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NEW BANG'S TEST *Proves Successful*

MARTIN H. ROEPKE
and KATHERINE G. PATERSON

THE NEW milk and cream ring test has recently proved itself a great step forward in the control of brucellosis in Minnesota. This test is so sensitive that it can be used on mixed milk or cream samples collected at the receiving line in a creamery or milk plant. In a high percentage of cases a positive test is obtained even though the milk or cream from one infected animal is mixed with the milk or cream from 5 to 15 negative cows.

This new ring test was developed in Germany and first announced in 1937. Since 1942 a number of reports on the test have appeared in the scientific journals of Sweden and Denmark. These reports described improved methods of preparing the sensitive stained antigen or test fluid and of conducting the test. Extensive information of studies showing the test's efficiency in locating infected herds was also reported.

The ring test is now being used quite extensively in Denmark and Sweden as a rapid and inexpensive method of locating infected herds. It is an official adjunct to the blood agglutination test in the brucellosis control programs of these countries. As the milk is received at a dairy plant, small samples of each can are obtained. To locate the infected or reactor animals blood tests are then made only in herds which show positive ring tests. By avoiding blood tests of large numbers of negative herds, this method saves time and expense.

The ring test is actually an agglutination test and depends on the same basic principle as the blood agglutination test. The agglutinins or antibodies, which the infected animal develops in attempting to rid itself of the disease, can be found in the milk as well as in the blood. The antigen or test fluid is stained a deep blue color so that the agglutination reaction may be observed in the presence of white whole milk.

In milk from infected cows the colored antigen collects on the fat droplets, and as the cream rises to the top a deep blue cream line or ring is formed. The skimmilk remains white. In negative milk the antigen remains in the skimmilk fraction to give it a light blue color, and the cream ring is white.

Reports from the Scandinavian countries were so encouraging that the ring test was considered for use in the Bang's disease control program in this state. Since many dairymen in this state market cream only, it was necessary to modify the test so that it could be used on cream.

In cooperation with the State Livestock Sanitary Board and members of the staff of the Bureau of Animal Industry, who have done much of the field work, 29 county-wide milk or cream ring tests have been made in the 25 counties of this state which are under the area control plan. A total of 30,811 herd ring tests have been made.

The ring tests were made in as many counties as possible just before the county-wide blood tests were conducted for reaccreditation of the county. Thus information was obtained on the number of infected herds in which the ring test failed and on why the test failed.

University studies indicate that:

1. If reasonable efforts are made to collect as many samples as possible of milk or cream at the creameries, cream stations, and dairy plants, samples usually can be obtained from 80 to 90

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How the Ring Test Is Made

Top. Sample is taken at creamery.
Center. Antigen is added to sample.
Bottom. Dark rings indicate infected herds.

New Varieties of Field Crops—
From Experiment Station to Farm

CARL BORGESON

HOW CAN I OBTAIN seed of new crop varieties? This question is frequently asked county agents and University of Minnesota staff members. Before finding the answer, let's take a brief look at the reasons for this tremendous interest in seed of new varieties and at the steps leading to the production of foundation seedstocks.

Since new varieties are widely publicized and only a limited amount of seed is available, farmers and seed growers are interested in obtaining seed early enough to capitalize on the premium on new seedstocks. Minnesota's progressive farmers are always looking for new, better-quality, higher-yielding, disease-resistant varieties.

How New Varieties Originate

Usually new varieties result from years of carefully planned breeding and crossing. Occasionally new varieties are developed from a single plant selected from a field of the growing crop. Kindred or "L" barley, Mindum durum wheat, and Gopher oats originated in this way.

In a carefully planned breeding program, the desirable characters of selected parents are combined in crosses to give a final product that is superior to the parents. The usual steps in developing a new variety are:

1. Crosses are made and grown in the greenhouse or in the field.

2. The new plants resulting from these crosses are grown in special disease nurseries where plants are selected both for disease resistance and desirable agronomic characters.

3. Individual plant progenies (offspring) are continued through several generations until desirable pure breeding lines are available.

4. The new varieties are then placed in yield trials both in rod rows and in 1/40-acre plots.

5. The new productions are tested for yielding ability, resistance to disease and insects, quality, etc.

6. Finally the performance of the variety is reviewed at the Branch Station Conference. All the data are brought together and new strains are compared with standard varieties before they are recommended. To be classified as a recommended variety, the new variety must have been tested at least three years in the plots.

How Seed Is Increased

As the first step in increasing seed, the plant breeder in charge of the improvement of a crop usually selects a number of heads or panicles of a new variety. He grows these under controlled conditions, eliminates the progeny rows not representative of the variety, and bulks the remaining rows to be used as the first increase. At this time a limited amount of seed is available for the increase plots.

Foundation Seed Stock. The Branch Station Conference plans for the increase of foundation seed from the plant breeders' seed. All foundation seedstocks are inspected both in the field and the laboratory by the Minnesota Crop Improvement Association the same as Certified seed.

The Approved Grower Plan

Since 1929, the Minnesota Agricultural Experiment Station has used a plan of distribution called the Approved Grower Plan. The Plan is designed to distribute the foundation seedstocks to Approved Growers. The ever-present weed hazard and the chance of varietal mixtures makes it important that the first release of seed of new varieties be multipled in the hands of trained, experienced, and trustworthy seed growers. These growers cooperate closely with the Minnesota Agricultural Experiment Station, the Agricultural Extension Service, and the Minnesota Crop Improvement Association.

THE PICTURE STORY OF NEW VARIETIES

The pictures on these two pages tell an important part of the story of new varieties.

ON THIS PAGE—(A) Agronomist Charles Rohde crosses varieties in the greenhouse. (B) H. K. Hayes, chief of the Agronomy Division, E. C. Stakman, chief of the Plant Pathology Division, and Carl Borgeson discuss legume problems. (C) Grains, as this flax, are tested in rod rows. (D) Plot Supervisor Harold Scott weighs oats from a rod row.

ON NEXT PAGE—Grain is tested in 1/40-acre plots (left) and then increased in larger plots (center). Once in the approved grower's fields, grain still has to be checked by inspectors.

Plan of Operation. Two committees plan the program and carry out the work of distribution.

The Advisory Committee of the Minnesota Agricultural Experiment Station makes allotments of seed to the counties and establishes general policies of distribution, such as price and minimum and maximum allotments to individual growers. This committee is made up of University staff members.

The production by counties over a three-year period is used as the basis for allocating the total amount of seed available. For example, counties that are high in oat production will receive the larger allotments of new oat varieties.

County Seed Distribution Committees nominate growers to receive the county allotment of seed. The nominations are approved by the Secretary of the Advisory Committee. The county committee includes the County Agricultural Agent (chairman) and two or more additional members interested in seed production who are appointed by the County Agent. One of the committee must be a local member of the Minnesota Crop Improvement Association.

The Approved Grower. The principal requirement of an Approved Grower is a previous satisfactory record in Certified seed production. These growers have clean land available for increasing seed, and satisfactory cleaning and storage facilities. They use extra precautions to keep seed pure.

A person may establish a satisfactory record of seed production by growing Certified seed of varieties eligible for Certification with the Minnesota Crop Improvement Association.

In obtaining seed of a new variety, an Approved Grower signs a Memorandum of Agreement with the Agricultural Experiment Station which among other things gives the station an opportunity to recall the seed and also establishes a maximum price for the seed the grower sells.

In many counties the County Agent, with the aid of representatives of the Minnesota Crop Improvement Association, has organized a County Seed Improvement Association. These local organizations promote the use of seed of adapted varieties through local fairs, seed shows, crop contests, and demonstrations besides increasing pure seed.

Hybrid Corn Seedstocks

A Corn Committee of the Experiment Station establishes the general policies of increase and distribution of hybrid seed corn. The Division of Agronomy and Plant Genetics increases the first crosses of hybrids recommended by the Minnesota Agricultural Experiment Station. This includes certain Wisconsin hybrids and the Minhybrid varieties produced and released by the Minnesota Station.

Growers are given an opportunity to apply for these seedstocks one year in advance. Thus the Experiment Station knows how much seed to produce. The single cross seed is grown through a contract arrangement with growers who have isolated fields and proper facilities for drying. It is then sent back to the Experiment Station for the final processing.

Thirty-five to 40 inbred or pure lines of corn must be maintained for this program. These are produced by hand pollination at University Farm, St. Paul, and at the Southeast Station, Waseca. About 40,000 hand pollinations are made each year. For the past four years 12,000 to 15,000 acres of double cross seed plots have been planted from single crosses furnished by the Experiment Station. This would provide enough seed for about 2,000,000 acres of commercial corn.

