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Keep Your Eye on *New Dairy Products*

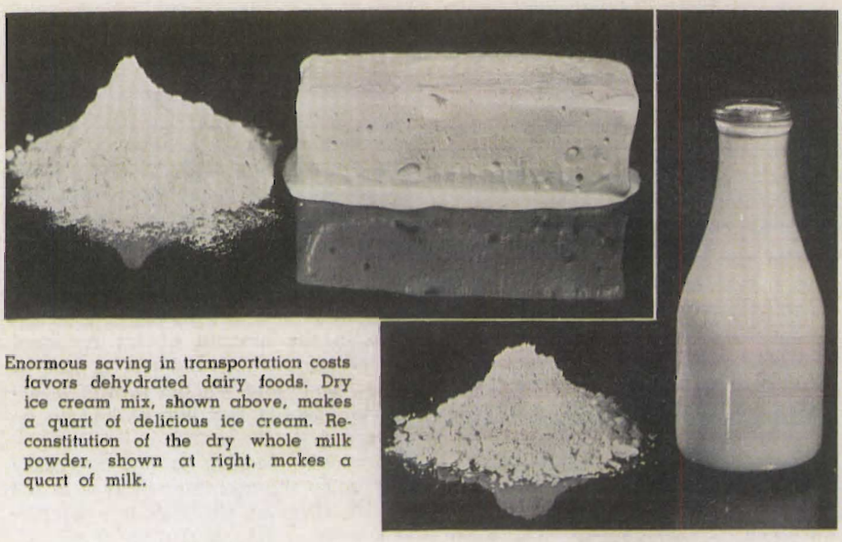
W. B. COMBS and S. T. COULTER

WANTED: a reliable and profitable market for 10 billion pounds of Minnesota milk annually!

For a number of years dairy producers and manufacturers have seriously considered this problem, and dairy research at University Farm has concentrated on improving the quality and increasing the variety and usefulness of dairy products. Minnesota, now the second largest producer of milk, must sell approximately 80 per cent of its production outside the state.

While the rapid shift to marketing of whole milk during the war has complicated the marketing problem, the dairy producer can take cheer from the likelihood that new methods and new products may come to the rescue when he needs new outlets.

The question of whether dairying can be profitable when cream alone is sold has been frequently debated. Actually in 1935 only 9.2 per cent of the milk produced in the state was marketed as whole milk. In 1945, however, it is expected that nearly 30 per cent of the output will be sold as whole milk. It is known from past experience that once a producer turns from selling cream to selling whole milk, he is not likely to go back to cream.



Enormous saving in transportation costs favors dehydrated dairy foods. Dry ice cream mix, shown above, makes a quart of delicious ice cream. Reconstitution of the dry whole milk powder, shown at right, makes a quart of milk.

Starting with a limited output at University Farm, Minnesota Blue Cheese, similar to the imported Roquefort, now ranks second only to Cheddar in the cheese industry of the state.

The swing to whole milk marketing resulted largely from the government demand for milk products, especially dry milk for human consumption. Prior to the war only about 35,000,000 pounds of dry skim milk were made in the state. In 1945 this figure will be boosted to around 200,000,000 pounds, of which 90 per cent or more will be used for human food. In addition, around 20,000,000 pounds of dry whole milk will be processed in the state and 15 to 20 million pounds of dry ice cream mix. To provide capacity for this tremendous increase in volume of dry milks, 33 large central drying plants have been equipped in Minnesota alone. It can be expected that these plants now mostly making dry milk will eventually equip themselves to make a greater variety of milk products.

To sell in large quantities on out-of-state markets, milk of good quality must be in a form attractive to the consumer and priced to meet competition

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Research Lends a Hand in *Meat Cookery*

ISABEL NOBLE

NOW that roasts do not grace the dinner table as frequently as they once did, they command far more attention. Naturally we want them to be as tender, juicy, and tasty as possible every time we serve them. Experiments show that we can make them so by following the methods recommended by the cooking committee of the National Cooperative Project on Meat.

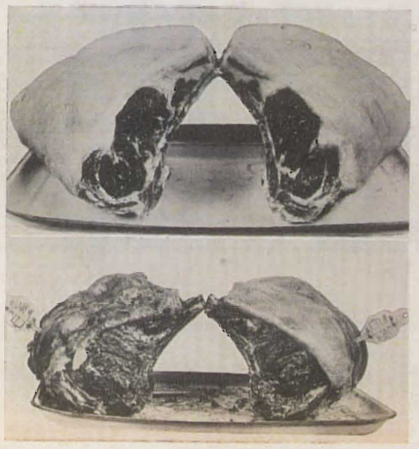
This committee is composed of staff members from various state agricultural experiment stations and the Bureau of Human Nutrition and Home Economics, U. S. Department of Agriculture, who have been interested over a period of years in developing methods of cooking which will give the most palatable product. Minnesota has taken an active part in the work from its beginning, one of the early workers having been the late Miss Alice Child. The present staff is engaged in finding what effect the methods recommended by this committee have upon the vitamin content of the meat.

The general principles underlying the recommended methods of cooking meat are simple and few in number. The first is to cook tender cuts with dry heat, and less tender ones with moist heat; the second is to cook all meat at a low temperature.

Now, let's see how these principles apply to roasting. First of all, only tender cuts should be chosen for this method, because it is a "dry heat" method of cooking. (The term "roasting," when applied to meat, is limited to cooking, uncovered, without the addition of water, in an oven. If the pan is covered, the method is "pot-roasting" or "braising," regardless of whether or not water is added and whether the heating is done on top of the stove or in the oven.) Any tender cut of meat can be used, but in order to have attractive servings, chunky pieces which can be sliced across the grain are usually selected. Most of these cuts are too familiar to need listing, but perhaps it should be mentioned that the chuck ribs, rump (particularly, if rolled), and top round from choice beef animals make good roasts.

Searing Is Unnecessary

Secondly, all roasts should be cooked, preferably without searing, in a moderately low oven (300-350 degrees Fahrenheit). The practice of searing was based upon the theory that quick browning of the outside of a roast



Effect of roasting temperature. (Top) Standing ribs weighing the same. (Bottom) Same ribs after roasting. Left, roasted at 450° F., and, right, roasted at 300° F., both to an interior temperature of 140° F.

"sealed in" the meat juices and thus prevented their loss. Experiments have proved this idea to be incorrect. They have shown, in fact, that roasts which were seared lost greater weights during cooking than similar ones which were not seared. The difference in weight-loss was due mainly to a difference in the amount of fat rendered out of the tissues, and not to loss of juices. Therefore, the old idea of "searing to keep in the juices" had to be discarded.

Moreover, searing is not necessary to develop the aroma and flavor in the outside slices or the rich brown color of a roast or drippings that is so enticing, if the roasting temperatures to be discussed later are used. Indeed, in some experiments, roasts which were not seared were judged more attractively browned than ones which were seared. Thus, unless unusually brown roasts are wanted, it is best to follow the lead of experimental laboratories and omit the searing procedure.

High Temperatures Shrink Meat

Moderately low oven temperatures are recommended for a number of reasons. One of the most important is that they cause much less loss in weight from the meat during cooking than do high temperatures, and thus give more plump, juicy roasts. This point is well illustrated above in the picture of the roasts standing end to end. The one on the lower left, which was roasted in a hot oven (450° F.), has obviously shrunk back from the tip of the bone much farther than the one at the right, which was roasted at 300° F.

Just how much the shrinkage may amount to will vary with the oven temperature, the kind of roast, and many other factors, but for eight- to nine-pound standing rib roasts, differences of one to one and a half pounds in the weights of cooked roasts have been found experimentally. That the number of servings is definitely reduced also is shown by the tape measure on the standing rib roasts pictured below. When raw, the roasts were the same width, but during cooking the roast on the left (that is, the one cooked in the low temperature oven) decreased only one inch in width, while that on the right (cooked in a high temperature oven) decreased two inches.

Low Temperatures Cook Uniformly

Another reason for recommending moderately low, rather than high, oven temperatures is that the roasts are uniformly done with the low temperatures, while they are unevenly cooked by high ones. The uniformity, or lack of it, is most easily recognized in rare beef roasts because the color is indicative of the degree of doneness. The meat connoisseur wants all but the very edge of each slice of such a roast to be cooked to just that shade of pink-

Effect of oven temperature on meat shrinkage. (Top) Beef ribs before roasting measure alike. (Bottom) Same ribs after roasting. The one on the left, roasted at 210° F., decreased one inch in width; that on the right, roasted at 482° F., decreased two inches.

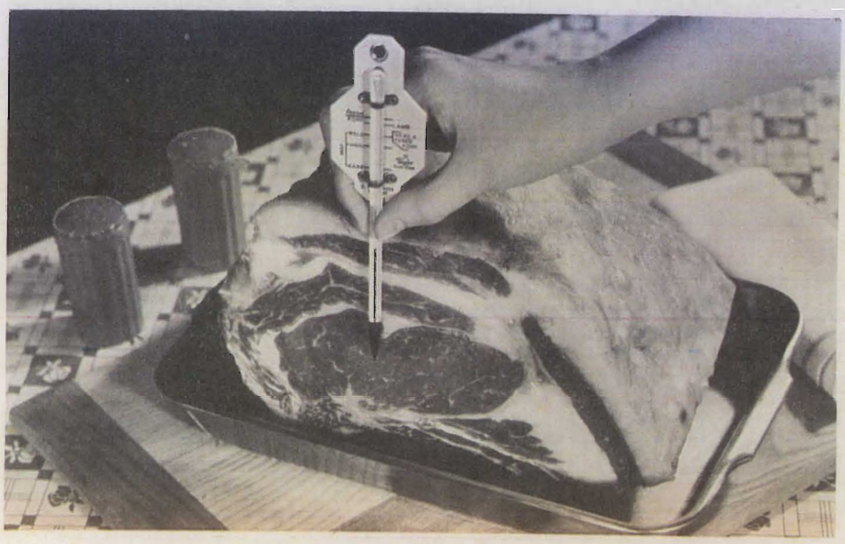
ness that corresponds to the degree of doneness he likes best. A piece of meat roasted at a high oven temperature will not be like that. Rather, the slices from the outside will be brown, while those from the inside will be brown around the edge and various degrees of pinkness in the center. Now, in the case of the rare roasts, you may not agree with the connoisseur because your family may have varying tastes, but in all other cases an evenly cooked roast is more desirable than an unevenly cooked one because it is more juicy.

