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Marketing Hogs *By Weight and Grade of Carcass*

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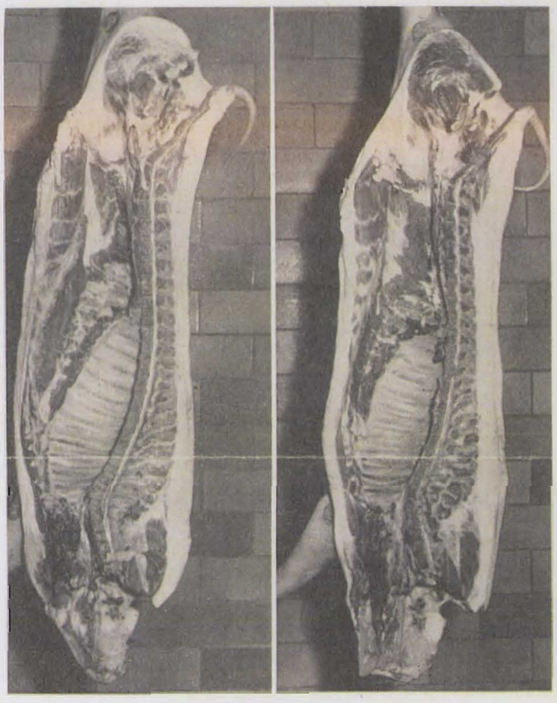
For the past two years, the University of Minnesota has been conducting an investigation to determine if it is possible to grade hog carcasses according to their cut-out value. The results of this study are presented here.



Left—a desirable Grade 10 carcass. This carcass weighed 150 pounds, measured 1.52 inches of backfat, and its index of lean was 70.9.

Right—this overfinished Grade 9 carcass weighed 157 pounds, measured 2.05 inches of backfat, and its index of lean was 66.3. Note the difference in backfat thickness.

THE INDIVIDUAL FARMER does not have much incentive to improve the quality of the hogs he markets today. He receives about the same price for all hogs of the same weight, except those with obvious defects. This tendency to price hogs largely on the basis of averages is a fundamental problem in marketing slaughter hogs.

If the farmer were to receive a higher price because his hogs made more satisfactory carcasses or "dressed out" better, he might try to improve quality. One important obstacle to pricing hogs according to their dressed value, however, is that the United States has no satisfactory carcass grade standards.

In Canada, Denmark, England, and Sweden, farmers sell their hogs by carcass weight and grade rather than by live weight. These carcass grades are based on "Wiltshire sides," which are sold on the British market.

In the United States, carcasses are broken down at the packing plant into wholesale cuts. These cuts, such as hams, loins, bellies, and lard, are the basis for sale from packers to butchers.

The divisions of Agricultural Economics and Animal Husbandry at the University of Minnesota have been investigating this problem for two years. Since the work was initiated, the North Central Livestock Marketing Research Committee has adopted "Marketing Slaughter Livestock by Carcass Weight and Grade" as a regional project.

The first step in establishing hog carcass standards is to determine why some carcasses are worth more than others. The hog carcass is made up of many wholesale cuts and trimmings. All differ in value. The hams, loins, picnics, butts, and bellies are the relatively high-value products, while lard is the most important low-value product. Therefore, the more valuable carcasses should yield more high-value cuts and a smaller amount of lard.

Overfat carcasses should be discounted because they yield too much lard and not enough of the high-value cuts. Carcasses carrying less "finish" yield less lard and more high-priced cuts, and consequently tend to be worth more. However, if carcasses are too thin or underfinished, some of the wholesale cuts—particularly the bellies, but also hams and loins—are likely to be worth less per pound because they lack sufficient quality to move in the wholesale trade as first-grade cuts.