Facilities

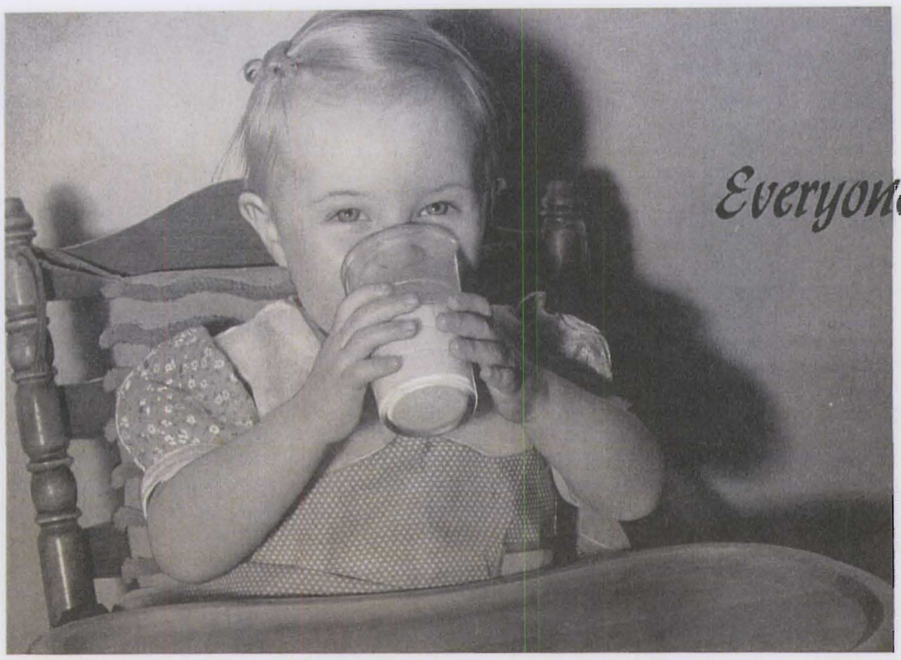
The program is designed to be self-supporting through the sale of seed. The Corn Seedstocks Building, erected in 1945, contains ample room for processing, storage, and office space for the workers. This year a two-story building, which will house the Minnesota Crop Improvement Association and offices of the Extension agronomists, is being erected. Funds from both the Crop Improvement Association and the Division of Agronomy and Plant Genetics have been used to erect this building.

Inter-state Relationships

Along with the black market that developed from shortages of other products during the war, there arose a black market in certain seedstocks of new publicized varieties. In order to help reduce this black market, the directors of the North Central Region appointed a committee of Seed Distribution workers from the various states in the region to help establish policies of inter-state cooperation. The plan developed by this committee requiries that a state that has developed a new variety will make seed available for early testing and increase to other states. Some of the other features of the plan are the cooperative naming of new varieties and the establishment of uniform prices. Announcements of new varieties are adjusted so that they are in line with available seed.

Plant breeders have made remarkable achievements in developing new varieties for special conditions and hazards. Even better new varieties will be developed. For this reason it is necessary that a satisfactory plan be maintained and continued for the increase and distribution of foundation seedstocks, not only from the Minnesota Agricultural Experiment Station but from other experiment stations. A sound program in the future depends on the continued wholehearted cooperation of state and federal workers, the Extension Service, certifying organizations, and the seed growers and farmers themselves.

Dr. J. L. Morrill, President of the University of Minnesota, and Dr. C. H. Bailey, Dean of the University's Department of Agriculture, inspect corn seed lots.



Everyone Needs Calcium

Milk is our best source of calcium.

JANE M. LEICHSENRING

ALMOST EVERY dietary study made in the past 25 years indicates that a large number of our population fail to obtain enough calcium in their daily diet. Many doctors now believe that a diet low in calcium over a long period of time, resulting in persistent calcium-poor conditions of the body, is an important factor in many chronic illnesses. They are convinced that a large number of people are living on lower levels of health and vitality than they could enjoy if their diets were better supplied with this essential mineral.

Recognizing the need for more study to throw light on this serious health problem, the University of Minnesota, Division of Home Economics has recently undertaken extensive research to determine how much calcium should be supplied in the diet of the average person and how that calcium may be used more efficiently.

Specific results of this research will be presented later in this publication. As a background for these findings, however, this article will contain a brief review of discoveries made here at the University of Minnesota and elsewhere in the United States.

Although 99 per cent of the body calcium serves to give rigidity to the bones and teeth, the remaining one per cent found in the soft tissues is of equal importance. It functions in the coagulation of the blood and in the activity of the nerves, muscles, and organs.

Milk and cheese are our best sources of this mineral. Greens, such as turnip, mustard, kale, and dandelion, also supply appreciable amounts, but other vegetables, fruits, cereals, and meats are less important dietary sources.

Dr. F. J. Stare of the Harvard School of Public Health was surprised in 1943 to see that the majority of X-ray studies of adults past the age of 45 to 50 years showed considerable demineralization of the bone. He suggested low calcium or reduced vitamin D intake as a primary cause of this condition. According to the late Dr. T. Wingate Todd of the University of Colorado School of Medicine, this condition is also common among adolescent American children.

Studies on Lower Animals

In studies on rats, extending over many generations, calcium intake above the amount needed for normal growth brought about pronounced nutritional benefits. Dr. H. C. Sherman and his associates at Columbia University found that increasing the calcium intake 70 to 80 per cent above the apparently adequate amount resulted in more efficient utilization of food, slightly increased growth, higher adult vitality, and an increase in the average length of the adult life of the animal.

Although findings from studies on lower animals must be accepted with reservation as a basis for understanding the functioning of the human body, the similarity of the diet of the human and the rat makes studies of this animal particularly useful. A comparable study of humans would obviously be impossible, since it would require observations extending over many centuries.

Numerous short-term calcium studies made in recent years show that marked differences in the ability to make use of food calcium exist between different individuals and in the same individual at different times. Many factors influence this utilization. On the average, humans utilize about 20 per cent of the calcium in their food. Rats utilize 90 per cent.

Body Stores Minerals

Studies on children indicate that increasing the calcium content of the diet results in greater storage of this mineral in the body. Studies made by Dr. Icie Macy Hoobler in the Research Laboratory at the Children's Fund of Michigan show that when the children had calcium intakes of 700 to 800 milligrams per day, the average retention was 125 milligrams. With each increase in dietary calcium, the amount stored in the body increased, so that when the calcium intake was 1700 to 1800 milligrams, the retention was 696 milligrams. Thus, increasing the calcium in the diet by somewhat more than 100 per cent resulted in a 500 per cent increase in the amount of calcium stored in the body.

Similar results have been reported in studies on college students. In the Division of Home Economics, University of Minnesota, the college women measured grew taller throughout their four years in school. When the calcium in the diets of a group of college women was increased the amount they stored also increased. This may have been because they were still growing or because they had not consumed enough calcium before the study for complete mineralization of the bones and for building up a reserve.

When generous amounts of calcium and phosphorus are included in the diet, the bones are capable of storing significant amounts of these minerals as a reserve. If the calcium intake is inadequate over a long period of time, this reserve becomes greatly depleted. Also, a high degree of demineralization in the bones themselves may result.

The importance of adequate amounts of vitamin D for the proper calcification of children's bones and teeth has often been convincingly demonstrated. Whether adults require a dietary source

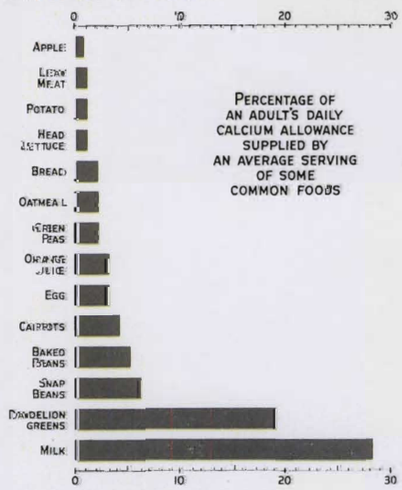
of this vitamin, however, is not so definitely known. Some studies indicate that a dietary source is not required because adults store adequate amounts of this vitamin in the summer by exposure to sunlight.

Widdowson and McCance in England reported better utilization of calcium from bread by adults during the summer than in the winter. They suggested that this was because enough extra vitamin D was available through food and sunlight. It is generally conceded that elderly persons and persons who work at night and get little sunlight need a small daily vitamin D intake.

A number of studies indicate that calcium absorption improves with higher acidity in the intestine. Orange juice is an example of a food which is a good source of such acid. In studies on lower animals, calcium utilization was increased by including lactose (milk sugar) in the diet. Intestinal bacteria formed lactic acid from the lactose, and thus improved the calcium absorption.

Investigations on growing animals have shown that rickets may be produced by an improper dietary balance between calcium and phosphorus. An excessive amount of either mineral interferes with the utilization of the other. Such extreme imbalances between these elements as used in these studies would not ordinarily occur. The diets of men and women in this country, however, frequently contain at least twice as much phosphorus as calcium. Thus, it seems desirable to study further the effect on calcium utilization of varying the ratio of calcium to phosphorus in the diets of human adults.

This is one of the phases of the research now being carried on at the University of Minnesota. The results of this research which concern the calcium requirements of college women will appear in a future issue of Farm and Home Science.



MINNESOTA LINEN EXHIBIT

ETHEL L. PHELPS and
LLOYD H. REYERSON

AS A SPECIAL FEATURE of Minnesota Week, February 14-19, 1949, an exhibit of cooperative research work at the University of Minnesota on the production of linen yarns and fabrics from Minnesota seed flax straw was shown in a window of a downtown department store in Minneapolis. The exhibit attracted so much attention that it was held over for a second week.

The researches behind this exhibit were set up originally by Dr. Ralph E. Montonna, former Assistant Dean of the Graduate School, and have been continued in the School of Chemistry and under the Minnesota Institute of Research by Dr. Elias Amdur and Mr. Floyd Grapp.

Studies of the yarns and fabrics derived from this flax fiber have been made in the textiles laboratory of the Division of Home Economics at the Minnesota Agricultural Experiment Station. A project in Agricultural Engineering at the Experiment Station has been concerned with the development of machinery for handling the straw as it is delivered from the harvesting machine. Earlier accounts of this work were reported in the February, 1947 and May, 1948 issues of Farm and Home Science.