Experiments at the Minnesota Experiment Station and elsewhere have shown that the almost universal home practice of allowing a certain number of minutes per pound of meat cannot be expected to produce the same degree of doneness in all roasts because many factors affect the time required. These are: (1) the oven temperature, (2) the degree of doneness desired, (3) the temperature of the raw meat, (4) the weight of the roast, (5) the composition of the meat, and (6) the degree of ripening of the meat. The first three factors have been taken into account in the most carefully prepared timetables. (The original temperature of the meat is usually assumed to be that of an average refrigerator, unless otherwise specified.) But the effects of the last three factors are difficult to incorporate into a table and so are omitted. In general, a small roast requires more minutes per pound than a large one, although, of course, the total time is less because of the smaller weight. A fat roast requires longer per pound than a similarly shaped lean one because the rate at which the heat penetrates is retarded by the solid fat. Unripened meat requires more time to roast than does ripened.

Thermometer Indicates Doneness

One way of always obtaining the same degree of doneness is to use a meat thermometer. Before the war there were several types on the market; these undoubtedly will soon be available again. The thermometer is inserted in the roast so that the bulb reaches the center of the largest muscle, but does not touch bone or only fat. As the heat from the oven penetrates the meat, the temperature at the center gradually rises. When the thermometer reads the internal temperature that indicates the desired degree of doneness, the roast is removed from the oven.

Whether or not a roast should be floured, when it should be salted, and whether or not it should be basted are all questions which may arise. Unfloured roasts have been found to be a little more desirable than floured



Thermometer should be inserted so the bulb reaches the center of the largest muscle but does not touch bone or fat. When thermometer reads internal temperature indicating desired degree of doneness, the roast should be removed from the oven.

ones because the latter are more likely to scorch. The drippings from the floured roasts are a more attractive brown, but if they are to be used for gravy, the same results may be obtained by browning the flour in the drippings at the time the gravy is made. At present, the time of adding the salt seems unimportant and, therefore, each cook may follow her own preference. Basting is not necessary if the roast is placed in the pan with the fat side up, because then the fat as it melts runs over the cut surfaces of the meat, and forms a self-basting roast. If the roast is lean, like veal, a layer of fat, such as strips of bacon or salt pork or pounded-out fat, should be placed on top.

The results of the experimental studies of the cooking committee of the National Cooperative Project may be summarized in the following rules which apply to the roasting of all kinds of meat:

1. Place the roast fat side up in the pan (or if lean, cover with slices of bacon, salt pork, or other fat) in order to make it self-basting.

2. Do not sear unless an unusually brown roast is desired, because searing does not keep the meat juices in, and it does cause the roast to lose an unnecessarily large amount of fat.

3. Use a moderately low oven temperature: 300° or 350° F. for beef, 300° F. for lamb, veal, and smoked pork, 350° F. for fresh pork. A low roasting temperature will produce a more plump, juicy, and appetizing roast, and one that will cut into a larger number of servings than will a high roasting temperature.

4. A meat thermometer is the only accurate means available to homemakers of telling when a roast is done. Beef roasts are rare, medium, and well-done at interior temperatures of 140°, 160°, and 176° F., respectively; lamb roasts are medium and well done at 175° F. and 180° F., respectively; veal and smoked pork roasts are done at 170° F., and fresh pork roasts at 185° F.

The experiments completed so far in our laboratory on the vitamin content of meats cooked according to the committee recommendations indicate that beef roasts retain around 55 per cent of the amount of thiamine they contained when raw, while lamb roasts retain about 70 per cent, and pork about 63 per cent. Other workers agree in general with these figures for thiamine retention. They report, also, average retentions of 77, 85, and 90 per cent of the riboflavin originally present in beef, lamb, and pork roasts, respectively. A little greater proportion of both these vitamins is retained if the drippings are used.

Strong overwintered colonies of bees are more valuable for pollination of fruit trees in the spring than are packaged bees arriving from the South. Finding the most economical way to overwinter bees in Minnesota will aid both the beekeeper and fruit grower.

Muskmelons can lose 25 per cent of their leaves at any stage of growth without materially affecting yield and quality and can lose 50 per cent of their leaves early in the season without serious injury to yield or quality.

MOLDS IN YOUR AIR

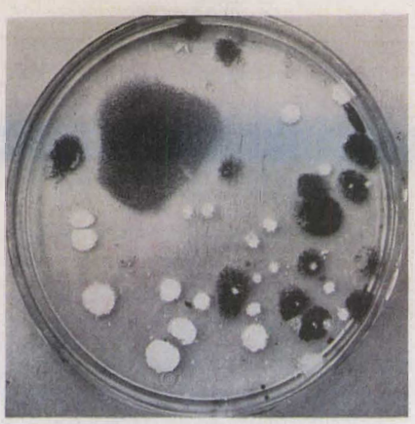
CLYDE M. CHRISTENSEN

YOU probably accept the air around you as something to be inhaled and exhaled without thought as to its content. It may seem a bit strange that research men should spend their time and your money in looking for invisible things in the apparently clear air. Yet this sifting of the air for contraband cargo is one of the important activities of modern science, and has borne very practical benefits for agriculture, industry, and the individual. Its future contributions may be even greater.

To prove that the air is full of mold spores we need only to take a few slices of fresh bread, put them in a tightly closed, moist container, and leave them for a few days. Invariably they will be covered with a lush growth of a number of different molds. In the laboratory we use covered culture dishes partly filled with an agar medium (a solid, gelatin-like substance) on which many different molds, yeasts, and bacteria will grow. To find out whether molds are present in the air we simply uncover a dish and expose it to the air for a few minutes, then cover it again and leave it for three or four days.

What happens? Unless the room is almost free of dust and the air is almost completely motionless, colonies of molds will develop on the agar in the dishes. The number and kind of molds will vary with the time and place of exposure, of course, but the air that most of us breathe, indoors or out, in the country or in the city, winter or summer, carries a liberal load of this invisible freight. A photograph of a typical plate, exposed for 5 minutes on the snow-covered prairie of North Dakota in January, 1945, can be seen in figure 1.

Fig. 1. Molds growing on a culture dish exposed to the air for 5 minutes on a snow-covered prairie in North Dakota in January, 1945. Forty-five colonies of 6 different kinds of molds were caught in this dish.



Similar studies at Winnipeg, Canada, some years ago proved that the air in that region was never free of mold spores, even in the dead of winter. Frequently mold spores are so abundant in the air that they will even sneak into closed culture dishes in the laboratory, as shown in figure 2. Unless the laboratory is kept scrupulously clean these contaminating molds pose a real weed problem, which is one reason good laboratory workers are likely to be more fussy housekeepers than their wives at home.

Of what concern is all this to you?

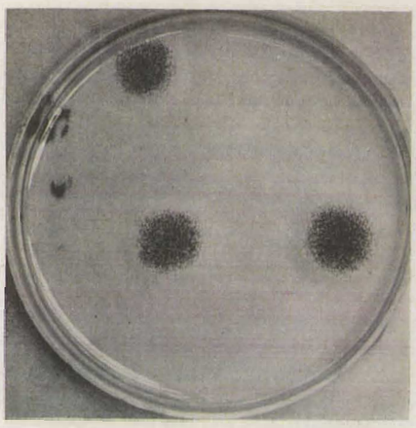


Fig. 2. Mold colonies growing in an unopened culture dish. They came from spores carried into the closed dish by the air.

Well, if you are subject to allergy caused by air-borne mold spores, as many people are, it affects you very directly. If you grow plants for profit or pleasure you will be concerned with the diseases caused by mold spores, and if you deal with or use food products, fabrics, wood, paper, or any one of a variety of other raw or manufactured products, the mold spores carried by the air are likely to be of very practical importance to you. Let's look at a few examples.

As long ago as 1919, years before most of the barberries had been eradicated from the spring wheat region, and long before many otherwise good citizens would admit any connection between barberries and black stem rust, the men who led the fight against black stem rust of wheat knew something was in the air. In some years rust infections on wheat started mainly near concentrations of barberries, and gradually spread from these centers. In other years the rust on wheat was more or less uniform over large areas throughout Minnesota, North Dakota, and South Dakota. These men knew that the spores of the stem rust fungus from wheat could be carried a great distance by the wind; they also knew that in the years of general infection rust was heavy in parts of the winter wheat region in Texas, Oklahoma, Kansas, or Nebraska. They naturally suspected that north-south winds might carry rust spores even from Texas to Minnesota.

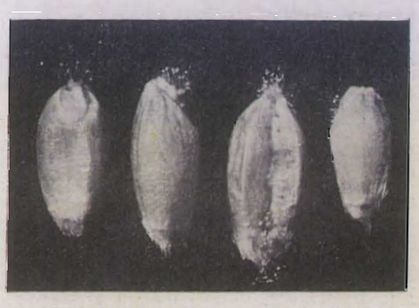


Fig. 3. Molds growing from moist wheat seeds. The seeds were infected by air-borne spores.