Table 1. Suggested Hog Carcass Grade Standard Based on Backfat Thickness and Carcass Weight

Carcass Weights lbs.	Equiv. Live Wt. (approx.) lbs.	Grade 8		Grade 9		Grade 10		Grade 11		Grade 12	
		Index of Lean %	Backfat Thickness in.	Index of Lean %	Backfat Thickness in.	Index of Lean %	Backfat Thickness in.	Index of Lean %	Backfat Thickness in.	Index of Lean %	Backfat Thickness in.
110-140	165-205	64.1	2.0-2.3	67.0	1.7-2.0	70.0	1.4-1.7	72.9	1.1-1.4	75.8	0.8-1.1
140-180	205-260	64.1	2.1-2.5	67.3	1.8-2.1	70.0	1.5-1.8	72.7	1.2-1.5	75.5	0.9-1.2
180-220	260-310	64.4	2.2-2.6	67.4	1.9-2.2	70.0	1.6-1.9	72.6	1.3-1.6	75.6	0.9-1.3
220-270	310-375	64.2	2.4-2.7	67.1	2.0-2.4	70.0	1.7-2.0	72.8	1.3-1.7	75.7	1.0-1.3

"Overfat" and "underfinished" do not provide a precise basis on which to build grade standards. How fat is "overfat?" How much finish should a carcass carry to be safely beyond the "underfinished" classification? Are there any physical measures that describe the carcass more objectively and provide the basis for grade standards with quantitative specifications?

Carcasses Measured

To answer these questions, data were obtained on 695 carcasses at the Geo. A. Hormel & Company packing plant, Austin, Minnesota, in the fall of 1946 and the winter of 1947. Several measurements of each carcass were recorded. These included average backfat thickness, length of body, length of ham, thickness through the shoulders, thickness through the hams, and belly pocket thickness. After being measured, each carcass was cut to determine what part of the whole carcass was made up of wholesale cuts and trimmings.

Detailed statistical analyses were applied to these data to determine if any of these measures could be used to estimate the percentage of high-value cuts (hams, loins, picnics, butts, and bellies) and lean trimmings in the carcass. The combined percentage of high-value cuts and lean trimmings was called the "index of lean."

Average backfat thickness proved to be the best single measure in explaining variations in the index of lean. Body length was second and the other measures less important. At any specific carcass weight, such as 140 pounds, the use of backfat thickness and body length together gave little improvement over the use of backfat thickness alone. For that reason, primary emphasis was placed on carcass weight and backfat thickness in the preliminary efforts to establish grade standards.

Backfat thickness, carcass weight, and the index of lean were used to develop the tentative hog carcass standards shown in table 1.

In this standard, Grade 10 is presumed to be the most desirable carcass grade. Grades 8 and 9 carcasses are the highly finished carcasses, but they are discounted because they yield more lard and a smaller proportion of high-value cuts (note the increased backfat thickness and reduced index of lean in these grades).

Grades 11 and 12 include the carcasses which lack adequate finish. They will yield a higher proportion of high-value cuts than Grade 10. They are discounted, nevertheless, because many of the bellies, hams, and loins coming from these carcasses are so lacking in quality that they cannot be sold as No. 1 cuts in the wholesale trade.

Grade Values Differ

The next important task was to determine the differences in carcass value among the several carcass grades. These differences depended upon (1) the expected average carcass composition within each of the different carcass weight and grade groupings, and (2) the relationship of the prices of the various wholesale cuts and trimmings to each other.

Information required to predict the average carcass composition was provided in this study. The price relationships of the various cuts and trimmings are constantly changing. But in general, the greater the margin between lard prices and the prices of the high-value cuts, the greater will be the discount for the overfinished grades.

If we use the average price relationships which prevailed from 1937 to 1941, and the average level of liveweight prices for all slaughter hogs sold in 1947 ($24.60), the composite carcass values for Grades 8, 9, and 10 would be as shown in table 2.

Table 2. Composite Carcass Values for Several Carcass Grades

Carcass Weight (Pounds)	Equivalent Live Weight (Approx. pounds)	Carcass Grades				
		8	9	10	11	12
110-140	165-205	$39.82	$40.63	$41.39	.....	.....
140-160	205-232	39.31	40.09	40.71	.....	.....
160-180	232-260	39.04	39.58	40.02	.....	.....
180-200	260-285	38.41	38.76	39.10	.....	.....
200-220	285-310	37.91	38.13	38.29	.....	.....

Carcasses within the overfinished grades (8 and 9) are discounted because they yield less of the high-value cuts and more of the low-priced lard than those in Grade 10. Within each grade, the heavier carcasses are discounted because their heavier cuts of hams, loins, picnics, and bellies usually sell at sharply lower prices. Not enough data on the numbers of discounted cuts from underfinished carcasses were available to determine precisely the proper price discounts for the underfinished grades (11 and 12).