The items included in the exhibit, as shown in the accompanying picture, are: (left to right) a bundle of ripened flax as taken from the field; a bundle of straw ready for breaking, i.e., with the heads and roots cut off; the straw as fed into the breaker rolls and after breaking; the sliver (a strand of fiber in loose, untwisted state) and the roving (a roll of fiber drawn out and slightly twisted), showing stages on the way to the chemical treatment which prepares the fiber for spinning; and spools of yarn spun from the chemically treated roving.

All of the fabrics shown are experimental products. On the two figures are a sport shirt made from a length of linen shirting and a nurse's uniform made of a linen suiting. Lengths of linen fabrics which have been dyed and screen printed by hand are shown in the background, together with place doilies made of the dyed material and a peasant-type hand woven tablecloth made of linen yarns spun in the laboratory. In the foreground are shown reprints of the two articles published in Farm and Home Science, and of a report of a cooperative study of an experimental toweling crash which had been subjected to 150 launderings at a commercial laundry. None of these materials, either yarn or fabrics, is available for sale or distribution, since only experimental products have been made.

One problem yet to be worked out is the development of mechanical means whereby harvesting and the proper preparation of the straw in bundles may be combined. In addition, a pilot plant is needed in which this process of preparing fiber, spinning it into yarn, and weaving the yarn into cloth, may be carried out on a larger scale.

The materials shown in this exhibit are illustrations of the satisfactory products which can be developed from seed flax straw when all of the problems involved in this project have been solved.

Where Do We Stand with NEWCASTLE CONTROL?

B. S. POMEROY
and R. FENSTERMACHER

WHAT HAS HAPPENED to Newcastle disease in Minnesota since it was first diagnosed in May, 1946? Has the disease been as serious as first anticipated or has it been overemphasized?

Since May, 1946, the disease has been definitely diagnosed by laboratory methods as being present in 75 of Minnesota's 87 counties, involving 434 outbreaks in chicken and turkey flocks. In many counties the disease has been identified only in a few scattered flocks, but in other areas it is a definite problem. In the areas where there is a large poultry population, the potential spread of the disease is more serious. The incidence of the disease is increasing.

Loss Is Often Great

Although the virus of Newcastle disease is capable of infecting fowl of all types, the only natural outbreaks encountered in Minnesota have been in chickens and turkeys. Other states, however, have reported the disease as being present in pheasants. Free-flying birds and upland game birds are susceptible to Newcastle disease by artificial exposure.

In 150 outbreaks in chicks under four weeks of age the average loss was 34 per cent. The loss in some outbreaks was practically 100 per cent. It was not uncommon to have a 60 per cent mortality in broiler plants. In adult birds the average loss has been about 5 per cent, but in some flocks the loss has been 20 per cent or more. The principal economic loss in the laying flock is due to the drastic reduction in egg production. It may be two to eight weeks before individual birds return to their former rate of production and most flocks rarely return to pre-infection rate of egg production.

How Newcastle Disease Spreads

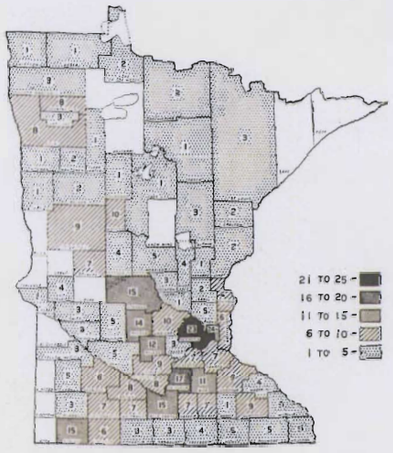
During the past few years the farmer's demand for started chicks has been increasing. This means that in many hatcheries started chicks have been confined in batteries in brooder rooms located in the same building or in buildings entirely separate from the hatchery. In spite of precautions, the virus of Newcastle disease is introduced occasionally into the battery rooms, and before it is realized the disease has spread throughout the plant.

Sometimes chicks from such an infected plant are delivered to the purchaser in person or are shipped by express before it is realized the chicks are infected with Newcastle disease. These shipments of infected chicks not only set up new centers of infection in various areas, but there is also the possibility of infecting other shipments of birds while en route. The majority of the outbreaks in started chicks in Minnesota can be traced back to the source of the chicks. Rarely has the disease been traced to a hatchery supplying day-old chicks.

Poultry crates and other equipment may become contaminated and thus be a means of spreading the virus. Unless feed sacks have been properly sterilized, their re-use should be avoided.

Hatchery operators should never allow sick chickens to be brought to the hatchery for examination there because such birds might introduce a virus infection such as Newcastle disease or infectious bronchitis. Instead, the poultryman should seek the advice of his local veterinarian.

The virus of Newcastle disease is present in the eggs laid by birds which show symptoms of the disease. If infected eggs are broken in the hatchery, the virus will contaminate the incubators, equipment, and wearing apparel of the personnel of the hatchery. It is the responsibility of the hatchery-supply flock owner to report to his hatcheryman any abnormal drop in egg production or the presence of a respiratory infection.



Newcastle disease outbreaks as of April 12, 1949.

Two Vaccines Are Available

Vaccination alone is not the answer to the Newcastle disease problem. Good sanitation and management are as necessary as ever for a successful poultry enterprise.

At the present time two types of Newcastle vaccines are available for use:

(1) One is the killed vaccine that is not capable of causing the disease and produces no reaction in the vaccinated birds. This type of vaccine may be used on birds from a few days of age to birds in production. It gives temporary protection from 30 to 90 days or longer. Such vaccination, according to our present information, has to be repeated or followed by the live virus vaccine if continued protection is desired.

(2) The second type of vaccine is a live virus vaccine which causes a mild reaction. Some birds may show symptoms of paralysis and colds. Birds vaccinated by this method develop a permanent immunity. The average loss from the use of the vaccine may be from 1 to 2 per cent. This vaccine should be used on birds from four to five weeks of age to as old as five months and should not be used on birds in full production.

Widespread Use of Vaccines Should Be Checked

Flocks vaccinated with the live virus vaccines are potential sources of infection for two to three weeks following vaccination. The widespread use of the live virus vaccines in Minnesota at the present time is not justified, although its use should be considered in those areas where the disease is a serious problem.

More information concerning the use of the live virus vaccines may be obtained from your local veterinarian, from the Minnesota State Livestock Sanitary Board, from the University of Minnesota Division of Veterinary Medicine, your Agricultural Extension Agent, or your hatcherymat.

Dry Milk Industry *Faces Uncertain Future*

DALE BUTZ and E. FRED KOLLER

DANGEROUS TIMES may lie ahead for Minnesota's war-expanded dry milk industry. Dry milk product prices have fallen and manufacturing costs have risen. As a result, the price that the farmer receives has dropped and the shift back to cream, which began in 1947, is likely to be speeded up.

As more and more farmers go back to selling cream, the volume at dry milk plants will fall and manufacturing costs per pound will rise even higher. All this will put a serious squeeze on the dry milk industry and may cause trouble in plants with high operating costs and low receipts.

United States production of dry milk remained high during 1948 in spite of substantial reductions in government purchases. This indicates that more milk powder than ever before was used at home or sold abroad.

Minnesota continues to be one of the leading milk powder producing states. In 1948 Minnesota manufactured about one-fourth of the nation's nonfat dry milk solids, one-fifth of its whole milk powder, and almost one-half of its dry buttermilk. Since 1945, the output of all products, except dry whole milk, has fallen, but still remains well above prewar levels.

Since 1942 the number of Minnesota dairy plants producing dry milk has remained at about 110. Average output per plant, however, has increased decidedly. In 1947 only 40 plants produced less than 400,000 pounds of powder annually, compared to 65 in 1942. During the same time the number of plants producing over 1,000,000 pounds increased from 25 to 56.

Early in 1947 the prices of nonfat dry milk solids dropped sharply from the O.P.A. level of 14.5-15 cents a pound to the government support level of 10 cents for spray powder and 9 cents for roller. In the fall of 1947, however, prices began to advance and reached a record level of 15.8 cents a pound in August, 1948. Prices remained near that level during the fall.

Left. A roller-type drier used in making dry milk. Right. Packing dry milk in barrels for shipment.

Late last December the government announced that its current funds for purchasing dried milk were depleted. The price of nonfat dry milk solids fell to 4-5 cents under the summer level before the market became stabilized.

In February, the government again entered the powder market and announced that it would buy 150,000,000 pounds of powder during the year. Although some purchases have been made, powder prices during the first four months of 1949 remained considerably below last year's record levels. These drops force plants to reduce drastically the price they pay for skimmilk. A 4-cent drop in powder prices would result in a 34-cent-per-hundredweight reduction in the price farmers can be paid for skimmilk.

Manufacturing Costs Vary

In 1947 the average cost of manufacturing a pound of powder for 22 spray drying plants was 4.4 cents and for 24 roller drying plants, 3.7 cents (table 2). Labor, packing supplies, and fuel made up nearly three-fourths of the total manufacturing costs.

Spray drying plants had an additional cost of collecting milk or skimmilk from nearby creameries. The University's studies showed that these interplant hauling costs averaged .87 cents per pound of powder produced. Much of the roller drying equipment is located in creameries at which most of the milk is received directly from farmers. These hauling costs were not included as a part of the manufacturing costs.