So these pioneers went up in planes over the winter wheat region when stem rust was plentiful and exposed clean, greased slides which could later be examined by microscope in the laboratory and the rust spores counted. The spores of the stem rust fungus are so characteristic in shape, size, and color that they can be identified in this way with comparative ease. Rust spores by the thousands were caught as high as 10,000 feet above badly rusted fields in the South; some were caught as high as 14,500 feet. Undoubtedly, then, stem rust spores were getting up into the air by the billions. How far and where were they carried? To find out, scientists began exposing slides at various places throughout the spring wheat area during spring and early summer. At each station a slide would be exposed for 24 hours, then put in a tight

Fig. 4. Mold growing from a dead wheat seed. The small white dots are masses of spores; in a week's time the mold growing from this one seed has produced hundreds of millions of spores to be spread by the slightest current of air.

box and sent to University Farm to be examined for spores of the stem rust fungus. This daily census of stem rust spores in the air was begun in the early 1920's and has been carried on every year since that time. Thus it was possible to prove that living rust spores often were carried from the southern winter wheat area to the northern spring wheat area in numbers sufficient to infect wheat over thousands of square miles.

Aided by the new knowledge of rust and its habits, plant breeders set out to breed rust-resistant varieties of both winter and spring wheats. Similar aerial trade routes of the stem rust fungus have been found in Europe, Asia, India, and Australia; the conditions differ from place to place, but the principles discovered in the work first begun at Minnesota in cooperation with the U. S. Department of Agriculture apply to many of the main wheat-growing regions of the world, and the information gained from this research eventually will help reduce the losses from stem rust everywhere.

Late blight of potatoes is another perennial scourge in which air-borne spores of the fungus cause infection. Recent studies in Maine have proved that the late blight fungus overwinters on stored potatoes, and first develops in the spring on plants that grow from potatoes thrown out of warehouses and cellars. The spores produced by the billion on plants in these refuse heaps blow to neighboring fields, infect the potato plants, and produce more spores. Given conditions favorable for the rapid development of the disease, a full-sized epidemic is soon under way. There is a possibility that late blight spores may be carried for many miles and still cause infection. We do not yet know, but it is important to find out. Eventually we shall know whether it is enough to clean up all potato dumps within the main potato-growing areas of the state or whether they must be eliminated from Maine to Washington.

Tracing the course of spores in the air is a big job. The case of stem rust of wheat in the Midwest has been charted more fully than any other. Obviously the winds that carry the spores of stem rust, potato late blight, or mildew must carry also other spores that rot our goods, cause stored grain to heat and spoil, infect seeds while they are still forming on the plant and so reduce next year's crop, or cause us to break into fits of coughing and sneezing.

Molds are "ever-present" largely because they produce a tremendous number of spores. A moderate infection by the stem rust fungus will result in 10,000,000,000,000 spores per acre. The fungus which causes corn smut will

One of our most useful molds is that from which penicillin is extracted. Dr. Christensen and his associates played an important part in the federal-sponsored program to increase the supply of penicillin during the war.

produce about 50,000,000,000,000 spores per acre with galls on only 10 per cent of the plants, which is a very moderate infection. With 100 million acres of corn grown in the United States every year, this would add up to the good round sum of 5,000,000,000,000,000,000,000 spores of the corn smut fungus, or plenty to go around. Some years there are at least several times this number. Not all of them get into the air, of course, but enough of them do so that the air over the nation is filled with corn smut spores during the fall and most of the winter. The fungus causing bunt or stinking smut of wheat will produce around 5,000,000,000,000 spores per acre with only 1 per cent of the plants infected. Infections of 10 to 30 per cent or more are not at all uncommon in some of the western states, and the spores of this fungus have been caught in hundreds per square inch a hundred miles from the nearest infected fields.

Some of the common molds that grow on fallen leaves, dead plants, stubble, soil, and all of the assorted debris that cover most of the land surface of the earth are equally prolific. Starting from a single spore, many of these common molds will, within a week, produce hundreds of millions or even billions of spores.

The spores of most of these air-borne molds are so light that the least disturbance of the air around them is enough to waft them away by the thousands or millions. The "wash" of air from a fly's wings as he takes off is enough to send them on their way. Once in the air they are at the mercy of air currents and must go where the wind listeth. Convection currents carry them upward as far as man has yet been able to trap them—some seven miles or more. Some of them probably have been drifting around up there for centuries as part of the cosmic dust, and never will get down again except by a lucky accident.

Their ability to survive in living condition during their flight through the atmosphere or stratosphere varies tremendously. A few kinds of spores will remain alive only a few minutes if exposed to dry air or sunlight. Others are unaffected by drying, at least over a period of years or decades. The intense ultraviolet light at high altitudes probably kills many spores, but some kinds have thick walls impregnated with dark pigments which protect them effectively from ultraviolet. Most of the air-borne spores endure cold so well that the low temperatures they encounter on their flights has little effect on them.

Because spores are so small and have so large a surface for their mass, they fall in still air with surprising slowness. The largest ones, about 1/300 of an inch long and 1/1,000 of an inch wide, real giants among fungus spores, will fall as fast as a foot in 25 seconds, while some of the smaller ones, only 1/8,000 of an inch long, require from 2 to 30 minutes to fall a foot in still air. This means that once they have attained a height of a mile or more, they may be carried for hundreds or even thousands of miles before they come to earth again.

Eventually we must chart more carefully the aerial trade routes of the spores, not only because we like to know all we can about the world we live in but also because the solution of many practical problems depends upon our doing so.

BETTER POTATOES ARE ON THE WAY

Dr. Krantz cross-pollinates potato varieties in the University experimental fields on the North Shore.

F. A. KRANTZ

EVEN TODAY the potato varieties most commonly grown in Minnesota and the United States are the same our fathers and grandfathers grew. This does not mean that the potato is incapable of improvement, although this important food crop does present peculiar problems to the plant breeder not found in the grains, for instance.

Since 1930 improved varieties have been developed at an ever-increasing rate, and growers are finding that it pays to use the newer selections. Turning point in potato development came with the organization of the national potato breeding program in 1929 under which a number of states interested in better potatoes were able to take advantage of the earlier breeding work of the Minnesota Agricultural Experiment Station and the U. S. Department of Agriculture.

This work had indicated the greater potentialities of the sexual method of breeding over the method of selection in clonal lines, that is, by means of cuttings. Superior individuals suitable for use as parents in the broader breeding program were already available as a result of this earlier experimentation. These parents when crossed produced progenies from which the recently improved varieties were obtained. The breeding stock developed at Minnesota and by USDA has been made available to plant breeders in other states who are cooperating in the national potato breeding program. This has led to a rapid expansion of potato breeding during recent years.

Breeding better potatoes presents a special problem in that the object is not better fruit, or seed, as with grains, but better tubers. To make the problem more complex, the varieties having the most bloom and the heaviest set of fruits generally produce less tubers. However, the sexual method of breeding depends on the flowers to obtain self-pollinated and crossed seed.

The commonly cultivated varieties have the characteristic of being self-nonfruitful. Thus potato fields seldom produce any fruit even though the plant may flower. On the other hand, the seedlings, as distinguished from the plants grown from cuttings, usually produce fruit in abundance when grown under conditions favorable to flowering.

The common varieties which are self-nonfruitful by reason of male sterility cannot be crossed with each other. They can, however, be crossed with the self-fruitful types which are male fertile.

The first step in producing superior varieties is to obtain both sterile pollen and fertile pollen plants with the desired characters.

These sterile pollen and fertile pollen types are produced by crossing, combined with some form of inbreeding. When the two types are crossed, the breeder selects from their progeny those individuals that produce high yield of tubers and that have the desired combination of characters. These individuals are propagated by tubers and after careful testing are introduced as improved varieties.

When we speak of a "desired combination of characters," we refer to many objectives which vary in importance with time and place. Growers are interested in yield and plant characteristics that affect production, maturity, resistance to frost and drouth, and adaptability to specific locations. More and more the plant breeder is called upon for varieties to resist many pests such as flea beetles, leaf hoppers, aphids, and psyllids, as well as numerous diseases such as mild, latent, and veinbanding mosaic, yellow dwarf, spindle tuber, leaf-roll virus, early and late blight, tuber rot initiated by fungus causing late blight, common scab, potato wart, fusarium, southern bacterial wilt, and ring rot.

Market and table quality have to be built into the tuber itself; therefore the breeder must watch shape, depth of eyes, evenness of surface, smooth versus flaky and russet skin, flesh and skin color, length of rest period, per cent of dry matter, starch content, cooking quality, mealiness, tendency toward blackening, hollow heart and hair sprout, freedom from knobs and growth cracks.

The desirable characters are widely dispersed among many varieties with relatively few in any one variety. The task of the breeder is to combine them into varieties useful to growers. For instance, varieties resistant to common scab have been known for a number of years. Plant breeders have been working to combine this character with the characters that go to make up a desirable commercial variety. As a result a few varieties with limited adaptability are being introduced at the present time.

The potato breeder proceeds toward his objective by crossing and selection. For example, quick-maturing varieties resistant to common scab would be highly desirable in Minnesota. As a step toward this end the long season, scab-resistant varieties Hindenburg and Richter's Jubel, obtained from Germany, were crossed with the selected pollen parents known in the laboratory as 15-2 and 80-7. It was known from previous tests that these numbered se-

lections had good combining ability, producing when crossed progeny adapted to Minnesota conditions. The crosses were made as follows:

Hindenburg x 80-7
Jubel x 15-2

Selections were obtained from both crosses that approached in desirability the best early varieties and which had a medium amount of scab resistance. The next step was to cross the sterile pollen selections of one cross with the fertile pollen selections of the other cross. It is possible to obtain from these latter crosses the expected combination of earliness, adaptability, and other desired characters, with high scab resistance.

