for Poultry

DAVID C. SNETSINGER

WHY DOES A RATION containing protein from soybean meal generally outperform rations containing a variety of other proteins, even though the requirements for protein have been met by all poultry rations? Why do turkey poults require 10 percent more protein in their rations than do chicks?

Scientists may soon have the answers to these and other questions leading to even better rations. They hope to find the answers by developing and experimentally using highly purified diets which substitute amino acids for intact proteins such as fishmeal or soybean meal. This article tells how these diets have been used to increase our knowledge of poultry feeding.

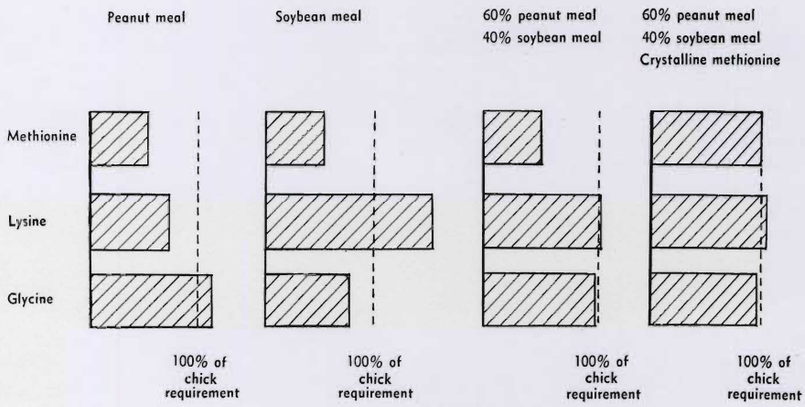

Fig. 1. An illustration of the use of protein mixtures and crystalline amino acids in balancing the essential amino acids of a ration.

What Are Amino Acids?

Amino acids are the small nitrogen-containing molecules which form proteins when chemically combined by either plants or animals. It is these amino acids that make up proteins—and not the proteins themselves—that animals need for growth and well-being.

The required amino acids come from two sources. First, the digestive enzymes in the animal's body can break down an intact protein such as corn or soybean meal. Second, scientists can make crystalline amino acids in the chemical laboratory. It is these chemically pure, crystalline amino acids that scientists use in experimental diets where amino acids are substituted for intact proteins.

Of the approximately 20 amino acids commonly formed in body tissue, poultry actually require only 11 in their rations. The chick or poult can synthesize, or make, the others to meet their needs.

The amino acids which the ration must furnish are called **essential** while those that are not needed in the ration are described as **nonessential.**

David C. Snetsinger is assistant professor, Department of Poultry Husbandry.

What Determines Value of Rations?

The lack of any marked deficiencies or excesses of the essential amino acids largely determines the value of a feedstuff as a source of protein for poultry rations. If the feedstuff contains a high quantity of all essential amino acids without gross excesses of any, it will generally be a very good protein supplement.

Unfortunately, most protein sources, when fed in sufficient quantities to meet the requirements for all essential amino acids, have too much of a number of these amino acids. Most essential amino acids, when in excess, either directly reduce growth themselves or indirectly cut down growth by producing a deficiency of some other essential amino acid. It is the presence or absence of either one or both of these factors which alters the amino acid balance of proteins.

Figure 1 shows how protein supplements and crystalline amino acids are used to balance the protein of a ration. In this case matching the amino acid deficiencies of one protein against the excesses of another improves the amino acid balance. Where crystalline amino acids are cheap enough, they also may be used to overcome deficiencies (see figure 1). This example considers only three amino acids. The situation is much more complex when all 11 essential amino acids are considered.

Why Use Amino Acids to Test?

Rations in which amino acids are substituted for intact proteins will be extremely valuable in studies to determine what constitutes good amino acid balance. Here the quantity of one or more amino acids can be altered by merely reducing or increasing the amount of the crystalline amino acids in the diet. This enables nutritionists to determine the effect of one amino acid on another and of several combinations of amino acids interacting. This cannot be done in rations where whole proteins such as soybean meal or corn are used because the amino acids in whole proteins are in a fixed proportion. Thus the quantity of one cannot be reduced without changing the amount of all others.

Only Recently Used

Researchers have used amino acid diets in poultry nutrition studies only recently, principally because of the extremely high cost of purified crystalline amino acids. Thus, only three or four universities have used amino acid diets in nutritional research. Now, however, many others including

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Park Kentucky Bluegrass

H. L. THOMAS

"Grass is the forgiveness of nature—her constant benediction. Fields trampled with battle, saturated with blood, torn with ruts of cannon, grow green again with grass, and carnage is forgotten . . . Its tenacious fibers hold the earth in its place and prevent its soluble components from washing into the waiting sea. . . ."

"The primary form of food is grass. Grass feeds the Ox; the Ox nourishes man; man dies and goes to grass again. . . ."

Senator John James Ingalls was thinking of Kentucky bluegrass when he penned these famous words in 1872 for a Kansas magazine. Here we tell about a new variety of Kentucky bluegrass developed by the University of Minnesota.

PARK KENTUCKY BLUEGRASS, developed by the University after a long period of study, has promise for both lawns and pastures. Wild bluegrass has long been popular because of its ability to survive indefinitely when mowed or pastured, its attractive appearance, its high nutritive value, and its ability to compete against weeds. Dormancy during hot, dry periods is its only serious fault.

Grass breeding work was started at the University of Minnesota Agricultural Experiment Station in 1937. Naturally, bluegrass was one of the species included. Scientists collected samples of bluegrass sod from widely separated areas in Minnesota. They broke these down to individual plants and grew 281 vigorous, healthy looking ones for further study and selection.

Botanists have known for a long time that Kentucky bluegrass was capable of producing seed without being fertilized by male pollen cells. By a process called apomixis, the female sex cells grow into mature seed without union with the male reproductive sperm. It was also known that in a certain percentage of plants regular cross fertilization, as in corn, also occurred. It was not known, however, how large a percentage of plants was cross fertilized. Investigations showed that for practical purposes all the plants could be considered apomictic.

Next, they picked the more desirable lines to keep. They selected these for seedling vigor, total yield, summer yield, percentage of crude protein, and freedom from diseases. At first, material was grown at Waseca, St. Paul, and later at Rosemount. The final testing of Park itself in comparison with Merion and unselected commercial bluegrasses was done at the branch Experiment Stations.

Scientists at The Pennsylvania State University had found that a mixture of several Kentucky bluegrass strains was superior to a single strain. Consequently the 15 best lines from the Minnesota selection work were put together and tested as a variety which became Park. Park was then tested in Iowa, Indiana, Ohio, Michigan, North Dakota, and Kansas, as well as Minnesota. These tests proved satisfactory, so in 1956 the University recommended the variety and named it Park.

Variety Characteristics

The outstanding characteristics of Park are quick germination, vigorous seedlings, resistance to stem rust, vigorous growth of mature plants, and tough, heavy sod formation. Under favorable conditions (fertile soil, plentiful nitrogen and water, and adequate light), Park is an excellent weed competitor.

Let's compare Park with Merion under Minnesota conditions. From the standpoint of quick establishment, Park is far superior. Under most conditions, Park also makes a tougher, more durable sod than Merion. At Rosemount in 1955, Merion ranged from 50 to 100 percent rusted compared to only 1 percent for commercial and only a trace for Park.

The comparison between Park and a good adapted commercial is not nearly as distinct as that between Park and Merion. However, Park is slightly superior to the best available lots of commercial for each of the characteristics discussed. The difficulty with commercial seed, however, is that certified seed is not available and there is no way to check genetic origin. As a result, different lots of seed may vary considerably in their adaptability to this area.

Possible Use as Pasture

Park first appeared on the retail market in 1958, and by the middle of the summer of 1959 approximately 50,000 pounds of seed had been distributed. Up to now Park Kentucky bluegrass has been used almost exclusively for turf, i.e., lawns, parks, athletic fields, and air strips. Six or seven growers have established fields for production of cultured sod.

However, University staff and seedsmen have never lost sight of its possible use as pasture. In 1944 and 1945 the component strains of Park were tested in comparison with commercial bluegrass. On the basis of 15 percent moisture forage, the highest Park strain averaged 2.0 tons per acre and commercial 1.4 tons. During 1959, Park was harvested for forage at Rosemount under a high nitrogen fertilizer program. By September 1 the yield of dry matter was 2.55 tons, which is approximately equal to 160 bushels of oats in feeding value.

Today Minnesota has over a million acres of open permanent pasture.

(Continued on page 19)

Fig. 1. Six-week old seedlings of Park and Merion grown under identical treatments. Left—Park, Right—Merion.

H. L. Thomas is associate professor, Department of Agronomy and Plant Genetics.

FOOD from MINNESOTA'S WATERS

LLOYD L. SMITH, JR.