The larger spray drying plants appear to have lower manufacturing costs per pound of powder (table 3). In 1947 the plants producing over 6,000,000 pounds of powder annually had an average manufacturing cost of less than 4 cents per pound, or more than one cent per pound lower than the average costs of the plants producing less than 4,000,000 pounds. Labor and fuel costs per unit declined as volume increased.

A preliminary analysis of 16 spray drying plants indicates that manufacturing costs per pound of powder were about 0.4 cents higher in 1948 than in 1947. Most of this increase resulted from higher fuel costs. Coal and fuel oil prices have increased from 20 to 30 per cent since 1947. Labor costs per pound of powder remained the same even though wage rates per hour increased about 8 per cent. This indicates that plants were using labor more efficiently. Packaging costs, as well as most of the other costs, were nearly the same in both years.

Wide variations in production of dried milk products during the year increase costs materially. (During 1944-1947, October production was approximately one-third of June production.) As a result many of the facilities necessary to handle milk flow during peak months stand idle during much of the year. These idle machines continue to depreciate and must be maintained, thus increasing costs. Other costs, such as labor, also cannot be reduced in

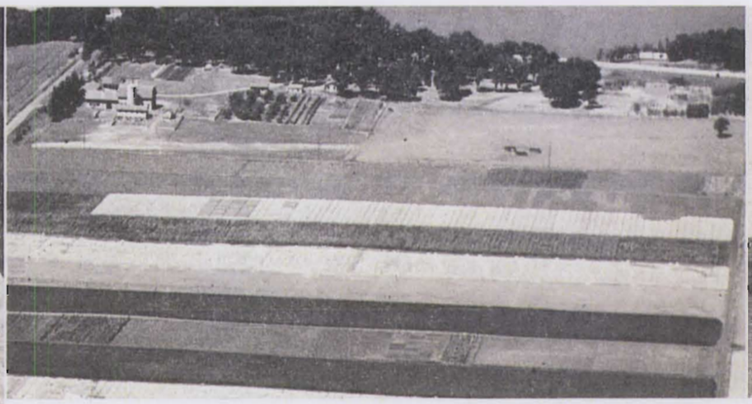
(Continued on page 15)

Table 1. Production of Dry Milk Products in Minnesota, 1944-1948

Year	Total production	Nonfat dry milk solids		Dry whole milk	Dry buttermilk	Dry skimmilk for animal feed
		Spray	Roller			
	thousand pounds					
1936-40 (average)	37,234	12,201*		0	17,374	7,659
1944	162,194	52,582	64,166	19,856	24,660	930
1945	222,734	79,411	88,183	31,646	21,826	1,668
1946	245,137	112,498	84,839	27,365	17,677	2,758
1947	210,227	106,167	58,660	22,803	20,060	2,537
1948†	219,306	106,643	56,018	35,790	19,215	2,240

* Spray and roller combined before 1940.
† Preliminary.

R. E. Hodgson, known as "Bob" to his many farm friends, enjoys working with animals.



This aerial view of the Waseca station shows how test plots are planted.

This pen-type l

The Southeast EXPERIM

R. E. HODGSON

"Land of plenty" is the Indian meaning for Waseca, which is the site of the University's Southeast Agricultural Experiment Station in Waseca County, 80 miles south and a little west of the Twin Cities.

Waseca is near the line which roughly divides the "dairy country" of the east from the "beef country" to the west. It's all "corn and hog" land, but poultry and sheep are also important enterprises on some farms. There is no school at the Waseca Station—all of the energy has been devoted to research, particularly in the fields of plant and animal breeding and testing.

The land is part of the old estate of Senator W. G. Ward, and was purchased by him before the railroad reached Waseca County. In 1912 the first 240 acres were acquired by the University, and an additional 357 acres were added in 1940, making the present area a 597-acre farm. All of the land is tillable, except 20 acres which will be drained whenever a good outlet can be obtained. The soil is rich, heavy, black, almost flat, and has a deep clay subsoil, which admirably resists drouth but sometimes floods when moisture is too abundant.

Dr. Boss Made Original Plans

The Southeast Station was originally planned by the late Dr. Andrew Boss as two units: an Experiment Station and a Demonstration Farm, which was intended to show the skeptical how proper drainage would improve land which had formerly been tillable only on the high spots.

Some tiling was done and enough of the surface water removed to permit a good arrangement of fields. These could be worked more economically because of their adequate size and regular shape. Horses furnished all of the power for several years.

New Varieties Developed

The experimental unit was relatively unimportant in the early days, but it has gradually expanded and finally absorbed the Demonstration Farm. Some of the land is used to grow feed for approximately 600 head of livestock. Other land is planted to increase new grain varieties as they are developed or introduced and put on the Minnesota "recommended" list. Several thousand bushels of "foundation seed" are thus made available each year to farmers and seedsmen. Moore barley and Andrew oats were increased in 1948 and are being distributed in 1949.

Some of the acreage is used for test plots which number up into the thousands each year. New material from the breeding plots of flax and cereals is given a chance to demonstrate agronomic characters and yielding ability in random-replicated plots. From the data so obtained, selections are made for further testing or for increase.

Samples of wheat, both winter and spring, are subjected to milling and baking tests. Sometimes hundreds of varieties, collected from all parts of the world, are propagated in short rows from which selections are made for disease resistance, stiffness of straw, or other desired characters which may be used in cross-breeding projects.

Forage crops of many kinds are tested for hay and for pasture use. Southern strains of brome grass have been proven superior to those from the north, while in tests on alfalfa the reverse is true. New varieties of alfalfa, such as Ranger and Ladak, have been tested and rated above older selections such as Grimm and Cossack.

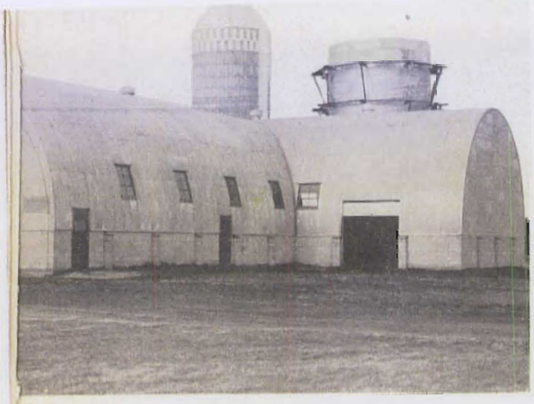
Longevity, disease resistance, and continued yields are measured over successive years and in repeated experiments in order to determine their long-time reaction to soil and climate. Pasture trials with all sorts of crops and mixtures are guides in advising farmers how to plan for high production on their own farms.

All of the University's corn breeding for southern Minnesota farms is carried out at the Waseca Station. The corn project, including breeding, crossing, testing, and the propagation of inbred lines, has grown until it occupies an area of nearly 40 acres. Every seed is planted by hand, and each row or plant is harvested individually after a complete set of notes on growth, disease reaction, and behavior is compiled.

During the pollinating season, a small army of men and boys rush up and down the corn rows putting on ear bags, placing tassel bags, and transferring proper pollen to the waiting silks, until darkness drives them from the field. The fact that 95 per cent of the corn grown in Minnesota is now of hybrid breeding shows the use farmers make of this field of research.

It is probable that the first double-crossed corn raised in Minnesota was grown at the Waseca Branch Station. Dr. H. K. Hayes, Chief of the Division of Agronomy and Plant Genetics at University Farm, has directed the corn work and supervised the production and distribution of other crops for over 30 years.

In 1921, he obtained a bushel of Burr-Leaming hybrid seed from Connecticut, and it was planted at the Southeast Station. The results were so encourag-



is used to test loose housing and the milking parlor.

NT STATION

ing that work with Minnesota lines was pushed as rapidly as possible. By 1930, a double cross, later named Minhybrid 403, was ready for comparison with the best open-pollinated corn grown in southern Minnesota. This variety and Minhybrid 301 were the opening wedges in a program which has revolutionized corn production in this state.

Swine Inbreeding Started

Can corn breeding methods be used to advantage in breeding swine? That question puzzled the University of Minnesota and other research institutions throughout the United States back in 1923. As a result, in 1924 the Waseca station started using on hogs the principles learned in corn breeding. The station started inbreeding a line of Poland China hogs. Today this line of Poland Chinas is one of the most highly inbred lines of domestic livestock in the country, with the exception of poultry.

In 1935 the establishment of the regional swine laboratory gave new impetus to this type of breeding work. The University's part in this project is under the direction of Dr. L. M. Winters. All branch stations cooperate closely with him in the project.

By agreement, the work is divided among the stations. To the Waseca unit is assigned the task of testing, in crosses, the inbred Minnesota No. 1 line from Grand Rapids, the A and B lines from the West Central Station at Morris, the No. 2 and B lines from Northwest Station at Crookston, and the highly inbred M line of its own breeding. The crosses are made and litters fed in test lots at Waseca.

When the pigs reach market weight, they are sent to a packing plant at Albert Lea, where detailed carcass yields data are obtained. These data then give a complete record of the animals from birth to final disposal, so that various crosses and methods of crossing can be compared and inbred lines evaluated.

About 50 spring and 20 fall litters are raised each year, and the pigs are measured for the five points of efficiency: (1) prolificacy, (2) vigor or livability, (3) rapid gains in weight, (4) efficiency in the utilization of feed, and (5) carcass quality.