The breeding of improved varieties in Minnesota was facilitated by finding a location on the north shore of Lake Superior unusually favorable for abundant flowering in potato plants. Here crosses are made between selected parents. These parents may be varieties, improved numbered selections, or some wild species of potato such as *Solanum demissum* from which immunity to late blight has been obtained.

The fruits resulting from the crosses are taken to University Farm and the seed removed. The seed is sown in flats the latter part of August, and the seedlings transplanted to pots in the greenhouse. During the short days of autumn the seedlings develop tubers and mature while the plants are still very small, hardly 6 inches high. This permits 5,000 to 6,000 seedlings to be grown in the greenhouse in a relatively small space. They are harvested in December.

The following spring, tubers of each of these 6,000 seedlings are planted at the North Central Station at Grand Rapids in a plot that has been heavily infected with the organism causing common scab. This plot is maintained by Dr. Carl J. Eide of the Division of Plant Pathology for the purpose of testing and eliminating susceptible seedlings. Between 300 and 500 seedlings are usually saved from the original 6,000. After three years of field trials at the branch stations and laboratory tests of vine and tuber characteristics, a selection with the desired qualities is tested for its range of adaptation in trial plots in growers' fields throughout the state. All selections are tested for two years in these trial plots before distribution to growers of the Minnesota Potato Improvement Association for increase, and two additional years before they are given varietal names and introduced as new varieties.

The Warba and Red Warba were the first varieties introduced by the Minnesota station. These two extra early varieties are widely grown in the United States and Canada wherever a quick-maturing variety is desired. The Mesaba and Kasota, varieties with much more limited adaptation, were next introduced. These are being followed by five selections of unusual promise. Selections No. 42 and No. 47 have been distributed to the growers for increase this past year. All five selections listed in table 1 have in five years' tests equaled or surpassed the Early Ohio, Cobbler, and Triumph in earliness, yield, market and culinary quality, and in the proportion of tubers of marketable size. Selection No. 43 has been less susceptible to common scab than any other early variety.

New varieties introduced by the U. S. Department of Agriculture and by other state experiment stations are included in the growers' trial plots to test their adaptability to Minnesota conditions. While most of these new varieties have required for their best performance a longer growing season than is found in most potato-growing areas of the state, a few like the Chippewa and Sequoia have been found useful to Minnesota growers.

Each fruit cluster is carefully labeled to record the parentage of the seed which it contains.

Minnesota has already introduced several new potato varieties including the Warba, Red Warba, Mesaba, and Kasota. The Warba has been widely accepted by growers requiring a quick-maturing variety.

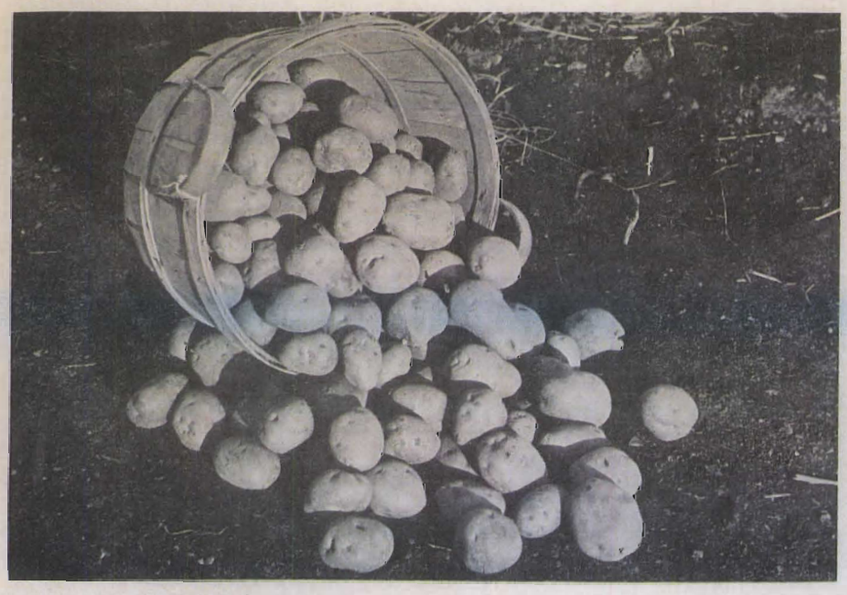


Table 1. Yield of New Varieties and Numbered Selections Developed at the Minnesota Agricultural Experiment Station in Comparison to the Older Varieties

	Location			
	Red River Valley	Early market section	Sand land region	Dry matter content
EXTRA EARLY	——Bushels——			Per cent
Warba and Red Warba	223	232	193	19.4
Minn. 35	206	278	175	17.4
Minn. 42	206	197	190	18.2
EARLY				
Early Ohio*	182	185	.....	17.9
Cobbler*	212	234	158	19.2
Triumph*	187	136	164	17.0
Minn. 47	216	218	192	18.3
Minn. 6	225	196	200	20.0
Minn. 43	235	211	196	18.1
Mesaba	208	238	250	17.7

* Older varieties.

Several thousand specimens of insects have been received from former graduate students with the armed services from all parts of the world. These have been added to the already very extensive insect collection maintained by the Division of Entomology and Economic Zoology.

Farm Building Priorities for the Postwar Period

A. J. SCHWANTES and H. B. WHITE

MANY FARMERS are now planning extensive building additions and improvements. In the past two decades farm buildings have been much neglected, yet they are extremely important in a successful farming enterprise. They represent a long-time investment and therefore improvements should be carefully considered and planned before undertaken.

To establish a uniform plan for remodeling the building set-up of all farms would be unwise even if possible. Each farm has its special conditions and needs. Nor is it possible to predict what developments in materials and design may take place in the next 5 to 10 years.

We can, however, stress important principles or "priorities" to guide farmstead improvements in the immediate future. This is especially desirable now when so many farmers are anxious to modernize and there is some confusion over availability of materials and manpower.

Five phases of the farmstead improvement problem to be given priority are:

1. A careful plan is needed for each farmstead.

2. Building improvements should aim at saving time and energy, for three-fourths of a farmer's working hours are spent in and around farm buildings.

3. The farmhouse, as the homemaker's workshop and the family's home, should have a prominent place in plans for remodeling.

4. Next to, and along with, electricity a water system presents the greatest opportunity for improvement.

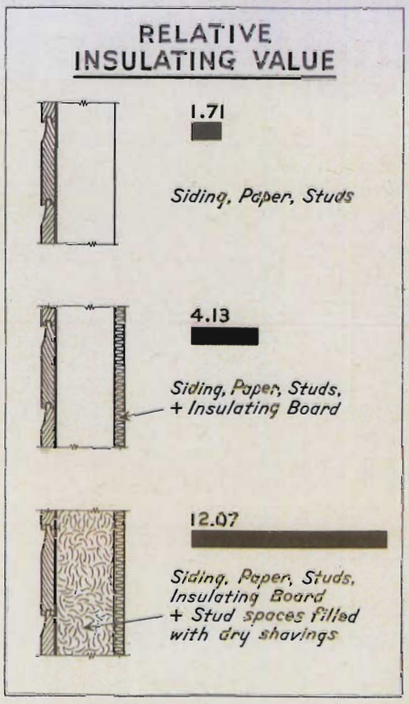
5. Proper insulation should be considered in rebuilding as well as in new construction.

A Plan for Every Farmstead

On most farms a farmstead has long since been established. Relocation, if desirable, may be feasible if some buildings need replacement and others may be moved readily. Good drainage and access to a main highway are foremost considerations in such relocation.

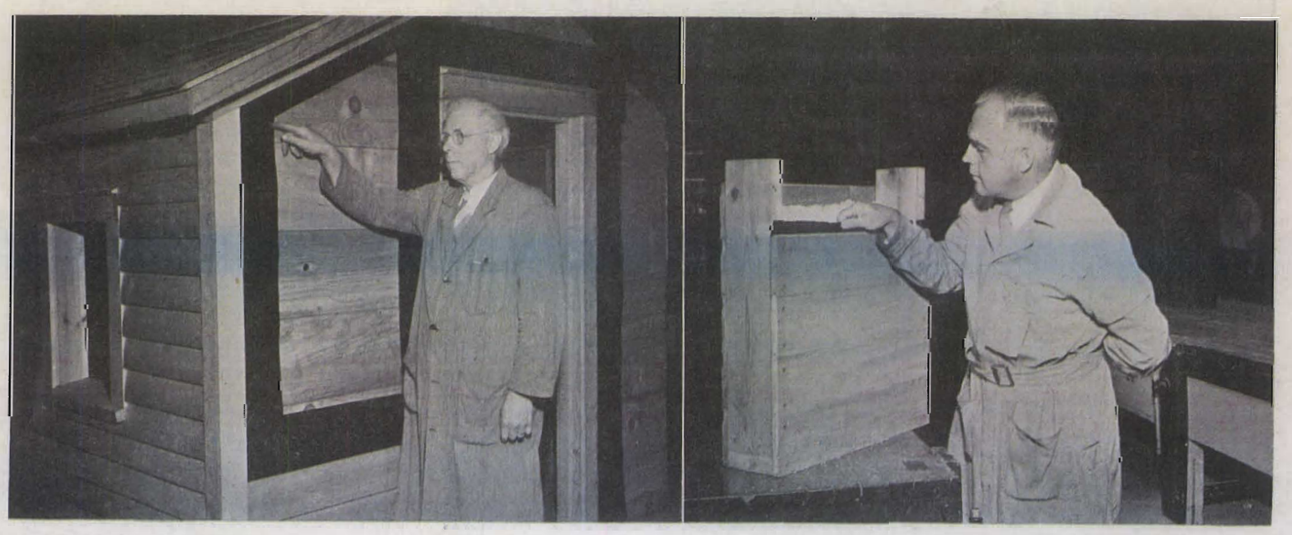
The first step in planning farmstead improvements is to make a drawing of the farmstead as it exists at present, locating all the buildings and facilities. The plan should be drawn to scale as nearly as possible. It is then advisable to prepare a new plan in which the buildings are located as they would be in an ideal arrangement. The working plan will be a compromise between the present and the ideal. If the major buildings are already established, the future farmstead will have to be grouped around these.