DURING the greater part of recorded history fish have been the basis of an important food industry and in many areas have been an integral part of agriculture. The early development of the United States was strongly associated with the exploitation of marine resources and, at present, commercial production is a billion dollar industry annually. Inland fisheries were first exploited commercially and later gained importance as a basis for a recreational industry.

It is only during the last four decades, however, that sport fishing has dominated management and research efforts in the midwest and Lake states. The large economic value of the recreational industry based on fishing and the importance of wholesome outdoor diversions to fill leisure time have overshadowed the potential value of inland waters as a protein-producing resource. Farm surpluses and adequate marine fish production have also prevented any serious consideration of means of producing maximum food-fish yields from lakes and streams.

If current estimates of national and world population growth are correct, protein food will be a major problem in the foreseeable future. At a time when there is no emergency, therefore, it is perhaps good business to examine the possibilities of our relatively untilled "back forty."

Minnesota has approximately 4 million acres of water area, including our portion of Lake Superior, from which it produces annually about 40 million pounds of fish. Of this total approximately 25 million pounds are taken by anglers and the remainder by commercial gear. An estimated 30 million pounds is used for human consumption and the remainder for animal food and fertilizer.

The greater part of Minnesota's commercial production is derived from state-sponsored lake management operations and from licensed netting on Lake Superior. Two smaller fisheries, one on Lake of the Woods and the other on the Red Lakes, are of major importance because they produce 1½-2 million pounds of fine food fish each year.

Of the total commercial production, carp, buffalo fish, and bullheads provide the greatest tonnage of food fish. Among fine fish taken, walleyes lead the list with an annual production of 1-1½ million pounds, or about 1/6 of total United States production. On the basis of totals, the figures appear impressive, but since smaller fresh waters can be made to produce about as much animal protein per acre as the adjacent farm land, a much larger yield might be expected.

The reasons why our waters do not produce maximum yields of food are simple. Except in the limited areas used exclusively for commercial purposes, such as Lower Red Lake, management effort is directed only toward producing desired game fish. In addition, because less desirable fish are taken only incidentally during game fish management operations, a large proportion of them are not caught but die of natural causes. In most cases where nongame fish are harvested, the purpose is to promote the growth of the game species by reducing the numbers of their competitors rather than to get maximum production of rough fish.

It is perhaps unfortunate that our taste in fish causes us to favor the species which will be the least productive in our waters. With the exception of the panfish, the desirable game fishes all depend on using other fish for food while the rough fish, such as carp, suckers, buffalo fish, and perch, are omnivorous or live principally on insects and other small invertebrates.

Production of fish begins with basic fertility in the water. The minerals are synthesized into microscopic plants and animals and are eventually reflected as fish-food organisms. Three to five pounds of this material is required to produce one pound of rough or nonpredaceous fish. The predaceous or game fishes, such as walleye, northern pike, and bass, must eat 4-5 pounds of forage fish to produce a pound of game fish. It is therefore evident that any body of water can have a much higher sustained yield of rough and forage-type fish than of predaceous game fish. Where the former group is favored by nature or by management, total animal production per acre will be much greater than in cases where predaceous sport fish are produced.

Investigation over a period of years has shown that an average annual harvest of more than 95 pounds per acre has been taken from rough-fish lakes where no effort was made to attain maximum yield, but on the contrary the objective was to reduce the annual production to favor game fish. Creel census has shown on the other hand that about 30 pounds per acre has been produced from game-fish lakes annually. John Moyle and others of the Minnesota Department of Conservation have observed that the standing crop of fish in game-fish lakes is approximately 110 pounds per acre, while in rough-fish lakes it averages 375 pounds per acre.

These figures have been cited to demonstrate the greater productivity of lakes when they produce forage-type or rough fish. Present conditions do not warrant any attempts to change the production of Minnesota waters from game fish to food fish. The economic value of game fish far exceeds anything that might be realized from food-fish management. In many game-fish lakes, however, 25 to 35 percent of the standing crop of fish is not now contributing to the annual harvest but could be used for food without substantially influencing present game-fish yields. Intensive management of Minnesota waters for food as well as game fish could substantially increase total production. If populations of nongame fish were to be developed in our lakes instead of game fish, total yield might be increased severalfold.

Until such time as food demands require a change, most Minnesota waters will be managed primarily for game fish with food fish being harvested incidentally. Knowledge that

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Lloyd L. Smith, Jr., is professor, Department of Entomology and Economic Zoology.

Land Forming - - -

LEE F. HERMSMEIER and CURTIS L. LARSON

LAND FORMING is a new water management practice which can increase crop yields and make the land easier to farm. With modern earth-moving equipment, one can actually reshape the land surface at a reasonable cost.

In the western states, regrading the land surface to permit more uniform spreading of irrigation water is a common practice. If this is not done, water is trapped in pockets which get too much water while other areas do not get enough.

Similar procedures are now being tried in other parts of the United States to improve distribution or removal of rainwater. A machine called a land plane (figure 1) is used to eliminate minor irregularities on the land surface, such as deadfurrows and headlands. This process is known as **land smoothing.**

Fig. 1. Crawler tractor and land plane in operation.

In land that has somewhat larger, though shallow, irregularities, some other type of equipment is needed to haul the large amounts of soil from the high spots to the depressions. Crawler tractors and scrapers are the most efficient machines for this job. Following this, the field must be gone over several times with a land plane. This process of reshaping and smoothing the land surface is called **land forming.**

Several systems of land forming are being tried at the present time. The most promising method for row crop areas is the one using widely spaced field ditches running across the slope. The rows are planted perpendicular to and across the ditches, therefore in the direction of the greatest slope. The land between the ditches is shaped and smoothed so that each row drains to a field ditch. The ditches are made wide and shallow so that they can be crossed easily with farm machinery.

This system of land forming is most beneficial on land that has little or no slope and shallow depressions. It is especially helpful for deep clay soils on which adequate tile drainage may be very expensive. Much of the Red River Valley has topography and soils that fall in this category.

Land forming aids crop growth by providing well-defined, uniform surface drainage. It does not provide subsurface drainage and is therefore not an adequate substitute for tile drainage.

Earth-Moving Requirements

In land forming, keep in mind certain principles affecting the cost and benefit from the system. Avoid deep cuts for two reasons: to prevent exposure of subsoil, and to keep the amount of earth moving and the cost as low as possible.

In figure 2 (top), we see a section through a level field that has been formed to provide a slope draining to the left. From this we see that the greater the slope of the finished surface, the greater the depth and the volume of cut. Thus, the slope should be no more than necessary for good row drainage.

How does the length of slope L (the distance between ditches) affect earth-moving requirements? By comparing figure 2 (bottom) to figure 2 (top) we can see that a shorter length of slope reduces both the depth of cut and the volume of earth moved. The average length of haul H, shown in figure 2, is equal to two-thirds of the slope length L. Thus, by reducing the length of slope, we reduce both the volume of earth moved and the length of haul. The result is a large reduction in cost.

Assuming that the volumes of cut and fill are equal, we can develop the following approximate equation for the volume of earth moved per acre in cubic yards:

$$V = 2.0\,S \times L$$

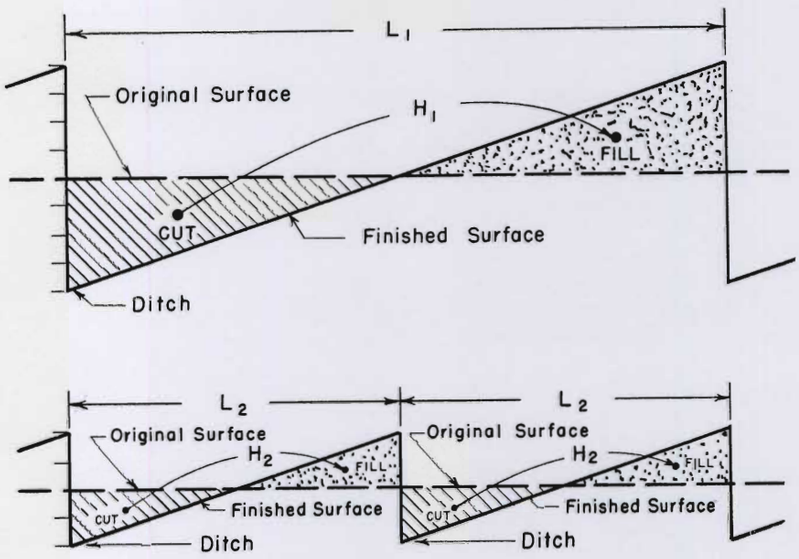

Fig. 2. Earth-moving requirements on level ground for two different slope lengths.