New Sheep Breeds Sought

The University's success in the program of producing highly efficient swine has led to a similar project with sheep. The Waseca flock retains a mildly inbred line of registered Shropshires for comparison with a new breed in the making, designated as Minnesota 102. Crosses at Waseca involve the Shropshire, Leicester, Targhee (a new breed developed by the U. S. Department of Agriculture at Du Bois, Idaho), and Columbia breeds.

Selections from this new combination of inherited characters will emphasize qualities especially useful under southern Minnesota conditions: prolificacy, rapid growth, mutton quality, and heavy fleece. Since this project has only recently been started, the end results cannot be measured.

Dual-Purpose Dairy Herd

Other branch stations maintain herds of Holstein and Guernsey dairy cattle and small herds of beef Shorthorns. At Waseca, a dual-purpose herd of Milking Shorthorns has been used for experimental purposes since 1916. The herd was closed in 1938, and since then no outside breeding has been used.

A new project has recently been started—the crossing and inbreeding of these cattle, following the pattern which has been successful with Minnesota No. 1 and No. 2 swine. The bull being used in this new cross is himself a cross of the Brahman dairy breed, Sindi, with American Jersey. This bull is being used in breeding part of the station's Milking Shorthorn herd. A number of the old line Milking Shorthorns will be retained as a base for measuring results with the new procedures. Others have reported that one-eighth Brahman breeding gives good resistance to insects and heat. No one knows, however, how this cross will stand the cold of Minnesota winters. The experiment probably is the only one using Sindi breeding in Northern United States.

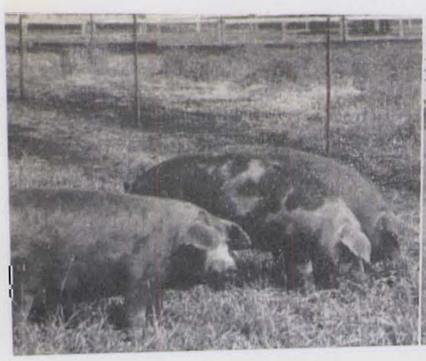
Horses have largely faded from the farm picture, but a team comes in handy for many operators. At Waseca, Percherons have been crossed with an Arabian, and the new strain is being tried. These horses are heavy enough for all ordinary work, but agile enough for pleasure riding. This is one of many minor projects.

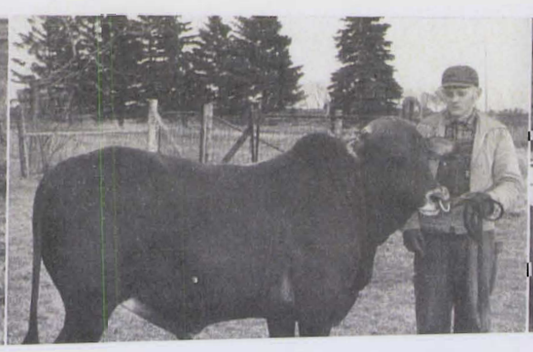
Pen-Type Barn Built

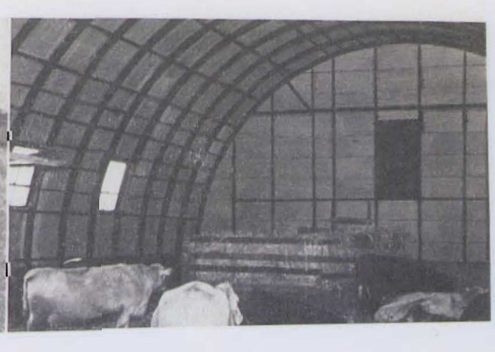
The station is also trying out a pen-type barn for managing the dairy herd and getting cows up on a platform to make milking easier. Other minor projects include making silage from first-cutting alfalfa, and drying hay by heated air forced through the material. So far, drying in "doughnut stacks" has been the most successful.

Like all the other branch stations, the plant at Waseca is a busy place. Caring for the stock and preparing seed grain keeps a crew of 13 busy through the winter months. In the summer, when field work is in full swing, as many as 75 men and boys are required. Letters, questions, visitors, and farmers' meetings spread the information gained from trying, testing, and criticizing new material, new methods, and new suggestions. It is the aim of those who spread this information to make farm operations in southern Minnesota more profitable and pleasant, and more satisfying for those who support and maintain this farm research center.

Animal breeding is an important part of the work at all of the University's experiment stations. Shown here from left to right are crossbred hogs, a Sindi-Jersey bull which will be used in crossbreeding with Milking Shorthorns, and finally part of the station's Milking Shorthorn herd.







Improve Your Stands of Legumes and Grasses

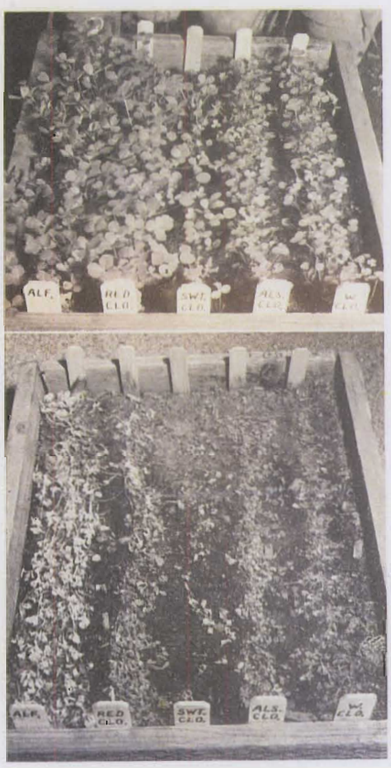
A. R. SCHMID and H. R. ARAKERI

NEGLECT your crop rotation and you may be neglecting the No. 1 key to farm success in years to come. A good crop rotation will furnish a sound foundation for better yields, for the conservation of soil, and for the maintenance of fertility.

The success of a good crop rotation in Minnesota will more than likely hinge on obtaining and maintaining a good stand of grass and legumes. The first requirement for a vigorous, successful stand of legumes and grasses is good soil condition. Most legumes grow poorly on acid soils. If soil is acid, apply lime before seeding. If soil lacks phosphorus or potash, add fertilizer.

Fertile nonacid soil alone, however, will not assure a good stand. Recent experiments by the University of Minnesota have pointed to several other essentials to good legume and grass stands.

A poorly-prepared loose seedbed often causes stand failures. The top layer of soil drys out more rapidly in such a seedbed than the same layer in a firm seedbed. As a result, the new seedlings may be left high and dry shortly after germination. For spring seedings, fall plowing is preferable, as it gives a firmer seedbed. When spring plowing must be used, extra discings or use of the cultipacker may bring about a firm seedbed.



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Above. Five legumes—alfalfa, medium red clover, biennial white sweet clover, alsike clover, and white clover—grown in the greenhouse three weeks.

Below. Same five legumes after having been hardened at 39.2° F. for two weeks, frozen at 14° F. for eight hours, and then left in the greenhouse one week. Note complete killing of all plants.

Avoid Seeding Too Deeply

Seeding too deeply is another common cause of stand failure. Seeding experiments conducted at University Farm show that the best depth for seeding small seeded legumes and grasses, such as alfalfa, sweet clover, red clover, alsike, and timothy, is ¼ to ½ inch.

Farmers commonly broadcast the small seeded legumes and grasses and then harrow to cover. With spring seeding under normal conditions this system usually produces satisfactory stands. During dry weather, however, using the cultipacker either before or after seeding, or both, aids materially in obtaining better stands. A method-of-seeding test, conducted at University Farm in the dry spring of 1948, showed that where the cultipacker was used following seeding, 56 alfalfa plants per square yard were obtained. Where harrowing followed seeding, only 21 alfalfa plants per square yard survived.

Since the ground is usually quite dry during the hot summer months a cultipacker is almost a necessity for summer seedings. Cultipacker seeders now on the market are ideal for seeding small seeded legumes and grasses.

Some of the larger seeded legumes and grasses can be seeded a little deeper. Brome grass, sudan grass, and millet, for example, will sprout well when planted one inch deep. These grasses, however, cannot be seeded as deep as oats or corn sometimes are. Since brome, sudan, and millet are commonly seeded with a grain drill, the drill should be set to seed shallow and still give good coverage.

Drouth Resistance Important

Another factor of importance in obtaining good stands is the drouth resistance of seedlings of different species. A quick-growing, tap-rooted plant such as alfalfa is easier to establish in midsummer than slow-growing fibrous-rooted plants such as most of the perennial grasses. For this reason alfalfa-grass mixtures seeded in July often result in a good stand of alfalfa but a poor stand of grass.

Sometimes a stand failure is due to a poor selection or management of the companion crop. The less competition offered by the companion crop for moisture and nutrients, the better the chances of obtaining a good stand. Flax is one of the best companion crops if the crop is to be harvested for seed. The use of flax is impractical for establishing sweet clover, however, because the sweet clover grows taller than the flax and interferes with its harvest.

The next best companion crops are the early, short-strawed, small grains. Weak-strawed varieties of oats and barley which are apt to lodge or a tall-growing crop like rye, if taken for seed, are undesirable as companion crops. If a small grain is used for a companion crop it should be seeded at ½ to ⅔ of normal rate per acre. For summer seedings, no companion crop should be used.

The management of the companion crop is also an important factor. Experiments conducted by A. C. Arny at University Farm have shown that better stands are obtained when the companion crop is cut for hay than when it is allowed to produce seed. Lenient grazing of the companion crop by cattle or sheep results in even better stands than cutting it for hay.