Some principles are best kept in mind whether the farmstead is entirely new or a rearrangement. There should be adequate space between buildings for necessary driving and fire protection, but they should be close enough to each other to make convenient working units. As a general rule it is advisable to have the house at least 150 feet away from the highway and the main barn about the same distance away from the house. Ideally, the house should have the highest point on the site so that livestock shelters and yards will drain away from it. The location of the house with respect to the service buildings should be such that odors and noises will not readily carry to



Filling stud spaces as shown here tripled the insulating value.

(Left) Mr. White points out the importance of careful construction such as overlapping paper at corners on this demonstration building in the University Farm shop. (Right) According to Mr. Schwantes the vapor barrier near the inside of an insulated wall of a livestock shelter is important in preventing accumulation of moisture in the wall.



the house. Some of the service areas may be screened from the house by means of suitable plantings.

Unity in the style of building will improve the appearance of the farmstead as a whole, as, for example, the unity which comes from like-colored roofs or buildings painted alike or in related colors. Enough variety is desirable to avoid an effect of monotony, yet there should be sufficient likeness to give the appearance of consistency. A common design, such as a pitched roof on all buildings, gives a desirable effect, but if a gambrel roof is used on the barn it should not be repeated on the house.

The arrangement of walks and driveways often makes possible improvements in appearance as well as in serviceability. Properly planned landscape plantings will add much to the appearance of the farmstead. The windbreak should be designed to protect people and livestock against prevailing winds and to prevent snow from piling up in the yard.

Saving Time and Labor

The number of man hours required for the production of field crops has been greatly reduced during the past two or three decades, but little attention has been given to saving time about the farmstead. A study of records from a large number of livestock farms by the Division of Agricultural Economics has shown that nearly three-fourths of the farmer's working time is spent in and around farm buildings. More or less standard laborsaving devices, such as elevators and manure carriers, can be installed, of course, but many opportunities for such savings are lost unless there is a close study of farm chores and how they may be lightened by building improvements.

On Minnesota farms about 160 man hours are required annually per producing dairy cow (including the care of the young stock). A large percentage of this time is required for handling feed. Improvements should point toward having feed stored as near as possible to where it is fed. Carts for transporting can replace many trips with fork or basket. Use of carts, of course, involves width of doors or alleys, type of floor, and covering of gutters.

It is advantageous to have a feed room equipped with an elevator, a feed grinder, and possibly a mixer. Much labor can be saved if grain is stored in overhead bins so it may be removed by gravity. Grain to be ground may be fed automatically from an overhead bin into the grinder from which the ground feed may then be conveyed to another overhead bin by means of the

(Continued on Page 14)

What Can You Pay for a Dairy Barn?

S. A. ENGENE

WHAT can you afford to pay for a dairy barn? The costs and returns for your dairy herd will help to provide the answer to this question. After all, the herd must pay for the barn if the investment is to be profitable. Detailed records on dairy costs obtained from Minnesota dairy farmers from 1932 through 1943 show a method of analysis and some interesting information about dairy barn costs.

	Average all herds studied	High-producing herds	Low-producing herds
Pounds butterfat per cow	232	299	175
Man hours per cow	157	191	140
Value produced per cow*			
Dairy products	$ 86.30	$115.94	$ 63.54
Animals	36.24	40.82	31.29
Total	$122.54	$156.76	$ 94.83
Costs per cow*			
Feed minus manure credit	$ 58.69	$ 69.51	$ 50.01
Horse work, equipment, interest on cattle, veterinary	11.92	16.57	9.53
Total	$ 70.61	$ 86.08	$ 59.54
Value remaining to pay for labor and buildings	$ 51.93	$ 70.68	$ 35.29

* Costs and return for entire herd divided by the number of cows.

The value remaining to pay for labor and buildings is the return per cow less market prices for feed, interest, equipment, veterinary, etc.

What would be the return to labor after paying building costs? If a barn, silo, milk room, and water system for 15 cows and the usual number of young stock cost $4,000, the investment would be $267 per cow. The annual cost of dairy buildings is 8 per cent of the original cost, or $21.36 per cow per year for this barn. Subtracting this from the $51.93 for the average of all herds leaves $30.57 as return for 157 hours of labor, or 19 cents per hour. The return per hour of labor for the three levels of production and with different investments in barns would be:

Investment	Production		
	Average	High	Low
	Cents per hour		
15-cow barn costing $6,000	13	20	2
15-cow barn costing 4,000	19	26	10
15-cow barn costing 2,000	26	31	18

Wages, including board, for men hired by the year were 22 cents an hour during this period. Only the high-producing herds returned hired man's wages with $4,000 barns. Low-producing herds failed to return hired man's wages even if dairy buildings could be built for $2,000.

- What do your dairy records show?
- Will your herd pay for a barn and give satisfactory returns to labor?

It's Time to Control *Swine Brucellosis* Now

H. C. H. KERNKAMP, M. H. ROEPKE, and DONALD E. JASPER

BRUCELLOSIS has been given considerable attention during recent years, not only because it has great economic significance in the raising of cattle and swine but because it can be contracted by man. To complicate matters, there are three members of the family of Brucella bacteria, one common to cattle, one to goats, and one to swine. Man may become infected with any one of the three. In animals, the disease caused by these bacteria is commonly called contagious abortion or Bang's disease. In man, the disease is usually spoken of as undulant fever or Malta fever. More recently, the name brucellosis has been adopted for the disease in both man and animals.

Two members of the Brucella family are of particular importance in Minnesota. These are *Brucella abortus* which is responsible for Bang's disease in cattle and *Brucella suis* which is common to swine. So far as is known, *Brucella abortus* does not infect swine. However, cattle do occasionally become infected with *Brucella suis* from swine. The swine type of Brucella is much more infectious and produces a more severe disease in man than does the type of Brucella common in cattle. In those instances in which dairy cattle become infected with the swine type, the danger to human health may be very serious if unpasteurized milk is used.

Epidemics of undulant fever in this country have been traced to drinking raw milk from cattle infected with the swine type of Brucella. Although it appears that under natural conditions cattle do not become infected readily with the swine type, it is desirable to prevent swine and dairy cattle from associating together, unless the swine are known to be free of brucellosis.

Best evidence we have today indicates that working with infected animals or discharges from such animals is probably the most common way of contracting undulant fever. For this reason, it is very desirable for the herdsman to avoid any unnecessary exposure to infection if the herd is not known to be free of the disease. This is particularly true during the farrowing season or after abortions.

An attempt is now being made to determine the extent of swine brucellosis in Minnesota. A large number of blood samples have been collected at various packing plants at intervals over a three-year period and examined with the agglutination test. This preliminary survey suggests that probably not over 2 per cent of Minnesota swine are infected. Although the per cent of infected animals in the swine population appears to be relatively low, studies on infected herds usually show that a high percentage of swine of breeding age are infected in such herds.

Symptoms—The symptoms of brucellosis in swine are not always readily recognized. In fact, many infected animals do not manifest any visible symptoms. Although a number of abortions in a herd indicates infection, it is not uncommon to find infected herds in which only a few or no abortions occur. If there are abortions, they may be in early or in late pregnancy. In fact, the abortion may occur so early in pregnancy that it escapes the notice of the caretaker. It appears that those animals which become infected at the time of breeding or while pregnant are most likely to abort. Some of the other symptoms occasionally observed in sows are inflammation of one or more of the joints of the legs and spine which gives rise to symptoms of arthritis. It is believed that many of the apparent breeding difficulties, especially where sows seemingly fail to settle, are actually due to unobserved early abortions.

The most striking symptoms in the boar, occasionally observed, is an inflammation or enlargement of one or both testes. The inflammation may be so extensive as to cause sterility. Arthritic symptoms may occur in the males as well as the females. The lack of a desire to breed is sometimes observed, even in a normal-appearing boar.

Transmission—The disease may be transmitted by contact or association with infected animals or other infected material such as discharges and afterbirth or raw meat and offal from infected swine.

Boars appear to be as susceptible to Brucella infection as sows. Brucella organisms have frequently been isolated from the semen of infected boars collected at the time of breeding. For these reasons the boar should be considered one of the most important means of infecting and spreading swine brucellosis in a herd. A noninfected boar may carry the infection from an infected sow to a noninfected sow during the breeding season.

Diagnosis—Very frequently the symptoms are not evident to the extent that a reliable diagnosis of the disease in a herd can be made without the aid of laboratory tests. A blood agglutination test such as is employed for Bang's disease in cattle is the most reliable test available at the present time, especially when the test is applied to all the animals of breeding age (six months and over) in the herd. Occasionally the agglutination test fails to give a positive reaction even though the animal is infected. It is known that some animals show a negative agglutination test even when Brucella bacteria can be obtained from their blood or tissues. For this reason, a negative agglutination test on a single animal may not

In his laboratory at University Farm Dr. Roepke applies the agglutination test to a group of blood samples to reveal the presence or absence of brucellosis in swine.

(Left) Dr. Kernkamp shows how blood samples are drawn from a small pig. (Below) Dr. Jasper draws a test tube of blood from a sow's ear.

be reliable, but the majority of infected animals do show positive blood tests. Thus, the blood agglutination test is recognized as quite reliable for determining the presence or absence of the disease in a herd.

Prevention and Control—Since swine brucellosis may exist in a herd without the owner being aware of its presence, the first step in developing and maintaining a herd free from this disease is to conduct a blood test of all swine of breeding age. If the herd test discloses the absence of the disease, then precautions should be taken in the future to prevent any introduction of the infection. Avoid contact between the herd and neighboring swine. Avoid feeding garbage containing raw pork from unknown sources. Introduce new animals only from herds known to be free of the disease.