Lee F. Hermsmeier is Agricultural Engineer, Agricultural Research Service and research fellow, Department of Agricultural Engineering and Curtis L. Larson is associate professor, Department of Agricultural Engineering.

where S is the increase in the percent of slope and L is the slope length in feet. In practice, the volume will be up to 50 percent greater than this for two reasons. First, a considerable amount of earth moving may be necessary merely to eliminate the high spots and depressions without changing the existing overall slope. Secondly, due to compaction, the volume of cut is usually greater than the resulting volume of fill.

Research on Land Forming

Although many acres have already been modified by land forming with obvious benefits, many questions remain. What combination of length and percent of slope is best from the standpoint of crop response? How much topsoil can be removed without seriously impairing crop yields? If yields are seriously reduced in some areas due to topsoil removal, how can these areas be made productive again? Does the use of heavy earth-moving equipment cause a soil compaction problem? What overall benefits can be expected, and how do the benefits compare to the costs?

To obtain answers to some of these questions, a research project on land forming was established by the Agricultural Research Service Regional Laboratory at Morris. The study was begun in 1957 in cooperation with the Agricultural Engineering and Soils Departments of the Minnesota Agricultural Experiment Station.

We set up two field experiments, one near Wolverton and the other near Campbell, both in Wilkin County. Site A consisted of 24 plots 120 x 640 feet in size, with ditch spacings of 320 and 640 feet, and slopes of 0.2 percent, 0.5 percent, and "check." We did no grading or smoothing on the check plots. Site B, constructed in 1958, is similar except that the plots are 176 feet wide and the slopes are 0.1 percent, 0.2 percent, 0.3 percent, and "check." On both sites the established grade and the rows run the long way of the plots.

At Site A, the crop rotation includes sugar beets, soybeans, small grain, and summer fallow. At Site B, the crops are corn, soybeans, small grain, and clover. Continuing measurements being taken at both locations include crop yields, rainfall, soil moisture, soil temperatures, and bulk densities. We will need several years of these records before we can make any conclusions.

Figure 3 is a typical profile of the original ground surface at Site B,

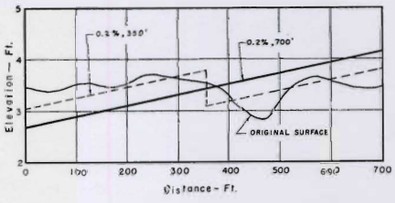

Fig. 3. Typical field profile and earth-moving requirements for slope lengths of 700 and 350 feet.

showing many shallow depressions and no general slope. This particular plot was graded with a 0.2 percent slope and a slope length of 700 feet. This required 328 cubic yards of cut per acre. If a slope length of 350 feet had been used at the same location (see dotted line), the amount of cut would have been reduced to 140 cubic yards per acre. Also the depth of topsoil removed would have been reduced 0.3 foot over most of the lower half of the plot.

At both sites the ditching and rough grading were done with a Caterpillar D-4 tractor with dozer blade and a DW-40 scraper, which has a 4.5 yard capacity. Smoothing was done with a Gurries Model GP-40 land plane and the same tractor. Data were taken on all phases of the earth-moving operation. There are other models that can be used, but the data in table 1 came from these models.

Earth-moving data for Site B are given in table 1. As expected, the amount of soil moved increased with both the length and percent of slope. In all cases but one the actual yardage exceeded the theoretical by a small amount. For the ditching and smoothing operations, the amount of tractor time was not affected a great deal by the slope length and percent of slope. However, the tractor time for grading increased with the percent of slope, and increased very rapidly with the length of slope.

The costs given in table 1 were determined by using a rate of $8.00 per hour for the equipment and operator. These costs are, of course, based on land forming of experimental plots on land having no general slope. When done on a field basis, costs would probably be reduced. Also, a field with some initial slope could be formed at a lower cost.

Table 1. Amount of soil moved, tractor time, and costs for land forming, per acre (Site B)

Slope	Plot length	Soil moved		Tractor time				Costs
		Theoretical	Actual	Grading	Smoothing	Ditching	Total	
percent	feet	cubic yards		hours			hours	dollars
0.1	350	70	96	0.88	0.81	0.62	2.34	18.72
	700	140	159	1.89	0.66	0.44	2.99	23.92
0.2	350	140	178	0.80	0.84	0.62	2.26	18.08
	700	280	387	5.08	1.04	0.44	6.57	52.56
0.3	350	210	226	1.67	0.77	0.62	3.06	24.48
	700	420	374	5.77	1.14	0.44	7.36	58.88

Social Participation and School Grades

GORDON BULTENA, GEORGE A. DONOHUE, and MARVIN J. TAVES

MOST HIGH SCHOOL STUDENTS face a dilemma. On the one hand, great stress and importance is placed on scholastic achievement. On the other, students are lured from their studies by an array of teams, clubs, and organizations which compete for their time.

There is a growing concern that high school age youngsters are devoting too much of their time to social activities and not enough to classroom work and the formal curriculum. Yet good grades in school are very important as they often determine whether a youth is able to continue his education or enter a particular occupation.

Can a youth do well in school and still participate in the many school and community activities? Do the students who participate extensively in such activities do as well in school as those who participate little?

Contrary to the expectations of many, previous research has generally indicated that youth who are most active in school social activities also receive the highest grades. Other studies indicate that youth tend to receive higher grades during periods of high than of low participation in extracurricular activities. Thus previous research has indicated that youth can be active in the **school's** social activities without hindering their regular schoolwork. In fact, such participation often appears beneficial to classwork. But the relation of **community-centered** participation and scholastic achievement has not been determined.

Granted that the youth who participate in **school** activities excel in school, do the youth who participate in **community** activities also do well? Furthermore, what kind of grades do the youth receive who are active in **both** school and community social activities? How about the students who refuse to take part in any activities—what is their scholastic achievement level? At the request of community leaders and with the cooperation of the high school administration, University sociologists conducted a study in Willmar, Minnesota, to help answer these questions.

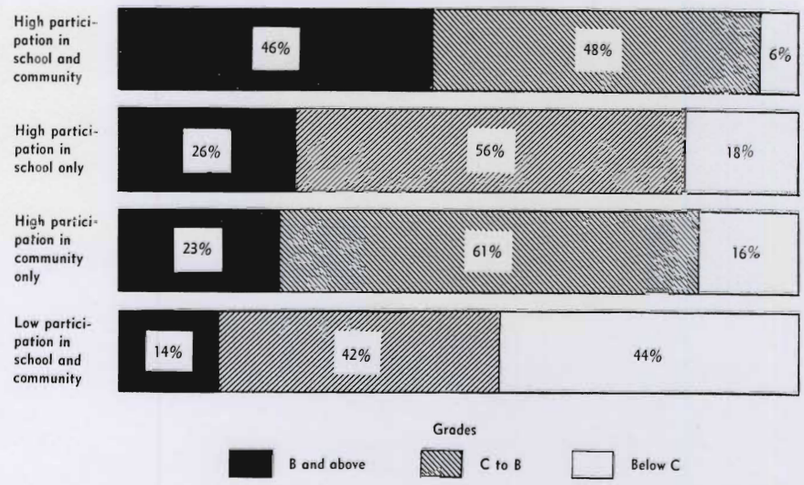

Fig. 1. Distribution of high school students' grades by participation in organized group activities.

Approximately 450 junior and senior high school students were studied. The degree of each student's participation in both school and community-centered groups and his average grades received in all school classes were computed.

The degree of participation was based on membership, attendance, committee responsibilities, and officerships. The individuals who devoted a great deal of time and effort to a club or organization received a higher score. On the basis of their score in each type of activity (school and community) each student was ranked as being either a high or low participator. The relation of participation and grades was tested.

Youth participation patterns were evaluated only for the organized (not the informal) groups attended. Organized social groups were defined as those groups which have fairly distinct objectives, elect officers, hold meetings, and have planned programs of activities.

Findings

Grades and participation. Students who are most active in both school and community activities tend to have higher grades than those who are less active or who are inactive (figure 1). There is little difference in the scholastic achievement of students participating in **either** school **or** community-centered but not in both activities. Individuals who fail to take part in school and community activities tend to have the poorest grades.

Of the students who are active in both school and community activities, 46 percent have a grade average of B or higher, while only 14 percent of those who fail to take part have attained such a high grade average. Approximately 25 percent of the students who are active in only school or only community activities have a grade average of B or higher. This tends to disprove the argument that the extremely active students do not do well in school.

The high participators have a lower percentage in the below C category than the low participators. Only 6 percent of the students active in both school and community activities have a grade average of below C whereas 44 percent, or almost one-half, of the

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Gordon Bultena is a research assistant in the Department of Sociology, George Donohue is associate professor and Extension rural sociologist, and Marvin J. Taves is associate professor and supervisor of rural sociology.

A Study of St. Paul Campus Leaders

WHAT MAKES LEADERS?