Seed at Right Time

Still another cause of stand failure may be seeding at the wrong time. Field experiments have shown that for most reliable results early spring seeding is best. There are times, however, when summer or fall seedings would be desirable if they could be established successfully. The question then arises, will the seedlings of various legumes and grasses established in the summer or fall survive the winter, and how well advanced must they be to survive?

To determine the comparative resistance of legume and grass seedlings to freezing injury, five grasses and five legumes were grown for various lengths of time in the greenhouse. These were then subjected to artificial hardening and freezing conditions. It was found that grasses showed much better survival to freezing than legumes, particularly at early stages of

growth. Grasses showed some weakness in survival at an early stage when only the second leaf was developing. But the survival was still sufficiently high to indicate that they may be seeded successfully in the fall—the earlier in the fall the better.

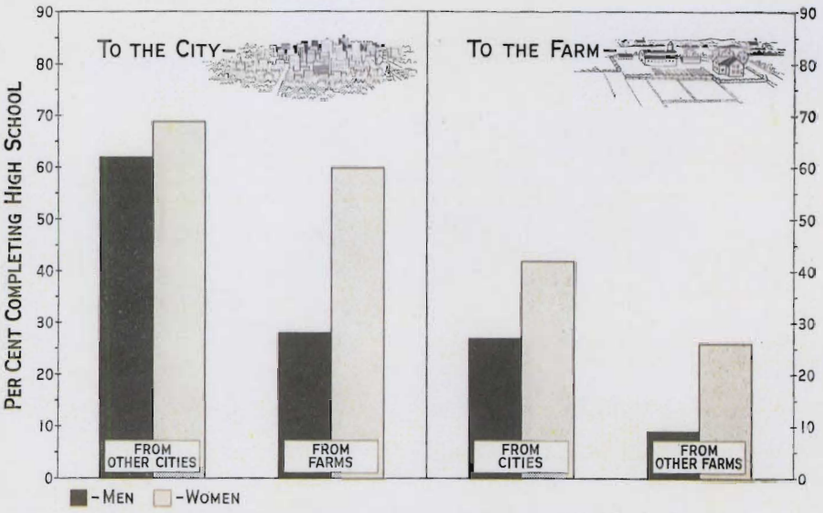
The five grasses tested were Lorain timothy, Lincoln brome, Kentucky bluegrass, meadow fescue, and reed canary grass. The latter three were from commercial northern-grown seed. Reed canary showed low survival from freezing while in the early stages of development, indicating that for field seedings it should be planted either early in the fall or late enough so that no germination occurs before winter.

How Legumes Survive Winter

After emergence from the soil but still in the early stages of development the legumes showed very poor survival to freezing. The five legumes tested were Ranger alfalfa, biennial white sweet clover, medium red clover, wild white clover, and alsike clover. The latter four were from northern-grown commercial seed. Alfalfa began to develop some resistance to freezing after four weeks of greenhouse growth. Medium red, wild white, and alsike clover began to show improved survival at five weeks of growth. Sweet clover survival was almost nil until after nine weeks of greenhouse growth. Although a week's growth in the greenhouse is not comparable with a week's growth in the field, the relative difference between these legumes grown in a greenhouse should indicate what might be expected in the field.

Field experiments at University Farm have shown that alfalfa plantings made much later than August 10 have consistently winterkilled. According to the greenhouse and freezing experiments, the chances of a stand of red clover, white clover, alsike clover, and especially sweet clover coming through the winter, if seeded as late as August 10, are not good. For summer seedings of alfalfa the safest policy is to seed before August 1. Even then, if the soil is so dry that no germination occurs for a few weeks, serious winter injury may result.

By following good seeding practices, such as using lime and fertilizer where needed, seeding at the proper time, seeding shallow on a firm seedbed, and reducing the rate of seeding of a companion crop, the normal seeding rate of the grass or legume can be reduced by as much as ⅓ to ½. Conversely, increasing the seeding rate is no substitute where these conditions do not exist.



Percent of migrants, age 25-34 inclusive, who had completed high school in 1940.

Who Loses in Migration?

DARCIE BYRN

EACH YEAR thousands of persons leave Minnesota farms for village, town, or city—or they move from one farm to another. In fact, the number of people leaving the farm in recent years has exceeded the natural increase, so that the actual number of farm people has declined while the state's population has remained about the same.

Migration is the process by which population redistributes itself in relation to resources, economic opportunity, and desires of individuals in regard to a place to live and the kind of work. In the process, however, various segments of the population are affected quite differently. Let us turn our attention to some specific aspects of migration as they affect the Minnesota situation.

Q: How many people are there in Minnesota?

A: According to the 1940 census, the population of Minnesota was 2,792,300. This included 1,427,545 males and 1,364,755 females. At that time Minnesotans made up slightly over two per cent of the nation's 131,669,275 population. Later the Minnesota Department of Business Research and Development placed the population for July, 1947, at 2,896,000 for Minnesota and at 142,628,000 for the United States.

Q: Are there more men or women in Minnesota?

A: Latest figures indicate that there were almost 105 males for each 100 females in the state. However, there were more females than males between 18 and 30. In the 20-24 age group there were only 99 males per 100 females.

The discrepancies between male and female numbers become more marked when we consider place of residence. In the farm areas, males outnumbered females 123 to 100, while in the cities there were 94 males per 100 females. These differences are greatest at the "marrying" age. Obviously then, many young people will have to look beyond their own age and residence group for a life companion.

Q: Where are the surpluses of males and females most likely to be found?

A: Considering the whole population, there were 102,764 extra males in rural areas, while there were 39,974 extra females in the cities.

Q: How many migrants are there in Minnesota?

A: The census people picked up this information by checking the 1935 and 1940 addresses of each person. If a person's former address was in another county, he was automatically listed as a migrant.

On this basis, 328,663 persons, or 12 per cent of Minnesota's population, were migrants to some degree. Of these, 162,053 were males and 166,610 were females, a surplus of over 4,000 females.

Q: Are there more long or short moves?

A: By classifying moves within the state as short ones and those across state lines as long ones, the short moves have a decided edge.

Q: Do farm people move as frequently as city people?

A: Proportionately, there are about as many migrants in the country as in

(Continued on page 13)

Government officials grade all beef carcasses.

Marketing Slaughter Cattle *by Carcass Weight and Grade*

A. A. DOWELL, GERALD ENGELMAN, E. F. FERRIN, and P. A. ANDERSON

WOULD IT PAY farmers to sell their cattle by carcass weight and grade rather than by liveweight as done today? This question has been asked by many farmers and businessmen in the past few years.

Under our system today, buyers inspect the cattle and then estimate their dressed yield and carcass grade. They bid for the cattle on the basis of this observation. The accuracy of the prices they offer, therefore, depends upon the accuracy of their estimates.

In this study the actual yield was determined by weighing the carcass after slaughter and the actual grade was given by a United States Department of Agriculture grader. Thus, the differences between estimated and actual yield and grade were determined. By looking at these differences in terms of dollars and cents, it was possible to measure what advantage, in accuracy of pricing, the carcass weight and grade method holds over the present liveweight method.

The Divisions of Agricultural Economics and Animal Husbandry of the University of Minnesota have been studying and comparing the two methods for the past three years. Since this work was started the North Central Livestock Marketing Research Committee has adopted "Marketing Slaughter Livestock by Carcass Weight and Grade" as a regional project.

The University's study on beef cattle was conducted at the Geo. A. Hormel and Co. packing plant at Austin, Minnesota. Data were obtained on 400 slaughter cattle, including 219 steers, 76 heifers, and 105 cows. An experienced packer buyer estimated the dressed yield of each animal on the hoof to the nearest one-half per cent and the carcass grade on the basis of the upper one-third, middle one-third, and lower one-third of each official grade. The chilled carcasses were graded by one government grader on the basis of the upper, middle, and lower one-third of each official grade. This was called the "actual grade."

The prices for carcasses used in this study are based upon the unweighted average wholesale price of good grade beef steer carcasses at Chicago during 1947. Price differences between official grades were adjusted on the basis of the differentials of 1937-41.

How far off was the buyer's estimate made on the live animal? Table 1 shows the figures on one lot of 20 steers, the total price error per 100 pounds liveweight, and what part of this error was due to estimating yield and what part to estimating grade.

Actually, errors in this lot ran from $1.82 too little to $2.31 too much per hundredweight. On this basis, the error in price for a 1,000-pound steer would be from $18.20 too low to $23.10 too high.