The introduction of animals from unknown sources or from herds of unknown status as to swine brucellosis is dangerous even though the new animals may be negative to the blood test. The basis for this danger is that an occasional infected animal will show a negative blood test. If introductions must be made, such animals should be kept in strict isolation until they pass two negative tests over a 60-day period, one at the beginning and the other at the end of the isolation period.

Since the boar is believed to play a very important part in the transmission of swine brucellosis, utmost attention should be given to obtaining and using a boar known to be free of the disease. This precaution cannot be emphasized too strongly. If a boar from a known disease-free herd is unobtainable, the next best practice, although not free of danger, is to place the animal in strict isolation for 60 days and require two negative blood tests.

Eradication—In case a herd test discloses infection, eradication of the disease from the premises should be an immediate objective. This may be accomplished by either one of two general methods. The first method, the most simple and satisfactory, is to dispose of all swine on the premises for slaughter purposes only. The premises should then be thoroughly cleaned and disinfected and left idle for at least three to four months. New breeding stock should be obtained from known brucellosis-free herds. If possible, such animals should come from only one herd.

The second method of eradication is a program of testing and disposal of infected animals for slaughter similar to that used for cattle. This program apparently is not as satisfactory as the first method and results in failure more frequently than with cattle. The more frequent failures are believed to be due to the fact that the blood test does not detect every infected animal, and that there is a more rapid turnover of swine than cattle. Therefore, the test and slaughter method is recommended only for valuable breeding herds.

If the test and slaughter method is to be used, the following procedure is recommended. At weaning time, all adult animals should be disposed of for slaughter or maintained in strict isolation on separate premises. From the weanling pigs approximately twice the number required for breeding stock should be selected and isolated into small groups of about 10 each. The remainder of the weanling pigs should be isolated and fed for slaughter only. Those lots retained for breeding purposes should be blood tested every 30 days and all infected animals removed. Each group or lot of pigs should not be considered as probably free of the disease until each group as a whole has passed two successive negative tests at 30-day intervals and also a negative test just prior to breeding. Any group of pigs that does not meet these requirements should be disposed of.

Vaccination of pigs with Strain 19 as used in calves has been found unsatisfactory for controlling swine brucellosis.

Jeep Proves Versatile in Morris Farm Tests

ALBERT C. HEINE

AT the present time the West Central School and Experiment Station at Morris has two Jeeps on test: the one, a regular military type, the other, a so-called "Agri-Jeep." The latter has heavier gears and is geared to a lower road speed than the military type. It is equipped with a belt pulley and power take-off. Its engine speed is governor controlled and it has a convertible type cab, roomier than the military Jeep.

Chores and field jobs performed by these Jeeps include pulling a harrow, single 10-foot and 14-foot tractor disc, 11-foot grain drill, 10-foot quack digger, 7-foot grass mower, side delivery rake, 10-foot power take-off grain binder, 12-foot grain swather, 10-foot blade road patrol grader, 14-inch two-bottom plow, and many others.

On the road, a Jeep will pull any load the average four-wheel farm trailer can carry. It will pull loads over slippery footing where the average light tractor will experience difficulty. Mud, snow, and ice are taken in stride by its four-wheel drive.

Some objectional features of the Jeep from the standpoint of the farmer are its inability to turn as short as a tractor, its very low road clearance at the axles, and the location of the belt pulley on the model adapted for farm use. The turning radius of the Jeep is 18 feet. This necessitates larger headlands and makes it difficult to cut square corners with a mower or a binder. The less than 9-inch road clearance at the axles prevents the Jeep from being a satisfactory row crop tractor. The rear-mounted belt pulley makes it difficult to belt up.

The Jeep is not quite as economical to operate as a tractor, truck, or car, if these are used for the purpose for which they were intended. This lack of economy is offset by the fact that the Jeep can be substituted for all three. Its speed of 2½ to 60 miles per hour, its governor-controlled engine, its four-wheel drive, its convertible all-weather cab, its seating capacity—all combine to make the Jeep worth consideration when a farmer studies his power and transportation needs.

(Left) Professor Combs believes that research in cheese manufacture will give new outlets for Minnesota milk. (Right) Dr. Coulter demonstrates apparatus which will determine the percentage of oxygen in a sealed can of dried milk.

New Dairy Products

(Continued from Page 1)

in the area to which shipment is made. It can be expected that butter, cheddar cheese, dry skim milk, and dry buttermilk will continue to be produced in volume and find an out-of-state market. However, it may be many years before the normal demands for dry skim milk equal the recent war-swollen volume. Attention must be given to products other than those mentioned above if the milk output of Minnesota dairy farms is to be disposed of at a fair price.

This becomes a problem of the processor, who in turn must have the help of dairy research. Minnesota agriculture and industry have a big stake in the development of new food products that incorporate liberal quantities of milk. Many of them, now in the laboratory stage, give promise of large markets in this country and abroad if packaging and storage problems can be solved.

The layman is familiar with such dairy products as butter, the various cheeses, and evaporated and condensed (sweetened) milk. Recently he has heard about dry skim milk and dry whole milk, but he may never have used them. He may also have heard of dry whey, milk sugar, cultured milk drinks, "frozen milk," plastic cream, "butter oil," and dry ice cream mix. In the future some of these new products may become as familiar as the dairy foods known for centuries.

A brief review of progress, as well as possibilities, of these new products will interest both the producer and the consumer.

Dry Whole Milk—Very early in the war, the army demanded large quantities of dry whole milk for use in camps in this country and abroad. Before the war only a very few manufacturers attempted to make this product for it was known to develop a tallowy flavor in a relatively short time. During the past three years, great progress has been made and today it is definitely known that by eliminating copper contamination and by packing in an inert gas such as nitrogen, dry whole milk can be kept in sealed cans for probably a year or more without developing a tallowy flavor. University of Minnesota research played a part in these discoveries and findings were recently published in Experiment Station Technical Bulletin 167. The research work here has been carried on in close cooperation with the U. S. Army Quartermasters Corps.

Although certain defects, such as a "stale" flavor, may develop in dry whole milk, many feel certain the future for this product is bright largely because of the enormous saving in transportation costs. The shipping charges on a 10-gallon can of milk from Minneapolis to Newark, New Jersey, are $1.32. The solids of this milk in the form of dry whole milk could be shipped for less than seven cents. Fluid milk in eastern and southern states now sells for about a dollar a hundred more than milk in Minnesota. Certainly the margin is significant. Even if city officials in the metropolitan sections of the East would object to Minnesota dry whole milk being sold as market milk after reconstruction, there still remains the possibility of such milk being marketed for direct use by the housewife. There is every evidence that this method of marketing will not only be applied to whole milk but to dry skim milk as well.

Dry Milk Combinations—Dry custards and pie mixes of a variety of flavors as well as dry cake mix, all complete except for the addition of water, have been prepared in the dairy products laboratories at University Farm. The production, storage, and marketing problems of these products now are being investigated. All show good promise as future outlets for Minnesota milk.

Other dry milk combinations are ready-to-mix drinks for the home or the soda fountain consisting of milk combined with sugar and pleasing flavors such as chocolate, caramel, and fruit.

Dry Ice Cream Mix—Among the most promising products is dry ice cream mix. All ingredients going into ice cream of almost any flavor are dried and combined so that the ice cream requires only the addition of water and freezing. Dry ice cream mix is going all over the world today with the American armed forces. The army and navy plan to supply 9 gallons of ice cream to every man and woman in our armed forces during 1945. Compare this to the normal per capita consumption in the United States of 3 gallons. Wherever ice cream is consumed abroad, some will find its way to local people and they will learn to like it. Today one Minnesota firm is shipping dry ice cream in limited amounts for civilian consumption outside the United States.

Condensed ice cream mix is still another product with a future. This may be made for areas in the United States where the supply of fresh milk and cream is limited.

Dry Whey—Whey, the waste product from cheese, has been dried for animal feed in the past, but new uses loom in the field of medicine and human nutrition. Whey is high in water but contains lactose or milk sugar, albumin, and some of the ash of milk. Milk sugar is used extensively in the manufacture of penicillin. In addition, a fermentation process has been developed for the production of a high potency vitamin "B" complex product from whey. While the demand for dry whey for poultry feed will continue, this product may have even greater value as human food.

Dry and Concentrated Cream and Butter—The problem of preparing dried cream that will not oxidize has greatly retarded the manufacture of this product, but with our present knowledge there is every hope for a dry cream that can readily be reconstructed in the home, in institutions, hospitals, restaurants, and hotels. Much of the research now underway with dry whole milk and dry ice cream mix will eventually be applied in the production of dry cream.

Still another product of the future may be "dry butter," already prepared experimentally. Visualize a product to which you may add water, stir, and chill to produce butter. No such product is on the market today but research men and processors are interested.

Butter oil is being prepared in New

Zealand and Australia on a large scale. Certain dairy interests in America are watching this product with the idea of introducing it to the American housewife. Butter oil is concentrated and can be turned into nearly normal table butter by addition of water and chilling. With the development of machinery and application of research, butter oil can become a leading Minnesota export product.

Plastic cream is simply a cream containing 75 to 80 per cent of milk fat. The product has been manufactured in Minnesota for more than 15 years but its uses can be greatly broadened. At present it is used in cooking, in ice cream manufacture, in the preparation of cream cheese, and in standardizing market milk.