GLADYS I. BELLINGER and JOYCE LUND TESTER

ARE THERE BORN LEADERS? Do they develop, or just grow like Topsy? What home and community experiences seem to stimulate leadership? How do leaders view or perceive themselves? Do leaders differ from nonleaders? If so, how. Survival in today's complicated, technological world may well depend on leadership and greater understanding of the principles underlying its development.

To find out more about the characteristics and background of leaders, the University asked many St. Paul Campus leaders and other students a series of questions. This article reports on several of these studies. Before discussing them, however, let's background the topic of leadership some more.

Leadership today is a function both of the individual's personality and the social situation. A leader, then, does not become a leader by merely possessing certain traits. The pattern of his personal characteristics must be relevant to the characteristics, activities, and goals of the followers and to the demands of the situation.

How we look at ourselves is important in personality development. Usually, the way the individual sees his world is reality for him and will influence his behavior. The family plays a key role in forming behavior patterns and experiences from which the child gains his concept of self.

C. L. Shartle of the University of Ohio says a campus leader is one who is:

- Elected by a group.
- Able to exercise positive influence on others.
- Most influential in goal setting.
- Chosen for a particular office because of high influence potential.
- Seen as controlling means for goal achievement.

Ralph M. Stogdill's extensive research at the University of Ohio indicates that a leader to get effective group functioning must be able to

(1) Integrate—increase cooperation and decrease competition.

(2) Communicate—increase understanding and knowledge of what is going on in a group.

(3) Produce—move volume of tasks toward accomplishment.

(4) Fraternize—make self a part of the group.

(5) Organize—structure and define his own work and that of the group or structure and define relationships in performance of work.

The unique aspect of leadership involves three common tasks: analyzing the situation, making decisions, and initiating required action.

Why This Research?

Four basic concerns of this study are included in the following questions:

(1) How do campus leaders view or perceive themselves?

(2) What are the differences between leaders and nonleaders?

(3) What family and community experiences influence leadership developments?

(4) Can a comprehensive, objective instrument be devised to get the answers to the first three questions?

What Was the Procedure?

First, in 1957-58 pilot interviews were given to 30 St. Paul Campus leaders. Subjects were chosen from recognized honorary organizations, by their fellow students, and/or faculty. They were asked for their opinions as to the most important family and community experiences in terms of developing their present leadership skills and abilities. Answers were classified into these divisions: Family communications, goals and expectations, opportunities for decision making, boundaries or limits, and types of discipline and encouragement.

Second, a family life inventory was given to a sample of 48 St. Paul Campus leaders, 1958-59. These included members of student government, religious, fraternal, housing, honorary, special interest, and academic organizations. By studying leaders from a variety of organizations it was hoped to discover basic patterns of experiences common to many leaders rather than those patterns unique to a specific organization or situation.

Third, during the winter quarter 1959 all members of Rhetoric 51, a junior or senior year class, were asked to fill out anonymously the same inventory if they had not previously done so in a leader capacity. Seventy-two persons or about 75 percent completed the inventories. The inventory did include age, sex, and year in college.

The Chief Findings As Leaders Look at Themselves

St. Paul Campus leaders view themselves differently from nonleaders in the following ways:

1. Leaders exhibit more courage and confidence in expressing ideas, opinions, and their own points of view. A certain amount of risk or threat is involved. Thus leaders require a strong belief in self or a high degree of autonomy which seems then to free them to participate more actively.

2. Leaders feel more self confident in positions or situations involving leadership responsibilities. Self confidence reflects a positive attitude about one's self; he feels experienced and capable enough to assess a situation and rise to its challenge. Further-

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Gladys I. Bellinger is associate professor and Joyce Lund Tester was research assistant, School of Home Economics.

This study is one aspect of Experiment Station research in cooperation with the North Central Regional Research on Farm Family Living.

DOES NORTHEASTERN AGRICULTURE NEED MORE RESOURCES?

FRANK T. HADY and SELMER A. ENGENE

THE NUMBER OF FARMS and farmers has declined rapidly in Northeastern Minnesota. The decline has been much more rapid than in the rest of the state.

According to the State Farm Census, there were 9,252 farms in Koochiching, Itasca, St. Louis, Lake, and Cook Counties in 1940. By 1958 the number had dropped to 4,081. This is a drop of 56 percent. The number of farms in the seven counties bordering this five-county area dropped by 37 percent. For the rest of the state the decline was only 18 percent.

Farming in the area has not developed as rapidly or as extensively as many residents had expected or hoped. In the five corner counties, only 8 percent of the land was in farms in 1954. Many business and community institutions were started with the expectation of a steadily growing farm population, and some of them have found it difficult to survive.

It has been suggested that the agriculture of this area could be expanded if more resources were available to these farmers. A survey of 140 farmers in Itasca and Carlton Counties in 1955 and other published records helps to analyze this possibility. Approximately half of these farmers devoted all of their time to farming; the other half were part-time farmers who combined nonfarm jobs with their farming.

Farms are smaller in this area than in most parts of the state. Additional land, and especially cropland, is needed in order to increase income. At present, an ample supply of all types of land is available for use by most of the farmers.

Of the 140 farmers surveyed, 103, or 74 percent, indicated that cleared land near enough to their farms to be usable was available for rent. In a number of instances, it was an adjacent farm. Thirty-seven farmers, or 24 percent, indicated that no such land was near enough to be usable. The availability of cleared land is the result of abandonment. Despite the widespread supply of cleared land available for farm expansion, there was little apparent demand for it through either rental or purchase.

Rental rates varied from $2.50 to $4.00 cash rent for cropland, or from one-fourth to three-fourths share on a share basis. The most common figure for hay land was $1.50 per acre. Pasture land was "free," "for taxes," or "to keep the fences up." There was no set pattern of prices.

Rental rates compare favorably with the cost of clearing land. With cleared land available, there apparently is no need for further clearing except for those farmers who find no other available land within a reasonable distance.

Many Barns Not Fully Used

The crops best adapted to this area are feed crops. These farmers, therefore, need livestock, particularly dairy cattle. To expand livestock production would require more capital for cattle and, in some instances, more capital for buildings.

Operators of half the farms indicated that the barns were full. No additional livestock could be cared for without expansion. On the other half of the farms, there was room for additional cows. In fact, there was unused barn capacity for 29 percent more cows on these 140 farms. Part-time farmers had unused capacity for 42 percent more cows and full-time farmers for 19 percent more. In most instances, when there was room for more milk cows there was also room for more young stock. Only about 14 percent of the operators indicated that they had unused space for poultry. Only a modest investment in barns would be needed to expand livestock production in this area.

Some of these farmers also need additional machinery, although most of them can handle more land than they now farm with their present machinery. Livestock equipment would increase labor efficiency as the volume of the farm business is enlarged.

Debt and Credit

More land, buildings, and machinery mean more capital. Would special assistance be needed? As a group, the farmers surveyed were in good shape so far as indebtedness was concerned. Seventy-six, or 54 percent, of them reported no debts. Twenty-two percent had real estate mortgages on their farms, 19 percent had only chattle mortgages, and 5 percent had both kinds of indebtedness. Of those who owed money, 36 percent owed less than $1,000, 44 percent owed from $1,000 to $4,000, and 20 percent owed more than $4,000. The highest debt was $9,500 and the average was $2,300. Of the 13 instances in which the debt exceeded $4,000, 10 of the farmers had off-farm employment. For some of these farmers it seems likely that the decision to borrow may not have been a wise one.

Less than 10 percent of the farmers indicated that they would have difficulty in borrowing money to obtain the resources needed to expand their farm business. However, 39 percent said they would not be interested in borrowing for this purpose. In addition, many farmers would make no attempt to obtain credit even though they might believe they would have no difficulty in obtaining it. Lack of credit does not appear to be a major block to expansion of these farms.

Labor is available in the area, if the farmer is willing to pay wages comparable with other employment. Many people live in the farming area but work at nonfarm jobs. Many farmers are not fully employed at home and could work part-time for others.

The general advancement of agriculture in Northeastern Minnesota is not being greatly retarded by lack of availability of the resources needed for expansion. However, within this general pattern individual situations may differ greatly. Many farmers who could increase the size of their farming operations may not wish to do so. Others who would like to build

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up their businesses may not be able to obtain the use of the necessary resources. Basically, however, the problems of the area will not be solved by programs of clearing more land, providing more credit, or building more buildings.

The Problem is Productivity

The decline in the number of farms is due largely to relatively low earning possibilities on farms. In many areas, yields are relatively low. More important, because of climate and soils, the best adapted crops are hay and oats. Farm management studies have shown them to be low-return crops.

The U. S. Census of Agriculture (taken in the fall of 1954) shows that sales per acre are relatively low in this area. In the five Northeastern counties, average sales per crop acre[1] amounted to $26. In the seven adjoining counties to the west and south, sales per acre amounted to $28.