These investigations were carried on to determine the relative accuracy of the present liveweight system of marketing hogs, and a carcass weight and grade system in pricing slaughter hogs according to actual value. Individual live hogs vary in value because of differences in the carcasses they produce and because of differences in their dressing percentage or carcass yield. (Although yield is a very important factor, no work was done in this study to determine why carcass yields vary.) In order to compare the relative accuracy of the two marketing methods, the study measured the reduction in variability of liveweight value accomplished by each method of marketing.

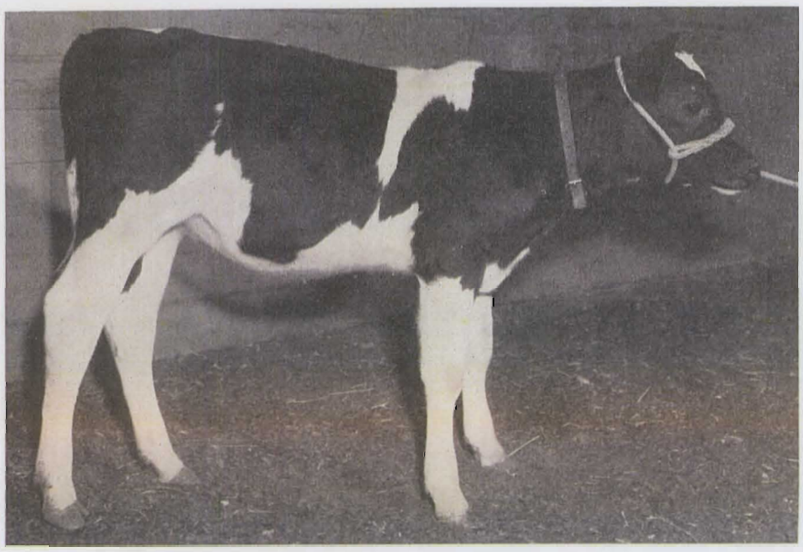
Methods Compared

The liveweight method alone removed 45 per cent of the total variation of individual live animal values. An additional 38 per cent, or a total of 83 per cent, could be removed through the carcass weight and grade system. These two figures, 45 and 83 per cent, are measures of the relative accuracy of pricing of the two marketing methods. This would leave about 17 per cent which can be accounted for by the value variations between carcasses within each carcass grade.

If we start with the present system as a base and consider only the remaining errors in pricing, it is significant that a little more than two-thirds of the remaining value variations could be removed through marketing of hogs on the basis of carcass weight and grade.

These results are preliminary and tentative. It is probable that further research may develop a carcass standard superior to that suggested here.

YOU CAN *Reduce Calf Losses*



LESTER O. GILMORE and T. W. GULLICKSON

MINNESOTA'S 150,000 dairymen can make their dairy enterprise more profitable by understanding the importance of good babyhood care for calves. Death takes a tremendous toll during the calf's babyhood. Cutting down this toll will give every dairyman a much larger group of heifer calves and future sires to select from. At the same time, of course, fewer deaths will mean less financial loss in the herd.

Of all the calves born between 1934 and 1945 in the University of Minnesota dairy herd at University Farm, approximately 10 per cent were born dead. Inbreeding was partly to blame because it brought together undesirable traits that otherwise might not have been evident. Just how many deaths were caused by this inbreeding, however, is not known.

Another 8 per cent of the dairy calves died before they were a week old. About 17 per cent died during the first month, and only 75 per cent of those born alive lived six months. Other studies showed that 40 per cent of the calves living beyond six months had been set back by scours or pneumonia, the most prevalent calf diseases.

Contrast this rather astonishing toll with a record of very little sickness and a mortality of 5 to 15 per cent among beef calves. The most probable reason for the difference is that beef cows are more often carried on grass and beef calves perhaps get better earlier care.

Before birth, the mother provides the calf with oxygen from her oxygenated blood cells and nutrients from her blood stream. Thus, the most critical time in a calf's life is probably during birth and the attendant adjustments of the heart, lungs, and digestive tract.

The difference between the environment within the dam's uterus and the outside is so great that some calves cannot adjust themselves. The adjustment is even more difficult when the calf suffers from some deficiency as a result of improper feeding of the dam, or inherits genes for low vigor or specific genes for lethal (death-producing) conditions. In cattle throughout the world, there are 26 such genes which are known to cause death prematurely. Many of them are carried by the breeds in the United States.