Cheese—Fuller utilization of Minnesota's milk output will certainly hinge on further development of the state's cheese industry. Important progress has been made in the improvement of Cheddar cheese, and there are many opportunities in the manufacture of special cheeses. A case in point is Blue Cheese, in the development of which University of Minnesota research played a leading role. Blue Cheese, very similar to the imported Roquefort, has taken over much of the market which went begging when European shipments were cut off. Starting with a limited output at University Farm, Blue Cheese has grown until it is now an important item in the cheese industry of the state.

In addition, limited quantities of brick, limburger, Italian types, cottage, and "dry" cheese curd have been prepared for consumption in the state and for export.

It is expected that because of the great quantities of skim milk available in Minnesota more attention will be given skim milk cheese, both perishable and ripened. More than 50 different types of cheese can be prepared from skim milk.

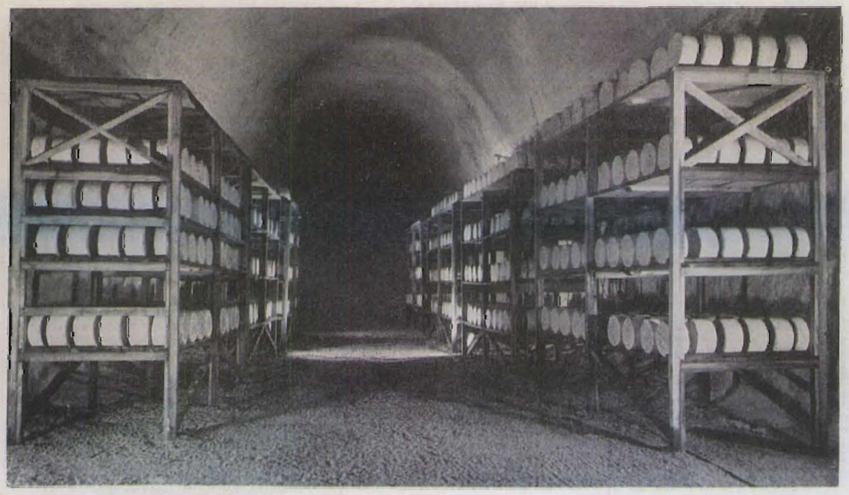
Improvement of products already on the market goes hand in hand with the development of new dairy foods. For example, housewives would welcome evaporated milk with a natural milk flavor. Recent advances in processing evaporated milk may result in a product which on dilution with the proper quantity of water will be practically indistinguishable from normal fluid milk.

No one can foresee the full possibilities of the dairy industry, but the future looks bright. At no time in the history of the industry has there been so much interest in dairy products research within the industry itself. Success of products in dry form has greatly increased Minnesota's chances of keeping open the market channels for the 80 per cent of the dairy output that must be sold outside of the state. If new products will brighten up the future for the producer, certainly they will improve the nutrition of millions who cannot now get enough of "nature's most perfect food."

Through cooperation of the Agricultural Experiment Station with the Minnesota Crop Improvement Association, pure seed of 14 varieties of small grain, 81 varieties or hybrids of corn, and 13 varieties of legumes and grasses were made available to farmers in Minnesota, other states, and foreign countries. This enabled farmers to obtain pure seed of recommended varieties at reasonable prices.

A total of 7,500 gallons of juice drained out of a silo filled with 185 tons of alfalfa hay silage.

Minnesota Blue Cheese owes much of its distinctive flavor to aging for three of its nine-months' ripening period in these caves in the bank of the Mississippi River near St. Paul.



Lambs Need Alfalfa Hay to Gain Top Finish

LAMB feeders have every reason for using good alfalfa hay in the ration even if hay is scarce. That conclusion may be reached from results of lamb feeding trials at Morris reported by P. S. Jordan and W. H. Peters. If anything, soft corn strengthens the argument for good legume hay.

Eight trial lots of typical white-faced feeding lambs averaging 70 pounds were put on feed at the West Central Station last December 5. The purpose of the trials was to check various combinations of shelled corn with alfalfa alone, with alfalfa and a fifth of a pound of oil meal per lamb per day, with prairie hay and oil meal, with corn silage and oil meal, and with oat straw and oil meal.

Mr. Jordan and Mr. Peters offer the following summary of results:

1. When alfalfa hay was fed, especially with one fifth of a pound of soybean oil meal per day added to the shelled corn, the lambs were ready for market at the end of a 98-day period.

2. When good quality upland prairie hay, or upland prairie hay and corn silage, were fed as the roughage, one fifth of a pound of soybean oil meal per lamb per day added to the corn, and a possible calcium or phosphorus deficiency avoided by feeding bone meal with the salt, good gains were made and a satisfactory result secured, though gains were lower than when alfalfa hay was fed as the roughage.

3. When oat straw alone, corn silage alone, or a combination of oat straw and corn silage was fed as the roughage, gains were slow, the corn requirement per 100 pounds of gain was large, and the cost per 100 pounds of gain was high. The lots of lambs fed these nonlegume roughages grew more difficult to keep on feed, ate less feed per day, and decreased in rate of gain as the feeding period progressed. Although the lambs were continued on these rations through a 141-day feeding period, during which they received all of the shelled corn they would eat plus one fifth of a pound of soybean oil meal per lamb per day and a mixture of one-half bone meal and one-half salt, many of the lambs still were not fat enough to be market topping lambs at the close of the long feeding period.

4. It is possible that the gains of the lambs fed the nonlegume roughages would have been more rapid and more efficient had corn of greater maturity and lower moisture content been fed or if more soybean oil meal had been fed to provide a higher percentage of protein in the ration.

Laying Streak by Inbred Hen Spotlights Poultry Breeding Work

Two-year-old inbred White Leghorn hen sets nonstop laying record at University Farm.

THOMAS H. CANFIELD

THE breeding research program of the poultry section at University Farm was spotlighted recently when an inbred White Leghorn hen in the college poultry flock laid 153 eggs on consecutive days. This two-year-old hen (C2634—Patricia) had an ordinarily good record of 214 eggs in her pullet year and was producing in only moderate fashion during the first months of her second year until March 17 when her nonstop laying streak started.

Inbreeding of poultry has been carried on in a limited manner, generally with small numbers of birds, by experiment stations and individual breeders for a number of years. In general, the earlier results with poultry have been disheartening chiefly because the lines died out rapidly and evaluations were based on the performance of the individuals themselves and not on their recombining value. Most inbred lines have automatically been terminated because of loss of vigor and reproductive failure after three or four generations of father × daughter, mother × son, or brother × sister matings. Hens either lay infertile eggs, or a high percentage of embryonic mortality occurs. Egg number and egg size have frequently decreased, and sometimes body weight as well as other characteristics of utilitarian value have lost ground.

Similar results are now common knowledge in the corn inbreeding work and more recently have been reported in swine. Not until the inbred lines were crossed with each other and their recombining value determined was it possible to decide which individuals should be kept and which eliminated.

The preliminary work in poultry at Minnesota began in 1937. Single crosses (crosses of two inbred lines) were first tested in 1944, with three-way crosses being made in 1945 and double crosses in the program for 1946. The inbreeding work is being developed with Leghorns, New Hampshires, and lines involving a New Hampshire × Leghorn cross and a New Hampshire × White Rock cross. The substation at Crookston is cooperating in this development. It will still be some time before a complete report of this experimental work can be published.

Because of the generally outstanding success of hybrid corn, poultrymen are all set for "hybrid" chicks, but caution in accepting such chicks is advised until there is quantity production of truly superior hybrids. A number of state experiment stations, the U. S. Department of Agriculture research center at Beltsville, Maryland, as well as some individual breeders, are now developing inbred lines. Whether or not this system of breeding will in time prove superior to the methods now used by the most successful Record of Performance breeders is still problematical. In view of its success in related fields, poultrymen should make every effort to investigate it thoroughly. This period for complete proving may take years. In the meantime it can be said that preliminary results give much promise.

Farm Building Priorities

(Continued from Page 9)

elevator or a blower which may be part of the grinder.

Feed handling is only one of the time-consuming farm chores that should be reduced by better arrangements. A modern milkhouse near the barn and equipped with cooling and washing facilities can transform a dairy business.

A farm shop equipped with the most commonly needed facilities and tools is also practically a necessity on the modern mechanized farm. Such a shop may be built into one end of the machine shed or as a separate structure. One dimension of the shop will ordinarily be about 18 feet and the other dimension will range from 12 to 20 feet. It should have plenty of light and a good floor as well as a stove for heating. The equipment will depend somewhat on the mechanical aptitude of the operator. The most common requirements are a workbench with metalworking and woodworking vises and with drill, bench grinder, forge, anvil, and cabinet for tools and supplies. At least the most commonly used metalworking and woodworking tools are needed. Some farmers will want an electric or acetylene welder.

Homemaker's Workshop

The important part farm women have played in food production during the war years has strengthened the demand for better working conditions in the farmhouse. Many homemakers now want a workroom, in addition to the kitchen, to serve as a center for such activities as canning, meat cutting, washing, and a multitude of other tasks that center in a farm dwelling. If the kitchen is sufficiently large, work of this character may be done there, but many prefer to use the kitchen only for the preparation of meals. The workroom is generally on the main floor but it may be in the basement if well lighted, heated, and equipped with running water and adequate kitchen facilities.

It is possible now on most farms to have modern conveniences in the kitchen. Where electricity is available, an electric refrigerator and electric range are great helps. If gas is preferred for cooking, bottled gas can be obtained in most localities. A kitchen should have sink and drain and ample storage and work space. It is important that stove, refrigerator, sink, and worktable be arranged to require a minimum of travel and that there be plenty of light.

Remodeling of the kitchen may not necessarily be expensive. In fact, careful planning before remodeling is started will help reduce the long-time cost.

Water Under Pressure

Perhaps the most important single advantage resulting from electrical energy is water under pressure that can be distributed to any of the buildings and to any point on the farmstead. In the farm home it makes possible running water in the kitchen and laundry room and will also make possible bathtub or shower and indoor toilet.