How does this compare with other areas? Since dairying is the most important enterprise in the Northeastern counties, let us compare these counties with the dairy counties of east central and southeastern Minnesota. In 13 counties, extending from Stearns to Winona County, sales per crop acre amounted to $54. This amount was twice as high as that for the northeast.

Topography and soils have made it difficult to adopt the large scale machinery and methods that have increased labor efficiency in other areas. Differences in costs do not offset the lower incomes.

With these low earnings per acre the number of farmers will probably continue to decline. New and improved practices cannot overcome these handicaps. Many farmers probably will find better earning opportunities in other areas or in nonfarm jobs.

The rapidly growing forests are providing a good alternative in the five corner counties. During the last decade, the income from agriculture in these counties amounted to about $8 million per year. Income from the forests was about $20 million, or two- and one-half times as much, and most likely will continue to increase.

Forests may also provide a good alternative in parts of the adjoining counties. They can be developed where there is a new growth coming on. Where most of the land had been cleared, the primary adjustment will be in consolidation of farms or in adjusting types of farming to the resources of the area.

[1] Acres of cropland + 1/10 of acres on woodland pasture + ¼ of acres in open pasture.

WHAT MAKES LEADERS?

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more, leaders appear highly motivated to prove themselves or bolster their own ego strength.

3. Leaders are more conscientious and persistent in carrying out responsibilities connected with an organization's achievement. Apparently, having accepted responsibility, leaders feel a high degree of obligation to discipline themselves and persevere until the task is completed. Nonleaders do not have this consistent drive toward goal attainment. Perhaps, leaders have more ego involvement or pride in fulfilling commitments and are more task than pleasure oriented.

4. Leaders prefer working with others and to operate in a cooperative rather than a competitive or solitary situation. Leaders seem to be flexible in subordinating or promoting individual behavior in line with group objectives. They are not unduly threatened by the presence or ideas of others but can adapt to the circumstances.

5. Leaders are more highly motivated in putting skills and abilities to work. Leaders apparently view themselves as having certain skills and abilities qualifying them to assume leadership. Consistent with the theory that ideas which seem real for persons become real to them, leaders behave in ways toward achieving their expectations.

6. Leaders feel that they are capable of sizing up the situation and making fairly quick, accurate decisions. Analyzing the problem, making choices, and initiating appropriate action are important steps in achieving goals. Such behavior probably reflects ego strength and self confidence.

7. Leaders feel that they can operate harmoniously with others in a group situation. Leaders are adaptable and can be dominant and/or subordinate to the group in promoting goals.

Effect of Family

Family relationships in four areas bring out differences between leaders and nonleaders. These areas follow:

Intellectual discussion—Opportunities for self expression, exploring new ideas, and taking part in intellectual discussions rank high in leader families. Such an atmosphere suggests a democratic acceptance of each child as being important enough to listen to—that he should be "both seen and encouraged to be heard." Acceptance and encouragement at home to participate in discussion probably creates a circular reaction wherein subjects are successful and wish to continue such activities outside the home.

Civic, service participation—Leader families take part in more civic and service activities such as church, community projects, 4-H, etc. Greater participation probably makes possible the development of more skills in interacting with people in a variety of situations. No doubt there are some factors of community approval and prestige which yield satisfaction.

Interaction with father—Leaders interacted with their fathers more often and in a greater variety of games and hobbies as they were growing up. Somehow, these fathers **took time and interest** in their children's play and projects.

Interaction with family—Leaders experience more and a greater variety of family group interactions than nonleaders. Both quantity and variety of experiences appear to increase flexibility of responses. Leaders thus are not limited by a few stereotyped roles.

Effect of Social Activities Before College

Creative activities were **the most highly significant group of items within the entire study.** These are the activities requiring imagination, re-

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STEPS TO BETTER DAIRY HERD MANAGEMENT

M. N. DEUTSCH and C. L. COLE

MOST MODERN DAIRY FARMERS are keeping step with the revolutionary changes in agriculture. Both their management practices and their cattle are improving. Production records dramatically show this. Today the average modern cow in Minnesota produces over 250 pounds of butterfat or about 6,700 pounds of milk compared with 5,200 pounds of her great-great-grandmother of 20 years ago. Even this level of production, however, is too low to afford the modern dairyman with a good return for his work.

Fortunately it is possible to make dairy cattle even better producers. For example, members of the Minnesota Dairy Herd Improvement associations today average over 375 pounds of butterfat or 10,000 pounds of milk per year. At that level they earn from $.30 to $1.85 per hour for their labor depending on how they sell their product—as cream, grade B milk, or grade A milk.

In this modern mechanized age, how can we produce milk most efficiently? Actually we must consider two aspects of dairy herd management. First, there are those factors concerning the dairyman himself; second there are those related to the cow and its environment. Here we review the important factors that University and U. S. Department of Agriculture research and practical farm experience show are important to greater success in dairying.

There are several factors important to the owner of the herd, manager of the herd, the herdsman, and other employees. They must like to work with dairy animals, they must be gentle and considerate, and they must have command of technical information and be able to apply it.

Dairy cows market a large part of the pasture, hay, silage, and grain produced from the farmer's land. Therefore, milk production involves crop production and farm management as well as the development and proper feeding and caring for the herd. Milk production is most efficient when the yields and quality of the feed crops produced from the land are high and when the feed costs are low.

Now let us look at five steps that research and experience show lead to better production.

1. Keep Production Records

It is important to keep private production records or participate in one of the organized record-keeping plans. These include Dairy Herd Improvement Association (DHIA), Owner-Sampler (OS), and Weigh-a-Day-a-Month (WADAM). Your county agent has the details on each plan.

The information obtained from these records should be used to select the better dairy cows, to feed cows according to their producing ability, and to cull the low producing, unprofitable cows from the herd. Using this information enabled DHIA herds to return $1.00 more per hour for labor than the average for the state.

2. Develop a Good Breeding Program

Develop a breeding program that will assure longevity and the inherited quality for producing large quantities of milk and butterfat per unit of feed consumed. Breed cows to sires that have proven themselves in an artificial breeding association. If proved sires are not available use a young bull with an ancestry of proved sires and dams. Artificial insemination is available in nearly all areas, and these facilities should be used for herd improvement.

Research at the University of Minnesota and the U. S. Department of Agriculture indicates that it may soon be possible to "insure" high yielding 10,000-pound producing cows by following good breeding and management practices.

3. Choose Feeding Plan Carefully

Choose a feeding program based on the forages and grains grown on the farm that will provide an adequate supply of utilizable energy, protein, minerals, and vitamins. In most instances, home-grown feeds, pastures, and other forages are the cheapest and best feeds for dairy cattle, provided they are harvested and stored in a way that will save a high percentage of the nutrients grown. Research shows that early cutting (one-fourth bloom), for example, increases the net energy percentage by 24 percent over late cut (full bloom) hay.

When it is necessary to purchase feeds, select them on the basis of cost per pound of digestible protein and/or net energy value.

Supplement permanent pastures during the hot, dry season with an emergency crop such as Sudan grass-soybean mixture. When pastures are too short or too mature, supplement by feeding hay, silage and/or grain.

Develop a suitable crop rotation system to provide the necessary pastures of a high nutritious quality. University demonstrations have shown that proper fertilization will increase bluegrass yields to a point where they may approximate legumes in value.

Feed young heifer calves plenty of high quality hay, skimmilk, or milk replacer, and a maximum of 4 pounds of grain per day. Yearling heifers can be maintained on good pastures or harvested forages. Provide water, trace mineralized salt, and shade for young heifers on pasture. The New York Agricultural Experiment Station said, "Heifers should not be over fed or under fed." For the lack of any specific information, a gain of about a pound a day is recommended.

4. Watch Management Carefully

The management program on a dairy farm should be such that labor, machinery, and equipment are used efficiently. Self-feed hay and silage wherever possible to save on labor; provide comfortable housing which is clean and sanitary; use plenty of bedding during the winter months; use proper milking procedures, such as washing and wiping the udder before

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ROCKSBURY SOILS

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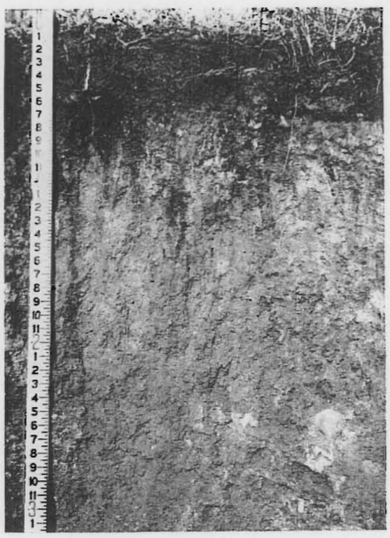

Fig. 2. Rocksbury silty clay loam. Note the dark surface, gray subsurface, and the numerous pebbles in the profile.