Inherited lethals most frequently show up at a few days after birth. Some, however, cause death earlier and the result is an abortion. Others start life, but fail to live their normal life span.

The Mother's Feed

Experimental evidence and experience of calf raisers show that the dam's nutrition is the bulwark of a program aimed at raising a larger proportion of calves born in a herd. Research has shown that vitamin A and iodine are essential in the dam's ration if the calf is to get a good start in life.

Early experiments showed that rations restricted solely to oats or wheat plants, or to a combination of the two, caused aborted, dead, or weak calves. However, cows fed rations restricted to the corn plant gave birth to strong calves at full term. One of the differences in the rations was the greater amount of vitamin A provided by corn. Cows fed a ration low in vitamin A may also produce blind calves.

A 1,000-pound pregnant cow needs at least 12,250 U.S.P. units of vitamin A per day. Five to ten times this amount is recommended especially during the last months before the calf is born. This vitamin is not likely to be deficient where cattle have good pasture and are fed good green-colored hay during the winter. If pasture is cut by drouth or if hay is improperly cured and stored, vitamin A should be added to the diet of the pregnant dam. Feeding 1,000,000 U.S.P. units of this vitamin daily for two weeks before the calf is due may be most effective in helping the calf combat early trouble.

The lack of vitamin D has not caused high death losses. The colostrum from cows fed plenty of sun-cured hay will generally provide the young calf with a liberal supply of vitamin D. Later needs are met by feeding sun-cured hay and by exposure to direct sunshine.

The popularity of vitamin E for cattle is on the wane. Carefully controlled experiments at the University of Minnesota show that cattle do not need this vitamin for reproduction.

Among the many mineral elements needed by gestating cows, iodine is the most likely to be deficient, especially in river basins such as the Mississippi. A severe deficiency of iodine may result in goiterous calves that are dead at birth or that die shortly thereafter. The general use of iodized salt or potassium iodide for all cattle provides the pregnant dam with adequate iodine.

Clean and pleasant maternity surroundings facilitate the calf's adjustment at birth. It is a good idea to let the cow calve in a small, quiet, well-

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The nipple plan of feeding is satisfactory for young calves.

Do Stored Potatoes Lose Vitamin C?

JANE M. LEICHSENRING
and LOANA M. NORRIS

SINCE EARLY colonial times, potatoes have been an important vegetable crop in the United States. Government reports have shown that Americans consume annually approximately 275 million bushels of potatoes, which is a daily per capita consumption of about 4½ ounces. Among low-income groups, however, potatoes constitute a much larger portion of the diet than is indicated by the national average. The potato is justly popular. It has a mild, pleasing flavor, is adaptable to various methods of cooking, and has good storage qualities, all at low cost.

Most people are aware that the potato is a good source of food energy, but few realize or appreciate its other contributions to the diet. Do you know, for instance, that three small potatoes daily will contribute to your diet significant amounts of two minerals: phosphorus and iron; and three vitamins: thiamine, niacin, and ascorbic acid, plus lesser amounts of other nutrients?

Newly-harvested potatoes are especially rich in ascorbic acid. Such potatoes, however, constitute only a small part of the annual potato consumption. The major portion of the yearly crop is held for varying lengths of time, and many potatoes are kept under different conditions of storage for months.

Recent studies have shown that potatoes lose their ascorbic acid content when subjected to storage. During the early part of the storage period, there is a very rapid loss of this vitamin. Such loss becomes more gradual with continued holding. In spring, when other sources of this vitamin are less abundant, potatoes are also less potent sources, containing only about one third as much ascorbic acid as was present at time of harvest.

This loss in ascorbic acid during storage is of considerable importance from the nutritional standpoint, particularly for the low-income groups in our population. Accordingly, we need to know not only which conditions of storage will assure potatoes of good table quality, but also which conditions will result in the maximum retention of this essential vitamin.

Authorities agree that storage at temperatures of 50° F., or higher, results in table stock of high quality. However, potatoes can be kept at this temperature for only 12 to 14 weeks without excessive shrinkage and early sprouting. Prolonged storage at temperatures below 40° F. retards sprouting, but at the same time it increases the sugar content, and makes potatoes soggy for table use. A temperature of approximately 40° F., therefore, is probably the most desirable compromise for long storage periods, because at this temperature the shrinkage is small, the cooking quality is fair, and sprouting is definitely retarded.