In some cases a price error in estimating yield was offset by an error in estimating grade. More often, however, the two price errors were in the same direction. If the buyer overestimated yield, he tended to overestimate grade, also. Although there is a tendency for

Table 1. Difference between Estimated Price and Actual Value per 100 Pounds Liveweight of Individual Animals in a Sample Lot of Slaughter Steers*

Steer number	Estimated price per 100 pounds liveweight	Actual value per 100 pounds liveweight	Price error per 100 pounds liveweight: Total price error	Part of total due to error in estimating: Yield	Part of total due to error in estimating: Grade
1	$23.83	$22.54	$+1.29	$+1.29	$ .00
2	24.03	22.15	+1.88	+1.03	+ .85
3	22.36	22.51	— .15	+ .67	— .82
4	23.85	23.44	+ .41	+ .41	.00
5	22.36	24.18	—1.82	— .20	—1.62
6	22.56	22.38	+ .18	+ .18	.00
7	23.62	23.90	— .28	— .28	.00
8	23.82	22.43	+1.39	+ .54	+ .85
9	24.06	23.93	+ .13	+ .13	.00
10	24.06	24.39	— .33	— .33	.00
11	22.15	22.74	— .59	+ .95	—1.54
12	23.82	21.51	+2.31	+ .62	+1.69
13	23.62	23.62	.00	.00	.00
14	23.41	22.82	+ .59	— .28	+ .87
15	23.62	22.59	+1.03	+1.03	.00
16	22.36	23.88	—1.52	— .64	— .88
17	24.05	22.92	+1.13	+ .26	+ .87
18	24.26	24.16	+ .10	+ .10	.00
19	23.82	22.38	+1.44	+ .59	+ .85
20	24.05	23.77	+ .28	— .62	+ .90
Lot average	23.49	23.10	+ .39	+ .26	+ .13

* This lot appears as Lot 5 in table 2.

price errors between individual animals to cancel each other, the price error for the entire lot in table 1 was +$.39 per 100 pounds liveweight.

The difference between estimated price and actual price was less for steers and heifers by lots (table 2) than for individual steers and heifers. The range in total price per 100 pounds liveweight for 18 different lots was from −$.95 too little to +$1.54 too much. On the basis of 20 head of 1,000-pound animals per lot, this would amount to an underestimate of $190 for one lot and an overestimate of $308 for another. The tendency for price errors between lots to cancel each other to some extent is shown in table 2.

The errors in estimating the yield and carcass grade of individual cows were somewhat greater than those for individual steers and heifers. On a dollars and cents basis, however, the total price error per 100 pounds was less for cows than for individual steers and heifers. This was because cow carcasses are worth less than steer and heifer carcasses.

On the basis of the data obtained and prices used in this study, about 33 per cent of the individual cows on foot would be expected to be priced within a range of $.50 per 100 pounds above or below their actual value, compared with 29 per cent of the individual steers and heifers, and 47 per cent of the steers and heifers by lots. Similarly, about 60 per cent of the cows would be priced within a range of $1.00 per 100 pounds above or below their actual value, compared with 55 per cent of the individual steers and heifers, and 79 per cent of the lots. The price error would be expected to exceed $2.00 per hundredweight for 9 per cent of the individual cows, for 13 per cent of the individual steers and heifers, and only rarely in the case of lots. These comparisons are based upon 1947 beef price levels.

It is probable that all producers combined receive about the same amount of money for all cattle sold under the present liveweight method as they would receive under the carcass weight and grade method. This study indicates, however, that under the carcass method the money would be distributed differently among the different sellers. The returns would be distributed more nearly in line with the actual value of the product delivered. The cattle feeder who sells one or more carloads at a time is interested to know how closely buyers can estimate the value of his cattle by lots. Many Minnesota farmers, however, sell individual cows, bulls, steers, or heifers, or small lots of two or three head at a time. They are interested in the accuracy with which buyers can estimate the value of individual animals.

It appears that other gains in marketing effectiveness would be associated with selling cattle on the carcass basis. The improvement in pricing accuracy would lead to a more effective utilization of resources in the production and fattening of cattle. Excessive filling before sale would be greatly reduced. A more accurate language for price quotations would be provided and sale by description would be encouraged. Producers would then have more information concerning the worth of their animals and would be placed in a stronger bargaining position.

Further studies are needed to verify or modify these findings. The practicability of carcass selling under conditions existing in this country also needs to be thoroughly studied.

Table 2. Difference between Estimated Price and Actual Value per 100 Pounds Liveweight of Slaughter Steers and Heifers by Lots*

Lot number	Number of head	Estimated price per 100 pounds liveweight	Actual value per 100 pounds liveweight	Price error per 100 pounds liveweight		
				Total price error	Part of total due to error in estimating	
					Yield	Grade
1	15	$23.13	$22.23	$+ .90	$+ .15	$+ .75
2	10	25.55	25.16	+ .39	− .38	+ .77
3	15	26.68	26.40	+ .28	+ .51	+ .13
4	15	24.93	24.72	+ .21	+ .34	− .13
5	20	23.49	23.10	+ .39	+ .26	+ .13
6	19	25.73	24.44	+1.29	+ .46	+ .83
7	16	28.58	27.94	+ .64	− .08	+ .72
8	15	27.78	27.04	+ .74	− .08	+ .82
9	6	22.51	23.28	− .77	− .13	− .64
10	17	23.88	23.95	− .08	− .21	+ .13
11	11	22.46	22.13	+ .33	+ .31	+ .02
12	10	23.39	23.52	− .13	− .23	+ .10
13	14	21.84	21.87	− .03	+ .15	− .18
14	13	28.76	27.22	+1.54	+ .15	+1.39
15	13	28.68	27.54	+1.14	+ .57	+ .57
16	11	26.19	25.03	+1.16	+ .54	+ .62
17	13	24.85	25.80	− .95	− .80	− .15
18	18	21.59	22.46	− .87	− .61	− .26

* The lots are arranged in the order in which they were purchased and slaughtered.

Migration . . .

(Continued from page 11)

the city—about 10 per cent for both males and females. In actual numbers, however, there are many more in the cities.

Q: Where do people go when they move?

A: In many cases they go to another place much like the one they left. Of the 62,000 farm migrants within the state, 61 per cent of the males and 51 per cent of the females moved to other farms. Twenty-two per cent of the males and 31 per cent of the females wents to cities, while the remainder found places in small towns, villages, or other places with less than 2,500 population.

Q: Who gains and who loses in this interchange?

A: Towns, villages, and cities have a net gain, while farms have a net loss. The towns and villages gained 4,692 males and 2,081 females; farms lost 2,503 males and 6,272 females; cities gained 4,191 females and lost 2,126 males.

It is evident that the farm population is a heavy loser in this exchange. The way the sex ratio is further distorted by the loss of almost 4,000 more females is but one of several critical aspects of the picture. One might also consider the effect on labor supply, the educational drain, qualifications of the replacements, nationality and religious differences, and many other equally important features.

Q: What does education have to do with migration?

A: In so far as Minnesota is concerned, the migrants are almost invariably better educated than comparable groups of nonmigrants. On the part of migrants there seems to be a strong trend toward more formal education. Or, to put it another way, the more one is educated, the more apt he is to migrate. The 25-34 age group is about the youngest group likely to have completed its education before migrating, so by studying the 1940 census figures on this group we can get a picture of the latest trends both in education and in educational preparation for migration. In rural areas, about 13 per cent of the nonmigrant men finished high school, whereas 45 per cent of the city men who did not move finished high school. On the other hand 28 per cent of the farm to city migrants and 65 per cent of the city dwellers who later went to other cities completed high school.

Q: How do females compare?

A: The direction is the same and the difference is even more extreme.

Q: Do the better educated people also move from city to farm?

A: Unfortunately for the farm interests, no. Among migrants from cities to farms in Minnesota, only 27 per cent of the men and 42 per cent of the women finished high school. High school attendance is almost invariably lower in farm areas, with attendance of migrants the lowest of all. Among those moving from one farm to another the percentage of those attending high school was 9 for males and 26 for females. This trend can leave little doubt that both the farmer and the city dweller have similar views as to the relative importance of higher education for a career in agriculture.

Q: What about those with grade school education?

A: Here we encounter a slightly different situation. For one thing, there is much less opposition to giving every child at least an elementary school education. Then, too, there are the compulsory school laws to discourage the tendency of some to drop out sooner. We realize, of course, that these laws cannot always be enforced, particularly among the more mobile members of the population. This explains why the people in the lowest educational levels always include many migrants who have crossed state lines.

Whatever the reasons might be, most of the 25-34 age group completed elementary school. We still find that the females have the advantage in formal education, with 95.7 per cent completing the eighth grade compared to 94.9 per cent for the men. The rural-urban difference is also present: 96.5 per cent urban males and 97.4 per cent urban females compared to 92.6 farm males and 95.6 farm females completed the eighth grade. A similar slight percentage lead is found for migrants over nonmigrants, both rural and urban.

Q: How about college education among migrants?

A: The same trends prevail on this level. The number who have been college trained is much smaller, and, therefore, the percentage difference between migrants and nonmigrants does not show up as great as for high school. In some respects, however, it is even more marked.

Q: Just how great was the numerical loss to the farm population?

A: We must remember that some of the out-migrants from the farms were replaced with migrants of similar educational qualifications from towns and cities. After balancing the number leaving the farm population against those entering, we discover a loss to the farm group of 661 persons, 328 males and 333 females, in the 25-34 age group. If we wish to consider just those with college education, the net loss was 124—72 males and 52 females. For the entire 25-34 age group there was a loss of almost 2,000—1,302 males and 694 females. Rather surprisingly, the cities were not the winners of the exchange. Although the greatest number of migrants in this age group went to the cities, an almost identical number of them left the cities. In fact the cities showed a net gain of only nine persons. The big winners were the small towns and villages.

Q: What is the financial loss to the farm population from this exchange?

A: Estimates of the cost of raising a child to the age of 21 years range all the way from $6,000 to $30,000 per child. Some extreme estimates have gone as high as $65,000. Considering $6,000, which comes to less than $.80 a day, as a minimum estimate, we arrive at a figure of $3,966,000 for the 661 with high school education. The farm loss in the entire age group moves up to almost $12,000,000.