Rocksbury soils are quite high in all of the necessary plant nutrients although some nutrients may be slowly available due either to the pH of the soil, usually 7.9 to 8.2, the lack of weathering, or both (figure 3). The surface horizons are generally slightly alkaline; but within 16-18 inches of the surface, the pH rises sharply, and the soil becomes strongly alkaline.

Geologically, these soils are relatively unweathered because of (1) a commonly wet condition; (2) the climatic condition; and (3) the rather short time, geologically speaking, since their formation. **Consequently, as the natural drainage is improved, the productivity of these soils increases.**

Problems of Area

Drainage, including both the external and internal drainage of the soil, needs improving. The normally slow internal drainage can be improved by following good farm management practices, such as a 4-5 year rotation with 2-3 years of grass and a deep rooted legume, minimum tillage, and tillage only at proper moisture content, which is commonly at or slightly below the field capacity of the soil. The level topography further increases the surface drainage problem since adequate outlet ditches must necessarily be large and deep (figure 4).

Fig 4. Type of broad, shallow, straight ditches used to drain Rocksbury soil.

Plant nutrient release is slow and needs to be supplemented, particularly during the cold wet spring. Early spring applications of nitrogen have proved beneficial on experimental plots and on a few farms. Super phosphate fertilizer applications of approximately 100 pounds per acre are effective and are becoming standard practice.

Rocks are sometimes very common. Once all rock removal operations were by hand. Now, rock picking machines and dozers are being used and, although still expensive, do a very effective and speedy job.

Timber and brush removal has largely been solved by the use of large dozers and brush discs (figure 5). It still is costly, but the cost can normally be recovered in 4 to 7 years.

Other soil problems—The original organic matter content is reasonably high but needs to be constantly replenished. Soil structure is weak and care must be taken to prevent further breakdown by improper tillage operations. Wind erosion can occasionally be a problem, but cover crops and mulch tillage are effective controls.

Fig. 5. Windrows of brush and small trees left from clearing land on Rocksbury soils. Note the oat crop between the windrows.

Severe climatic conditions limit crops to small grains, flax, potatoes, and some corn for silage. However, the development of adapted varieties, such as 75-day corn and early-maturing soybeans, has helped to diversify the crop growing possibilities.

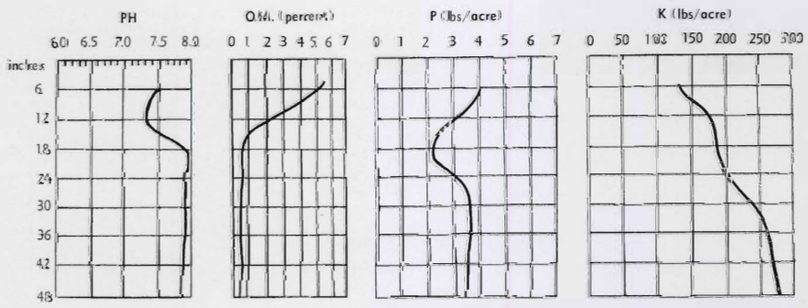

Fig. 3. The approximate pH and available plant food level in Rocksbury soils. O.M. = organic matter, P = phosphorus, K = potassium.

WHAT MAKES LEADERS?

(Continued from page 13)

sourcefulness, and the opportunity for trying out new possibilities which are invaluable in background experience for leaders. Apparently leader families permitted time and opportunities for and encouraged browsing, exploring.

Whatever stimulates the exploring, risk-taking facets of the personality is likely to be a key variable in both physical and intellectual aspects of personality development. Social activities stimulate the development of aggressiveness in trying out things and provide motivation for success, initiative, and prestige or status within the group.

Leaders participated more in church groups, social parties, and dramatic and musical activities. All these provided additional ways of expressing creativeness.

GRAIN FEEDING LAMBS

(Continued from page 3)

by the lambs, therefore, reduced the amount left for the ewes.

Lot 2. The ewes were fed the same as those in Lot 1. The lambs were creep fed bright green alfalfa hay and a simple grain mixture consisting of 9 parts cracked corn and 1 part soybean oil meal.

Lot 3. In addition to the regular roughage, the ewes received one pound of a grain mixture consisting of 9 parts cracked corn and 1 part soybean oil meal per ewe daily. The lambs were fed like those in Lot 2.

Lot 4. The ewes in this lot were fed exactly the same as the ewes in Lot 3. Their lambs, however, were not creep fed.

This feeding plan enabled us to determine the contribution that grain makes when fed to the ewe alone, the lamb alone, or both the ewe and the lamb.

Grain Feeding Lambs Pays Best

In general, grain feeding the ewe, or the ewe and lamb, or only the lamb results in increased gain. However, feeding grain to the lamb as a creep feed increased lamb gains far more than the feeding of grain to the ewe. For example, feeding .58 pound of grain and .42 pound of hay per day to the lamb increased lamb gains 70 percent above the gains made by the lambs in Lot 1. But feeding one pound of grain to the ewe (Lot 4) increased the lamb gains only 27 percent over the gains made by the lambs in Lot 1. Comparing Lot 2 (only the lambs grain fed) with Lot 3 (both the ewe and the lamb grain fed) shows that Lot 3 gained only 7 percent faster than Lot 2. (See table 1.)

This suggests two things. First, the bulk of any increase in lamb gains when only the ewe was fed grain (Lot 4) is likely due to the grain that is consumed by the lamb (lambs compete with the ewe for the grain). Second, grain feeding the ewe increased milk production very little.

The most economical gains were made by the lot in which only the lambs were grain fed. Conversely, the most costly gains were made when only the ewe was fed grain.

Not everyone's farm operation lends itself to producing fat lambs that are ready for market in June or July. However, records show that lamb prices are almost always the highest at that time and that farmers receive the greatest amount of return per ewe when they sell their lambs as fat lambs in June.

If you are attempting to produce lambs for the June and July market, the results of this one year's research work indicate that the following points should be kept in mind:

1. Creep feeding of the lamb is an absolute necessity. Frankly, it's a mistake to have January or February lambs unless you do creep feed the lambs.

2. If the roughage is fed in adequate amounts and is of average to good quality, feeding grain to the ewes only is a very questionable practice. Grain feeding ewes makes fat on their backs but not milk for the lambs. If you are limited in the amount of grain that you can feed, then by all means feed it to the lambs.

3. The most rapid gains will be made when both the ewe and the lamb get grain, the lamb being creep fed. If such a practice will enable you to sell your lambs on a higher price market (one week can make quite a difference in the price of lambs on the market) then follow this practice.

4. If your lambs are born in mid-March or April, there is little chance that you will be able to sell them on the June or early July market, regardless of which feeding method you follow. Then you may want to feed grain to the lamb only or feed no grain to either the ewe or the lamb.

Table 1. Effect of level of nutrition of the ewe and lamb on subsequent lamb growth

	Treatment			
	Lot 1— no grain	Lot 2— lambs creep-fed	Lot 3— ewes grained and lambs creep-fed	Lot 4— ewes grained
Average daily gain (lb.)	.36	.61	.64	.46
Gain index (percent)	100	170	177	127
Feed costs per 100 lbs. gain*	$11.17	$9.91	$11.24	$11.83

* Feed costs are based on the following prices: hay, $20.00 per ton; silage, $7.00 per ton; and grain, $45.00 per ton.

FOOD—

(Continued from page 7)

our water acreage may sometime be needed for food production as well as game-fish production is leading fishery biologists more and more to explore fundamental relationships between fishes, the mechanism of conversion of fertility to fish flesh, and similar basic problems in inland waters.

The Experiment Station staff is working on a number of such investigations. For example, current research on the Red Lakes has shown the fishing pressure alone does not influence subsequent yield, but that the factors which determine survival of new broods are the keys to harvestable surplus. Other investigations in smaller waters are aimed at gaining a more precise knowledge of how phosphorus, nitrogen, and other basic nutrients are converted into fish food and ultimately into fish flesh. Still others are attempting to discover what sizes of fish should be harvested under different conditions to give greatest yield. Research conducted by the Conservation Department specifically to help determine how predaceous fish production can be increased also adds to our basic knowledge of fish protein production.

When the need for more protein production finally arises, we have large aquatic pastures which can be more extensively used and which can be developed without reduction of other resources.

Jack Pine Stem Rusts

NEIL ANDERSON and D. W. FRENCH

IN MINNESOTA, jack pine occupies approximately 1 million acres, which is twice the area occupied by both red pine and white pine. Jack pine trees do not have the grace and beauty of many of the other pines, but it is a fast growing species with the wood qualities that make it adaptable for use in the manufacture of paper and other wood fiber products.