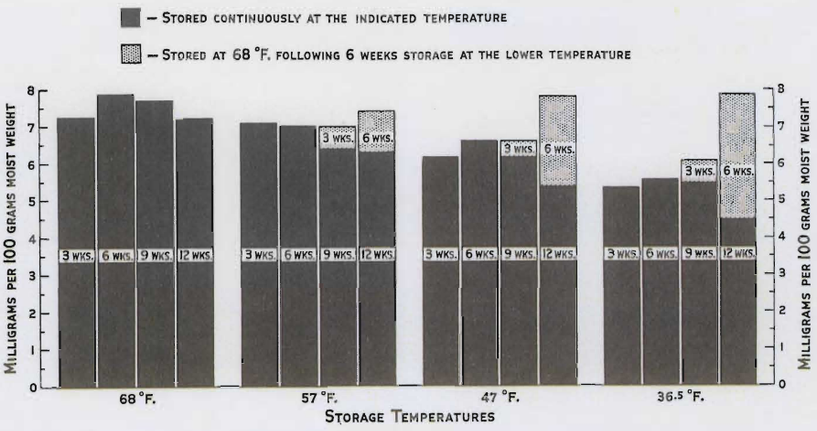

Fig. 1. Mean values of ascorbic acid content for three varieties of potatoes stored at four temperatures, compared with values for similar potatoes stored under different conditions.

To determine what conditions of storage would best conserve the ascorbic acid content of potatoes and at the same time prevent the development of excessive sweetness, a study was undertaken recently by the University of Minnesota Agricultural Experiment Station. Tests were made on three common commercial varieties of potatoes (Red Warba, Mesaba, and Chippewa) produced at the North Central Experiment Station at Grand Rapids, Minn. These potatoes were harvested in September and held in a root cellar at Grand Rapids until December 10, when they were delivered to University Farm. At this time the outside temperature was just above freezing.

Each of the three varieties was divided into lots which were stored at four different temperatures (68° F., 57° F., 47° F., and 35.6° F.) from mid-December until mid-March. At three-week intervals for a period of 12 weeks, tubers from lots of each variety were removed from storage and analyzed according to accepted chemical methods for ascorbic acid and total sugar content. After six weeks, half of the tubers stored at the three lower temperatures were transferred to storage at 68° F. These were analyzed after three and six weeks' storage at this common temperature.

The results of ascorbic acid determinations on the stored tubers are shown in figure 1. Because the three varieties responded similarly to the different storage temperatures, only the mean values for the three varieties are presented. The solid black portions of the chart show the ascorbic acid values for the potatoes held continuously at the four storage temperatures. The lighter portions represent the values for the tubers held at 68° F. following six weeks' preliminary storage at the lower temperatures.

Temperature Increases Loss

The chart shows clearly that storage temperature had a significant influence on the ascorbic acid content of the potatoes. Obviously, storage at the two lower temperatures caused appreciably greater losses of this vitamin than did storage at the higher temperatures, particularly during the last three-week period. Furthermore, tubers which were analyzed after three and six weeks' storage at 68° F., following six weeks' preliminary storage at the lower temperatures, showed marked recoveries in ascorbic acid content. This condition was most apparent in those tubers which had been stored originally at the two lower temperatures. In these, the ascorbic acid content at the close of the experiment was actually somewhat greater than that in the potatoes held continuously at 68° F.

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FUNGI THAT POISON SOYBEANS

MICHAEL G. BOOSALIS and
M. F. KERNKAMP

ONE OF THE MOST striking agricultural developments in recent years in the corn belt is the great increase of soybean acreage. The importance of soybeans in Minnesota is evidenced by the fact that the production in 1947 was 11 million bushels, 10 times greater than the 1940 crop. The principal reason for this spectacular increase was the rising demand for domestic oils and fats.

In view of this large and rapid increase of soybean production, the Division of Plant Pathology of the University of Minnesota Agricultural Experiment Station began to study the potential importance of soybean diseases.

Bacteria Menace Crop

Bacteria, viruses, and fungi can attack soybeans and cause destructive diseases. Within each group there are several species or types that attack the crop. Soybean diseases produced by bacteria and viruses have not been investigated as extensively in Minnesota as have those caused by fungi.