Trends in Migration

1. About 12 per cent of Minnesota's population moves from one county to another every five years (1935-40 figures).

2. More females than males leave the farm for the city, especially in the usual marriageable ages. Thus many farm boys are unable to find wives on the farm.

3. The majority of migrants move short distances and go predominantly to residential areas similar to those they left. In other words they move from farm to farm, village to village, and city to city. Farms, however, lose more people than they gain.

4. Migrants are generally better educated than nonmigrants, regardless of sex or place of residence. However, farm areas lose more of the better educated than they get back. The villages are the chief beneficiaries.

5. The net migration from farm to city represents a financial contribution of millions of dollars to the labor forces of town and city.

Bang's Test . . .

(Continued from page 1)

per cent of the herds in a predominantly dairy county.

2. The ring test is positive on 70 per cent of the infected herds. Of 107 failures to detect the infection in the herd, 65 per cent of the failures were due to the fact that the only infected animals were not producers at the time of the test. This illustrates the importance of conducting the test at a time of year when a high percentage of cows are in production.

In counties where dairying is predominant, one county-wide test may locate from 50 to 60 per cent of the infected herds and two tests 6 months apart many disclose from 75 to 80 per cent of the reactor herds.

3. Blood tests on herds giving positive ring tests show 56 per cent to have one or more reactors, 12 per cent to have one or more "suspicious" animals, and 32 per cent to be negative. If herds showing animals with suspicious blood tests are considered as agreeing with the ring test, this gives a 68 per cent agreement between the two tests.

Of the herds giving positive ring tests on cream, 60 per cent were classed as infected, 10 per cent as suspicious, and 30 per cent as negative to the blood test. This was an overall agreement of 70 per cent.

The sensitivity of the ring test could easily be changed to reduce the number of false positive reactions, but then significant numbers of infected herds would be missed. If with the aid of the ring test it can continue to be possible to locate 6 infected herds for each 10 herds blood tested, the test will be most helpful in the Bang's disease control program.

In the counties under the area control program in Minnesota the percent of infected herds is low. To keep the infection under control it is necessary to conduct blood tests on 20 to 100 herds to find one infected herd. Thus the time and expense of locating an infected herd with the blood test alone is quite great.

It is estimated that the cost of a county-wide ring test is about 10 per cent of that for a county-wide blood test. If used regularly once or twice a year in the counties under the area plan, the ring test would make fewer county-wide blood tests necessary and would save much time and expense.

We have had very fine cooperation from the dairymen and creamery managers in our experimental work on the ring test and the enthusiastic response of the herd owners is very encouraging. Because of the apprehension of the dairymen in the counties under the area plan regarding the condition of their herds during the long periods between tests (3 to 6 years), these men would welcome more frequent checking. The earlier the infection is disclosed, the more promptly they can cope with it.

The test seems to be of little value to individual herd owners. When it is used on an individual-animal basis a significant percentage (3 to 5 per cent) of negative cows give false positive

tests. This is because of peculiar physical properties of the milk from a few animals. If such milk is mixed with milk from several negative cows, a negative reaction is obtained. This is why the test is more reliable on a herd basis or on mixed milk. Because the ring test is very sensitive and by itself does not furnish final proof that an animal or a herd is infected, positive ring tests should be followed up with blood tests.

The ring test would probably be used best in an official type of cooperative program which involves the cooperation of the dairymen, creamery and milk processing organizations, and the animal disease control groups. Such a program should provide for follow-up blood tests on herds showing positive ring tests and provide help to owners with infected herds.

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Future of Dry Milk . . .

(Continued from page 7)

Table 2. Average Manufacturing Costs per Pound of Dry Milk Produced in Minnesota Spray and Roller Drying Plants, 1947

Cost Item	Average cost per pound	
	22 spray plants*	24 roller plants*
	cents	
Plant Expense:		
Labor and payroll taxes	1.19	1.06
Packaging supplies	.88	.81
General supplies	.21	.14
Fuel	1.05	.64
Power, light, and water	.06	.27
Plant maintenance	.19	.18
Depreciation and rent	.55	.27
Other	.02	.03
Total	4.15	3.40
Administrative and General Expenses:		
Administrative	.11	.16
General	.17	.14
Total	.28	.30
Total manufacturing cost	4.43	3.70

* Includes only human food plants.

proportion to output. When volume falls, the plant usually hesitates to lay off experienced men because they may not be available during the next flush season.

Prices of milk are usually higher in the fall and winter than during the flush production months of May and June. Farmers must balance higher prices against higher feed costs and competition labor in deciding whether to shift from spring to fall freshening or to adopt other means of increasing fall production.

Market Development Needed

In view of the current decline in prices, the industry needs more than ever to expand and develop new markets both at home and abroad. The use of dry milk in commercial products such as bakery goods, candies, and prepared food mixes as well as in institutional feeding for hospitals, sanitoria, schools, and cafeterias should be promoted aggressively. There is pressing need for educational and promotional programs to increase the use of dry milk products in home baking and cooking.

Efficiency of drying plant operation must be increased. Plants with greater volume of output should be encouraged, and powder production should be kept as nearly as possible at full plant capacity throughout the year. Plant layout, management procedures, and fuel utilization should be examined to make sure that operations are carried out as efficiently as possible. Introduction of more labor-saving equipment and methods should be considered.

There is a continued need for high quality products. Plant inspections are likely to become more exacting. As supplies become more ample, buyers will insist on the best-quality dry products. Quality is a joint responsibility of farmers, creameries, and the drying plants.

The market outlook for farmers selling milk to drying plants depends on how well the industry is able to make needed market developments and adjustments. If domestic and foreign markets are expanded as government purchases decline, prices of dry milk products are likely to remain at fairly high levels. Favorable prices coupled with efficient operation and low manufacturing costs could mean relatively high skimmilk prices for Minnesota farmers and a bright future for the dry milk industry. Failure to develop markets and to increase efficiency, on the other hand, will result in low skimmilk prices, the diversion of more milk to livestock feeding, and a slump in the Minnesota dry milk industry.

Table 3. Relationship between Manufacturing Costs per Pound of Dried Milk and Annual Volume of Output in 22 Minnesota Spray Drying Plants, 1947

Cost Items	Powder production in millions of pounds			Average all plants
	0-3.9	4.0-5.9	6.0 and over	
	cents per pound			
Plant Expenses:				
Labor and payroll taxes	1.42	1.17	1.08	1.19
Packaging supplies	.87	.90	.86	.88
Fuel	1.33	1.05	.98	1.05
Depreciation and rent	.61	.64	.44	.55
Other	.61	.45	.44	.48
Total	4.64	4.21	3.80	4.15
Administrative and General Expenses:				
Administrative	.14	.14	.07	.11
General	.25	.19	.10	.17
Total	.39	.33	.17	.28
Total manufacturing cost	5.03	4.54	3.97	4.43
Number of plants	9	7	6	22

A Century of Progress . . .

MINNESOTA
FARM AND HOME SCIENCE

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May, 1949

THIS YEAR we are observing the Minnesota Territorial Centennial. One hundred years ago what is now our state, and a part of our neighboring states of North and South Dakota, became the Minnesota Territory. In 100 years since 1849, this state has undergone many changes.

In the field of agriculture, the Minnesota Agricultural Experiment Station has contributed toward bringing about many of these changes. The Experiment Station has not existed throughout Minnesota's entire 100 years, but it is interesting to note that very early in the history of what is now our state, the thinking of the pioneers was concerned with the need for agricultural education and research. It is also of interest to note that the demand for these things came from the farmers themselves.

Undoubtedly, farmers of the early days found here a new environment which presented problems different from those they had encountered in their old homes. The late Dr. Andrew Boss pointed out, in a bulletin issued on the fiftieth anniversary of the Experiment Station, that the Territorial Agricultural Society, organized in 1854, was the first organization to actively push the idea of an experimental farm. In 1858, an act of the Legislature provided for the establishment of a State Agricultural College and experimental farm.

In 1868, the Reorganization Act for the University of Minnesota provided that the Regents were to obtain land for an experimental farm. The Experiment Station, as it now exists, came into being officially with a Legislative Act approved on March 7, 1885.

From a small beginning the experiment station has developed and expanded. In addition to the original station at University Farm, branches have been established at Waseca, Rosemount, Excelsior, Morris, Crookston, Grand Rapids, Duluth, and Cloquet. A biological station has also been set up at Itasca State Park. Numerous experimental projects are carried on about the state in cooperation with individuals and firms.

This Centennial Year is devoted not only to looking into past history and honoring those pioneers who laid the foundation for a great state, but also to looking forward into the future. These are confusing times in which we live. There is need for clear thinking in every field of endeavor. Someone has said that he who plows straight does much, but he who thinks straight does more.

Certainly, if those of us who are engaged in agriculture and related occupations are to fulfill our obligations to the world, we must make every effort to think clearly on those problems which now confront us.

Thinking is an important part of the research worker's daily life. From his thinking comes a design for proving an idea false or true. Minnesota Agricultural Experiment Station workers make no claim for being infallible in their thinking and their ability to solve the problems of this day. They do, however, take pride in the fact that they approach each problem with an open mind and allow the results to tell the story.

In a few months the Centennial Year will be over. Problems will still be with us. Working together, the farmers and the Agricultural Experiment Station will solve many of these problems, only to have others take their place. Let us look forward with confidence to the future, and with thankfulness in our hearts that the pioneers of an earlier day did recognize the importance of agricultural education and research. We can do no less than carry on the work for which they laid the foundation.

Theodore H. Fenske

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