Like the white pine, it is subject to attack by the rust fungi, and those managing jack pine must be concerned with no less than four serious stem rusts. They are called stem rusts because they invade the main stem of the tree and can girdle and kill small trees. On older trees they cause a distortion of the trunk (figure 1) so that it is very difficult to remove the bark, as is required in most processes using jack pine. The cankers caused by these fungi are avenues for the entrance of decay, (figure 2) and in stands ready for cutting more decay is present in the rust infected trees. Some of these stem rusts are responsible for a reduction in height growth and apparently cause some mortality in older stands. Apparently many jack pines in stands approaching maturity are killed because of rust infection.

Neil Anderson is instructor and D. W. French is associate professor, Department of Plant Pathology and Botany.

Fig. 1. Pine-sweetfern rust on jack pine showing the ridges and series of small galls produced on the main stem. The cankered area is severely distorted.

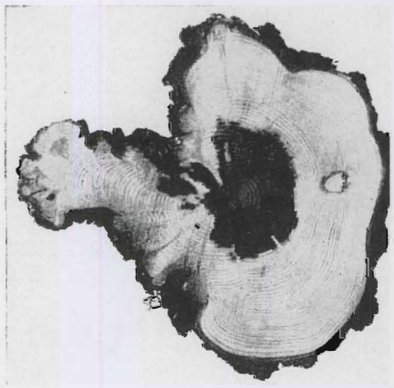

Fig. 2. Pine-sweetfern rust on jack pine showing the decay which entered through an old rust canker. The trunk is severely distorted in the canker area.

Similar to white pine blister rust and to many other rust fungi, alternate hosts are involved, and each fungus has five different kinds of spores. The pine-sweetfern rust fungus *(Cronartium comptoniae)* produces pycnia and aecia on jack pine and uredia, telia and basidia on sweetfern *(Comptonia perigrina)* or sweetgale *(Myrica gale)*. The aeciospores are wind disseminated presumably for long distances from the pine to the alternate host during the spring, usually May and June. The uredospores are produced in pustules on the underside of the sweetfern or sweetgale leaves during the early summer. From late July until frost the telial columns are produced and basidiospores will form on these telial columns any time that the weather is cool and wet. Periods of 24 to 48 hours at 50-70° F. and a high relative humidity are believed necessary for these spores to be produced and successfully infect the needles of adjacent pines. The basidiospores are delicate thinwalled spores which are wind disseminated relatively short distances.

Comandra rust *(Cronartium comandrae)* is similar but its alternate host is bastard toad flax *(Comandra spp.)*. This rust causes a canker and distortion of the branches and main stem and, as in pine-sweetfern rust, is frequently found at or near the base of the tree.

Stalactiforme rust *(Cronartium colcosporioides)* has two different alternate hosts, cow wheat *(Melampyrum lineare)* and Indian paintbrush *(Castilleja coccinea)*. The Indian paintbrush apparently is not much of a factor in the development of this rust in Minnesota; at least it has never been found infected in nature, although it can be successfully inoculated in the greenhouse. The cow wheat is a shade tolerant plant and is found in dense stands, while the Indian paintbrush grows in full sunlight. Stalactiforme

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Fig. 3. Stalactiforme rust on jack pine showing the elongated diamond shaped canker that resembles a mechanical wound. The tree in the foreground is healthy.

SOCIAL PARTICIPATION

(Continued from page 10)

low participators have such a low grade average. Approximately 17 percent of the students who are active in one but not the other have grade averages of below C.

These findings support the conclusion that students receiving the highest grades are those with a high degree of participation in both school and community activities. Those individuals showing a high degree of participation in either school or community activities fare next best. The students not taking part in either community or school activities do the poorest job in school.

In the study many of the factors related to high grades are reflected in the individuals who take part in school and community activities. Hence, the person who assumes leadership and desires to participate in many different organized activities may also be the type who will be satisfied only with above average grades.

In some instances, the very act of participating is beneficial to schoolwork. This is especially true for the many school clubs which are scholastically oriented. Participation in a French club, for instance, should aid the participator in his regular French classes. Much the same is true for individuals who participate in such activities as a library club, debate team, and other groups closely related to the formal curriculum of the school. Furthermore, the organized youth groups in a community often tend to foster the ideals and values of that community. Where these ideals and values favor scholastic achievement they tend to reinforce the participant's motivation to do good schoolwork.

Informal activities. It must be remembered that we considered only participation in organized social-group activities. While this study did not deal with informal participation, we believe that youth who devote their time to such informal activities as riding around in cars and "spending time with the gang" may not receive high grades in school. In many cases we suspect that youths who direct their time and energy toward such informal activities are also the ones who frown on the organized activities sponsored by school and community organizations. There is a need for further study to determine whether the relationship between informal participation and grades is the same as that reported for organized group participation.

Summary

Active participators in school and community activities do not receive lower grades in school than those less active or inactive. In fact, participation in organized social groups, both school and community-centered, seems to go "hand-in-hand" with scholastic achievement. Individuals who are most active in noncurricular school and community activities are the ones who receive the highest grades in school. Students who fail to take part in school and community activities are more likely to receive the lower grades. Thus social-group participation does not result in sacrificing scholastic achievement for most youth.

IMPROVING PROTEINS

(Continued from page 5)

the University of Minnesota are beginning to use diets of this type to study critically the amino acid requirements as well as certain amino acid interrelationships in chicks, poults, and laying hens.

Studies at the University of Illinois, Rutgers University, and the University of Wisconsin have shown that an amino acid, proline, previously thought to be not required by the chick, must be present in its ration for optimum growth. Other studies have shown that excess amino acids can be almost as harmful to good growth as deficiencies.

Since crystalline amino acid diets have been used only recently in research, there is little information which farmers or feed manufacturers can use to balance their protein sources more efficiently. Undoubtedly, however, the experimental use of amino acid diets will mean improved protein supplements within a few years.

STEM RUSTS

(Continued from page 17)

rust causes elongated diamond shaped cankers (figures 3 and 4) that may partially spiral around the main stem. The canker resembles a mechanical wound and rodents quickly clean off the spore material. This rust was first identified in Minnesota in 1958, but, judging from cross sections of infected trees, it has been here for decades and is well distributed in the jack pine stands of the state.

Pine-oak rust (*Cronartium cerebrum*), as the common name implies, has oak for an alternate host and the specific epithet refers to the cerebrum shaped galls (figure 5) formed by the fungus on the pine host. In contrast to the above rusts, this rust may occur on the main stem or throughout the upper part of the tree. It is not unusual to find 40 or more galls on a single tree.

There are several possible control measures similar to those applied to white pine blister rust. Eradication of the alternate host up to ½ mile or avoiding areas where the alternate hosts are abundant will help to prevent infection. The rust fungi attacking jack pine, though, are in the advantageous position of having several entirely different alternate hosts. In stands dense enough to prevent

(Continued on page 26)

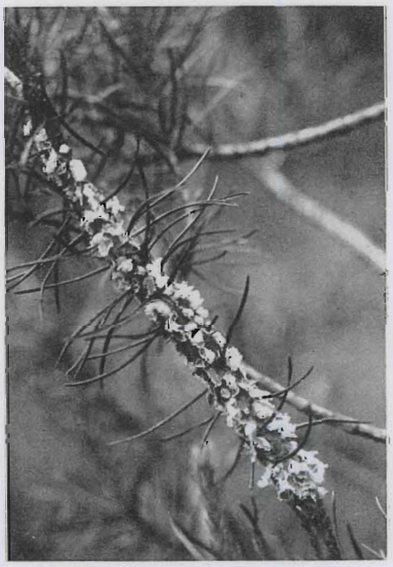

Fig. 4. Aecial blisters of stalactiforme rust. These spores are produced in May and early June.

PARK BLUEGRASS

(Continued from page 6)

Kentucky bluegrass is the dominant species, especially on the more fertile, well drained sites. Typically, however, our pastures are in poor condition and yield poorly. Bluegrass has been blamed for the low yields. University demonstrations have shown that with proper fertilization and grazing management bluegrass pastures can compare favorably with legumes.

Thus Park could be important for permanent pastures particularly in Northern Minnesota where cooler summers prevail and in Southeastern Minnesota where average annual rainfall is highest. Appropriate legumes such as trefoil, white clover, Ladino, or pasture type alfalfa should be planted with bluegrass for pasture.

New Seed Growing Methods

Minnesota has long been a leading producer of wild bluegrass seed. For example, our average annual production from 1944 to 1953 was 5,077,000 pounds and we were the fifth ranking state. All of the seed was harvested with strippers from natural meadows in North Central Minnesota.

The work of plant breeders is useless unless seed growers, through cooperation with the Crop Improvement Association, do a good job of producing and distributing the seed. In this respect, we have been very fortunate with Park.