Field surveys disclosed, however, that bacteria and viruses do constitute a real menace to the crop. The bacteria may destroy large areas of the leaves, causing stunting of the plant, reduction in yield, and production of poor seed.

The viruses may infect most of the plant organs of soybeans and cause yellowing, wrinkling, and crinkling of the leaves. The resulting injuries to the plants are about the same as those caused by the bacteria. At present, plant scientists are developing more resistant varieties for the control of bacterial and virus diseases.

About 10 species of fungi (molds) cause diseases of soybeans. Besides being able to cause severe injury to the plants, some of them can result in extensive damage to seeds in storage.

The plant pathologists at University Farm are investigating especially the soil fungus *Rhizoctonia* which is a "triple threat" to soybean fields. This plant killer is found in all soils wherever crops are grown. The mycelium (vegetative threads) of this mold can, under favorable conditions, cause 100 per cent "damping-off" (killing of the seeds and seedlings) of all the common Minnesota soybean varieties.

The struggle for survival is only half won by the plant if the seeds or seedlings escape damping-off, because the fungus may still continue to attack growing plants, partly or completely girdling the stems near the ground.

Studies made in the laboratory and in the greenhouse have shown that this triple threat fungus can excrete toxic substances which poison soybean seeds and seedlings even when the fungus itself does not penetrate the plant. The diluted toxic substances from a strongly pathogenic strain of *Rhizoctonia* were found to reduce seed germination and check root development of the seedlings. The diluted toxic substances from a weakly pathogenic strain did not affect seed germination or root development. Pathologists do not yet know whether toxic materials are produced in the field by the fungus or, more important, whether these toxic substances affect the soybeans.

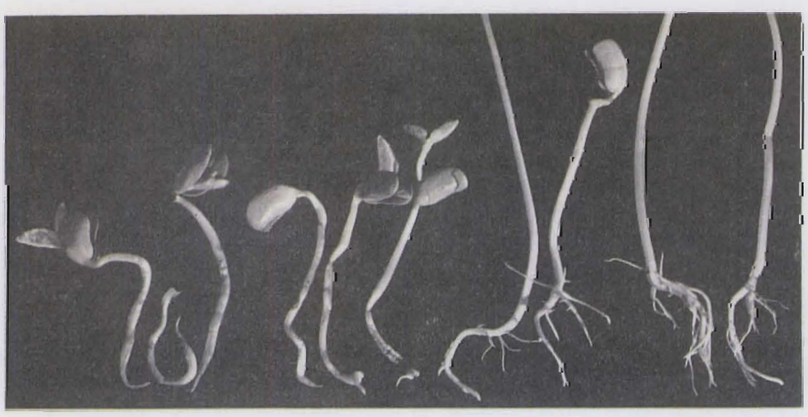
Chemical seed treatment, resistant varieties, and crop rotation are three possible methods for controlling the damping-off caused by fungi. The investigations made by plant pathologists have been confined to seed treatments for controlling root-rotting molds.

Left—healthy soybean seedlings.
Right—seedlings infected with root rot, showing necrotic lesions.

Experiments were made with soybeans in field plots inoculated with the pathogenetic mold. These tests show that damping-off is controlled better by some fungicides than by others. Because a root-rot epidemic did not occur in Minnesota during this investigation, it was not possible to determine the effectiveness of the seed treatments under natural conditions. Seed treatment experiments will be continued, however, to determine the best chemicals for controlling damping-off and ultimately for increasing soybean yields.

Many Factors Contribute

Thus far, there have been no soybean disease epidemics in Minnesota. In an epidemic, however, there are many contributing factors, such as parasitic races of the mold, environment, amount of inoculum, and susceptibility of the variety. Because of these factors, there can be no guarantee that a crop will remain healthy simply because it was not subject to diseases of epidemic proportions in the past. The knowledge derived, therefore, from this research may become applicable in future, unforeseen epidemics.



Germination and seedling development are affected by toxic substances from two root-rot molds.
Left to right: seedlings grown from soybean seeds germinated in toxic substances from strongly pathogenic molds; plants from seeds germinated in toxic substances which had been heated at 240° F. for 1.5 minutes; a weakly pathogenic mold supplied the toxic substance in which these seeds were germinated; no toxic substance was added to the germinating solution for these seeds.