A pressure water system consists essentially of a pump, a storage tank, and a system of pipes by means of which water is distributed to various places on the farmstead. First requirement is a good well with adequate capacity. The size of the electric motor must be in keeping with the depth of the well and the rate at which water is to be

obtained. For average farm needs this would be from 200 to 400 gallons per hour.

Household facilities with running water make necessary an adequate sewage disposal system. The septic tank, an underground container in which sewage is held until it is decomposed, is the best method for handling sewage on the farm. The tank may be of masonry, although steel tanks are also used. It is advisable to provide a tank large enough to meet all needs. It should have a liquid volume of about 8 cubic feet per person. The sludge chamber should be at least 5 feet deep. Septic tanks are made either as a single chamber from which the liquid flows more or less continually, or as a two-chamber tank in which the dosage chamber acts as a container to accumulate the liquid which is then discharged at certain intervals. Along with the septic tank there must be a disposal system consisting either of one or more lines of drain tile or an absorption pit. The effluent from a septic tank still may contain harmful organisms and consequently should not be permitted to empty into an open stream where cattle may drink, nor should it be disposed of in the soil closer than 50 feet from the well. A distance of 100 feet would be better.

Insulation Goes with Modern Building

The advantages of insulation are rapidly being appreciated. Certainly in Minnesota we should consider its use in all aspects of a building program.

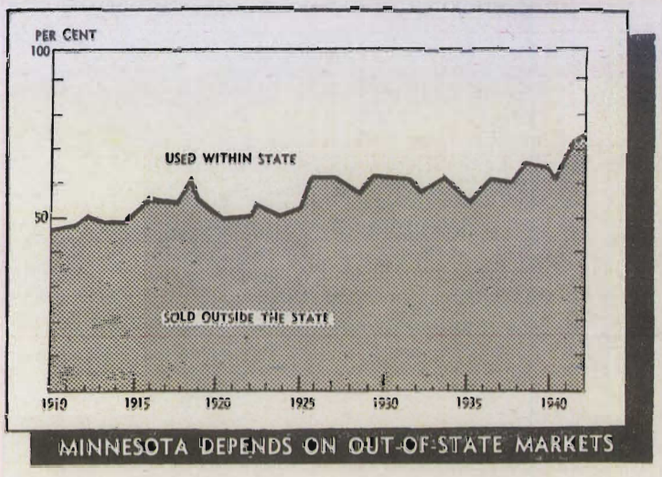
Although heat passes through all materials used in construction, certain materials are much better insulators than others. Insulation is usually classified as fill, flexible, and rigid. The fill type is available in loose form or in bats that fit into a wall. Flexible insulation is made in the form of blankets of various widths and thicknesses. Rigid material is available in board form, usually 4 feet wide and varying in length and in thickness.

The insulating value of commercial materials depends on the density and the number and size of air cells. That which is least dense and has the largest number of small cells has the greatest insulating value. Insulating value is also proportional to the thickness of the layer used. Some farm materials possess good insulating qualities and may sometimes be used to good advantage. These are planer shavings, sawdust, straw (especially flax), and ground corncobs. All of these materials must be dry when used and must be kept dry when in place. It is desirable also to treat them with a vermin repellent such as hydrated lime.

When a structure is well insulated, a vapor barrier, applied on or near the warm surface, is usually necessary to prevent the collection of moisture in the wall. The vapor barrier may consist of a sheet of paper treated with a continuous coating of asphalt or other similar material through which vapor cannot readily penetrate. This is generally a paper with a glossy surface. Sometimes a coating of a special paint or asphaltic material applied directly to the inside wall surface can be used. Some commercial insulating materials are made with a vapor barrier.

It is always advisable to have a reasonable amount of insulation in a dwelling. When improving the insulating value of an old house, the second floor ceiling is of first importance. It is usually accessible from the attic. Next in importance is weather stripping for the doors and windows. If additional protection against the escape of heat is desired, the space between the studs in the walls may be filled.

When animal shelters are insulated, ventilation to remove the moisture given off by the animals is usually necessary. Ventilation may be obtained by windows or doors, intakes and outtakes through which air flows by gravity, or openings through which air is exchanged by means of electric fans. The latter type makes possible automatic control.



Bulletin emphasizes great stake which Minnesota farmers have in high industrial activity and large agricultural exports now the war has ended.

MINNESOTA DEPENDS ON OUT-OF-STATE MARKETS

75% of Minnesota Farm Products Find Markets Outside the State

BECAUSE 75 per cent of their agricultural products are marketed outside of the state, Minnesota farmers have a tremendous stake in maintaining interstate and international trade channels in the present postwar era. Warren C. Waite, professor of Agricultural Economics, has analyzed sales of Minnesota agricultural products in Agricultural Experiment Station Bulletin 384. He points out that whereas only 45 per cent of farm products moved outside the state in 1910, the proportion had risen to 75 per cent by 1942.

Estimates have been made for the 19 principal agricultural products sold by farmers for the years 1910 to 1943 inclusive. The products included are: wheat, corn, oats, barley, rye, flaxseed, potatoes, hogs, cattle, calves, sheep and lambs, chickens, eggs, milk, butterfat, farm butter, turkeys, and wool. They represent about 90 per cent of the total cash sales.

The steadily increasing dependency of Minnesota farmers on out-of-state markets is shown by the graph reproduced from the bulletin.

Dr. Waite concludes further that the income received by Minnesota farmers from the sale of their products has fluctuated almost exactly in proportion to the national income in recent years. A change of a billion dollars in the national income has been accompanied by a similar change of about five and three-quarter million dollars in Minnesota farm sales. The value of sales to the nonfarm population is likewise closely associated with nonfarm income.

"The purchasing power of agricultural products depends upon the output of industrial products as well as agricultural products. When industrial production is high relative to agricultural production, the purchasing power of agricultural products tends to be high. In the period between 1920 and 1939, agricultural exports appear to have exerted a considerable influence upon this ratio. An increase of $5 million dollars in agricultural exports tended to increase the purchasing power of agricultural products by one per cent," according to Dr. Waite.

MINNESOTA
FARM AND HOME SCIENCE

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OCTOBER 15, 1945

Breeding Improved Crops

THE TASK of a breeder of improved crop plants is only partially completed when approval is given a new kind or variety of crop he has originated. Members of the Minnesota Agricultural Experiment Station draw up annually a recommended list of crop varieties that have been adequately tested for performance in Station trials. Each new approved variety must be increased rapidly and sufficiently so that a supply of seed becomes available for every farmer desiring to plant it. The first increase is made under the control of the Experiment Station. Further stages of increasing the seed stocks are under the control of a trained member of the Station staff to insure that these stocks are kept pure, and are reproducing uniformly the characteristics of the variety. Since the Experiment Station is unable to make large increases with the facilities available, relationships are established with skilled growers who have the land and the competence to grow the seed for the farmer.

Early in the history of plant breeding in Minnesota, this need was anticipated and provided for by convening a group of seed growers who became the members of an association later known as the Minnesota Crop Improvement Association. Membership has been opened to other farmer growers and to commercial seed houses. The association certifies seed of the varieties recommended by the Minnesota Agricultural Experiment Station and of other varieties approved by its Board of Directors. Income from fees collected for field and seed inspection services is applied to the payment of salaries and travel expenses of the chief certifying official and his inspectors. Commonly the secretary of the association is attached to the University staff and thus functions as a liaison officer between the agricultural department of the University and the association. The central office and laboratory of the Crop Improvement Association is in the Agronomy Building at University Farm.

In producing Minhybrid seed corn, the procedure is somewhat more complicated than for small grains. The seed of inbred lines is produced by hand pollination at University Farm and at the Waseca Branch Station. Arrangements are made with competent seed growers to produce the single crosses, following the detailed stipulations in the contract that is made with the Agricultural Experiment Station. The single-cross seed is returned to the Station where it is cleaned, graded, and stored in the thoroughly modern, new seed house recently constructed at University Farm. The grower's share of the seed is then made available to him or sold to other producers at his option. The Experiment Station's share is sold to producers of double-cross seed who are given an opportunity to apply in advance for the seed. They are required to follow the specifications of the Experiment Station if they propose to market the double crosses under Minhybrid designations. This entire procedure is designed to be self-supporting and to minimize the business activities of the University. It includes the requisite supervision to protect the purchaser of Minhybrid seed corn in so far as conformity to type and general quality are concerned, however, and at reasonable cost to the farmer.

These relationships have been evolved and thoroughly tested through the passing years. Seed growers get a fair return and the price of the seed is kept within reasonable bounds. Thus the facilities of the Experiment Station are greatly extended and the advantages are spread among numerous skilled growers of seed and even more numerous farmers who grow the crops.

C. H. Bailey

Dean and Director
Department of Agriculture
University of Minnesota

NEW BULLETINS

A general picture of the varied soil combinations in Minnesota is presented in Folder 131 just issued by the Agricultural Extension Service. Reproduced in color, a state map shows the soils arranged in 18 large groups.

"Soils of Minnesota," by P. R. McMiller, also gives brief descriptions of the soil associations which range from the highly productive, nearly level Clarion-Webster area of southern Minnesota to the rough stony land of the northeastern cutover region.

Free single copies of this folder and the other new publications listed below may be obtained from your county agent or from the Bulletin Room, University Farm, St. Paul 8, Minnesota.

EF 130—Pollen Substitutes
EF 132—Grafting—Methods Used in Top-Working
EF 133—Pasteurizing Milk at Home
EF 134—What Is a Good Farm House?
EF 135—Farmstead Planning
EP 141—Some Guides to Better Milk
EP 142—Saving a Soft Corn Crop
EB 244—Freezing Foods (Revised)

EF—Extension Folder EP—Extension Pamphlet
EB—Extension Bulletin

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