When Park bluegrass was released by the Experiment Station, a group of progressive farmers near Roseau, Minnesota formed the Northern Minnesota Bluegrass Growers Association. They went into the cooperative production of high quality Park seed.

Fig. 2. Combining Park bluegrass seed from the swath.

They plant 1 to 2 pounds of seed per acre with a companion crop, small grain, or flax in the spring and alone in the fall. A good fertilizer and herbicide is used. They have produced 200 to 400 pounds of clean seed per acre. First seed production comes in early July of the year following seeding. Since bluegrass is a true perennial, the same fields may be harvested for a number of years. By the fall of 1957, 2,200 acres had been committed to Park. Total area in seed by 1958 was 5,000 acres and this was increased again in 1959.

The crop is handled with modern machinery. It is swathed and combined like grain and transported in sacks to a modern cleaning plant especially designed for processing high-quality bluegrass seed. This plant produces 500 pounds per hour of heavy, weed free, high quality seed.

The bluegrass seed producers have taken full advantage of the services of the Minnesota Crop Improvement Association. Practically the full production of Park, estimated at 400,000 to 500,000 pounds in 1959, is certified or registered. This involves field and bin inspection with rigid requirements for varietal purity, germination, and freedom from weeds.

Fig. 3. Combined seed starting through the processing plant.

Seed Distribution

The seed industry cooperates with the Northern Seed Growers to handle final seed processing and distribution. Although Park has not, as yet, been widely advertised, there are at present 62 retail outlets in Minnesota and 55 in neighboring states. It is anticipated that most good seed stores will have it in 1960.

STEPS TO BETTER DAIRY HERD MANAGEMENT

(Continued from page 14)

each milking; and use a strip cup to check on abnormal milk. Milk cows giving abnormal milk after the others have been milked and discard the milk.

Breed cows to calve about every 12 months, giving them a rest period of 6 to 8 weeks between lactations. Ned Bayley, former dairy husbandry staff member, found that a 6 to 8 week dry period resulted in a 10 percent increase in production over no dry period.

Make regular use of approved fly repellents and insecticides for controlling flies and other insect pests on cows, in the barn, and in the milk house a part of your program. Develop other steps to control the breeding area of flies and insects. These are: cut tall grass and weeds around the buildings, farm yard, and lanes regularly; drain low water areas or fill in low areas with a good gravel base; keep barns and yards free of manure; and haul manure directly into the field when possible.

5. Maintain Quality of Milk

The production of high quality milk must be maintained throughout the year. It is important that all the cows and humans working in the dairy are free from disease. Cool the milk immediately after milking to a temperature of 50° F. or below and keep at this temperature until shipped. Feed strong-odored feeds, such as silage, only after milking and after the milk has been removed from the barn. Keep pastures free of poisonous weeds, and seeds that cause objectionable flavors in milk.

The standard of living for the entire family is highest on the farm where major emphasis is placed on dairy, and the skillful and efficient application of labor, machinery, forage production, and herd management practices are combined.

STEM RUSTS

(Continued from page 18)

the growth of sweetfern and Indian paintbrush, the cow wheat grows abundantly; in newly planted areas, where there is little or no vegetation, the sweetfern will invade the site and form almost pure stands. Thus it is not always easy to avoid or eradicate all of these varied hosts.

Infected seedlings should be eliminated at the nursery and not distributed for planting. The alternate hosts may be abundant in a given planting area, but not infected. The introduction of an infected seedling to the area will allow the fungus to spread to the alternate host and back to the pines, and so a damaging epidemic can develop.

Chemicals have entered the scene as a possible control measure. The antibiotic "actidione," which has been effective in controlling blister rust on western white pine, has shown promise in preliminary experiments on the sweetfern rust.

Rust-free trees have commonly been observed in natural stands which have a high percentage of the trees cankered. Using the rust-free trees, studies are now in progress to learn how the jack pine trees react when infected with these various rusts, and a long range objective is to develop trees resistant to these fungi.

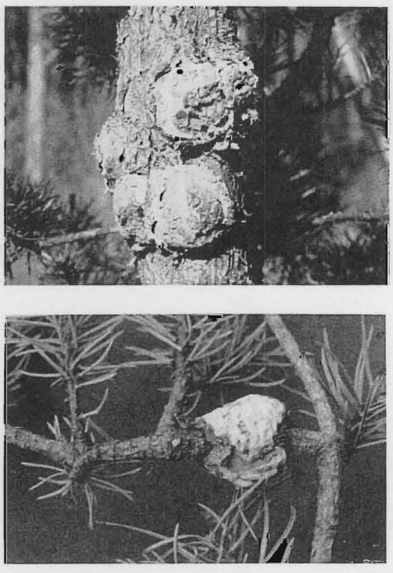

Fig. 5. Two versions of pine-oak rust on jack pine.

Research Shorts

Editor's note: Here we introduce a new feature briefing some of the University's research not covered in *Minnesota Farm and Home Science.* Some of it may be reported in detail in later issues. Other areas have been or will be reported in press, radio, and farm magazines or in scientific journals. We hope this additional feature will enable us to report even more research to you.

How much Strontium-90 and other radioisotopes are absorbed by farm crops? How real is the danger? University plant scientists will study this in a year-round bioclimatic field laboratory at Rosemount. They will consider several possible ways of dealing with the fallout problem, such as giving the plants calcium or other elements at levels that may reduce absorption of strontium-90.

★ ★ ★ ★

Different forms of nitrogen fertilizers have the same effect on farm crops. Liquid ammonia, ammonium nitrate, urea, and other forms are equally effective if properly applied. For the best buy compare costs per pound, consider how well each form fits your needs, and put on the right amount based on soil tests.

★ ★ ★ ★

Lee and Langdon wheat suffer much less from heavy attacks of stem rust than other rust-susceptible varieties. However, in years of moderate rust attack they do not come through better than other rust-susceptible varieties.

★ ★ ★ ★

Pelleted barley may have a bright future in hog feeding. Pigs at the Northwest Experiment Station at Crookston gained as well on a barley ration as did other pigs fed ground yellow corn.

★ ★ ★ ★

Minnesota farms are still family farms despite mechanization, larger farms, and a drop in farm population. About 85 percent of the labor comes from the family and 15 percent is hired. This is about the same as it was in 1947.

★ ★ ★ ★

There are 20 percent fewer dairy cows in Minnesota now than in 1944, but milk production per cow has been increasing about 100 pounds per year. Today it is well over 6,000 pounds. The average milk output per farm has also increased 35 percent since 1939.

★ ★ ★ ★

Land contracts are becoming increasingly important in financing farm sales. Over 40 percent of the sales are now handled this way.

Seed of Minton Oats, a new variety developed by the University, will be available for 1960 planting. Minton has medium maturity, and medium height, straw strength, and seed size. It resists smut, all prevalent races of stem rust except 7A, and all races of crown rust common in this area. It has yielded higher than other recommended varieties of comparable maturity.

★ ★ ★ ★

A limited number of female Minnesota No. 3 hogs have been released to commercial hog breeders. The No. 3 is an inbred line developed from 12 other breeds—60 percent from English origin.

★ ★ ★ ★

Fertilizing alfalfa in the fall is just as effective as fertilizing in the spring. Over a 9-year period at the Rosemount Experiment Station, the total alfalfa yield was 40.1 tons from spring fertilization and 39.4 from fall fertilization.

★ ★ ★ ★

Larger dairy herds can mean less labor per cow. Minnesota farm management association farmers with 10-cow herds, two single milker units, and can coolers spent 26.5 hours per cow for milking during a 23-week summer period. Those with the same milker units but with 20-cow herds spent 19.4 hours, those with 30-cow herds—17.2 hours, and those with 40-cow herds—16.0 hours.

★ ★ ★ ★

Stepping up doses of injectable iron can protect little pigs from nutritional anemia from shortly after birth until weaning. University scientists found that injecting 150 or 200 milligrams of iron into three- or four-day old pigs made it unnecessary to treat pigs again later. Up to now the normal dosage has been 100 milligrams.

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Feeding or implanting stilbestrol to steers does not lower carcass quality. However, an overdose can. In university trials, steers fed 10 and 24 milligrams per head per day did not lose quality. Those fed 36 milligrams did. . . If you either feed or implant stilbestrol, try to feed steers for the normal length of time if you want to reach the same grade as you would without stilbestrol.

★ ★ ★ ★

Loose smut of barley in Minnesota. Minnesota farmers lost over $1.5 million because of loose smut of barley in 1959. Fields were up to 30 percent smutted, with an average of 6.4 percent. Seed tests now under way will predict the amount of smut in 1960. Further testing can locate seed-lots safe for use as seed in 1960. Five dollars must accompany seed samples sent to the Minnesota Crop Improvement Association, St. Paul Campus, University of Minnesota, St. Paul 1.