CORN BORER Aggravates *Stalk and Ear Rot*

J. J. CHRISTENSEN
AND C. L. SCHNEIDER

THE SPREAD of the European corn borer into Minnesota has greatly complicated the development of corn varieties which will resist stalk and ear rots. Observations in Minnesota indicate that the greater the infestation of European corn borer, the greater the stalk-rot damage. Inbred lines and varieties of corn that are usually free from stalk rots may develop considerable rot when injured by the corn borer.

Stalk and ear rots are among the most important corn diseases in Minnesota, and in certain years may cause considerable damage. Under conditions favorable for rot development, stalk rots may kill the plants prematurely and thus reduce yields. They also may increase lodging and early stalk breakage. Obviously, lodged and broken stalks not only make harvesting of corn more difficult, but may also reduce the quality when the ears come in contact with moist soil and become moldy.

In Minnesota, stalk and ear rots of corn are caused by many different microorganisms, chiefly molds. Some of these molds cause important diseases on other cereal crops. One of the common stalk- and ear-rotting fungi also causes scab of wheat and barley. Some of the stalk-rotting organisms are relatively weak parasites on corn and can cause damage only when the plants are weakened or when entrance to the plant is provided through wounds, such as those caused by insects.

On the other hand, some of the more active parasites are not dependent upon injuries. They may enter through the roots, shanks, shoots, and at the junction of the leaf with the stalk. However, their entrance and subsequent development in the plant are greatly aggravated by mechanical injuries.

Stalks Examined

During 1946 and 1947 thousands of corn stalks were sliced lengthwise and a count was made of the prevalence and severity of the rot adjacent to the insect tunnel. In an experimental plot at University Farm where 59 lines and crosses are grown, most of the borer-infested stalks in 1947 had conspicuous rots associated with insect tunnels. By October 1, 81 per cent of the internodes with insect injuries had already developed rot. As the season progressed, more rot developed. The uninfested internodes in the same stalks were comparatively free from infection. It is rather significant that several insect tunnels may occur on the same stalk, and on various places on the same plant: nodes, internodes, shoots, shanks, and ears. Whenever these injuries are followed by rots, severe damage to corn may result.

Obviously the European corn borer weakens the plant mechanically, and the injuries also cut off a certain amount of nutrient supply. The weakened tissues are more subject to attack by certain parasites which are ordinarily too weak to cause damage. The rots that follow the insect injuries are therefore usually of much greater extent than the tissue actually destroyed by the insect. Consequently, injuries attributed to European corn borer may be due in part to damage of fungi (molds) following the insect injuries.

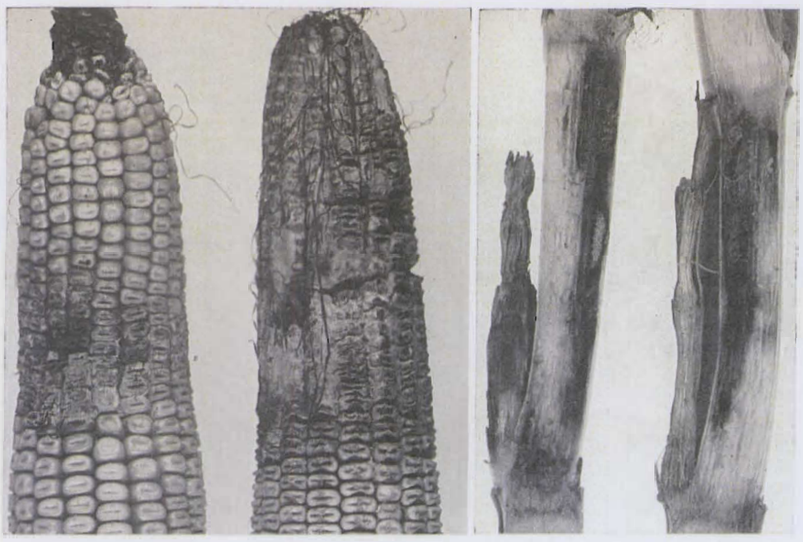
FOUR WAYS in which the European corn borer aids in development of stalk and ear rots:

- **It provides avenues of entrance for fungi (molds).**
- **Movements of borer larvae distribute organisms inside the plant.**
- **Excrement of the borer larvae in larval tunnels furnishes an excellent medium for the rapid growth of fungi.**
- **Plant injuries caused by the borer weaken the adjoining tissues, rendering them more subject to fungus attack.**

Holes Increase Rot

The borer larvae make holes in the stalks which provide an easy entrance for fungi and bacteria that cause stalk rots. Field tests over a period of years have shown conclusively that mechanical injuries of various types, such as those induced by nail punctures, greatly increase the percentage of stalk rots. Also, inbred lines and varieties of corn which are normally comparatively free from stalk rots may develop considerable rot when artificially inoculated through wounds. Thus, by means of mechanical injuries, the European corn borer may render resistant lines of corn susceptible to stalk rots.

The frass deposit within the insect tunnels is an excellent medium for the growth and multiplication of many fungi. Examinations have shown that frass from different tunnels is usually thoroughly infected with microorganisms of various kinds, including those associated with stalk and ear rots. Since many stalk-rotting organisms can grow readily on dead materials, the



Left—ears of corn showing different degrees of rot.
Right—stalk rot developing around corn borer tunnels. Note borer larva in stalk at left.

frass furnishes a favorable substrate for a rapid build-up of organisms and thus hastens the destruction of tissues. It seems likely that the frass may help to establish a parasitic relationship of certain weak pathogens, such as one of the blue molds which kills the corn tissue in advance of its penetration.

Laboratory tests indicate that the larvae of the European corn borer are usually infested both internally and externally with many microorganisms including those that cause stalk rots. The adult moths of the corn borer sometimes carry many spores of molds on their bodies.

The frass often makes up a large percentage of the organic material that collects outside the plant, between the stalks and the leaf sheaths. Stalk-rotting and leaf-blighting organisms may grow readily in this material. In this way, some of the fungi which do not depend on injuries for entrance into the plant are aided by the frass which provides suitable material for rapid multiplication of the organism at the place of entry.

The movements of the European corn borer inside the plant help to distribute the organism within the host. Although the pathogens may progress rapidly within the tissue of an internode, the node tissue greatly retards the spread of the fungi. The corn borer frequently attacks the node directly or tunnels through it, and aids in the rapid spread of fungi within the plant.

Although the larvae and moths carry the disease-producing organisms, this is of relatively minor importance in the spread of the molds, since these organisms are effectively transmitted by air currents, wind, rain water, and other agencies.

Control Problems

Any attempt to control stalk and ear rots of corn must take into account the importance of the European corn borer in this disease problem. In the program of breeding stalk and ear rot-resistant varieties of corn at the University of Minnesota Agricultural Experiment Station, more than one hundred lines and varieties of corn are tested each year for resistance to these diseases at University Farm, and at the Morris and Waseca stations. Pure cultures of stalk-rotting fungi are grown on toothpicks which are inserted into small holes in the stalks at about silking time. Inbred lines and varieties of corn differ widely in their resistance to stalk rot when inoculated in this manner. Thus, by simulating the conditions whereby certain stalk-rotting fungi may enter the plants, inbred lines of corn may be selected that are resistant to stalk rot under a wide range of conditions.

Three of the men most closely connected with the development of the new Minnesota No. 2 hog: from left to right are Dr. L. M. Winters, Mark Thompson, and T. M. McCall.

Minnesota No. 2 Hog Breed Dedicated at Crookston Ceremony

THE UNIVERSITY of Minnesota's second new hog breed, the Minnesota No. 2, officially joined the elite circles of recognized hog breeds at a special dedication ceremony at the University's Northwest Agricultural Experiment Station at Crookston, September 18. T. M. McCall, superintendent of the station, was host for the ceremonies.

Dr. C. H. Bailey, dean and director of the University's Department of Agriculture, formally presented the No. 2 to the farmers of Minnesota and the middlewest at the ceremony. John Olson, president of the Inbred Livestock Registry association, accepted the new breed in behalf of Minnesota farmers.

Olson also recorded the new hog in the registry association's rolls. The association will now officially register No. 2 hogs.

The No. 2 hog is the result of eight years of careful inbreeding by University experiment station animal husbandmen, headed by Dr. L. M. Winters. Most of the experimental work was carried on at the branch station at Crookston.

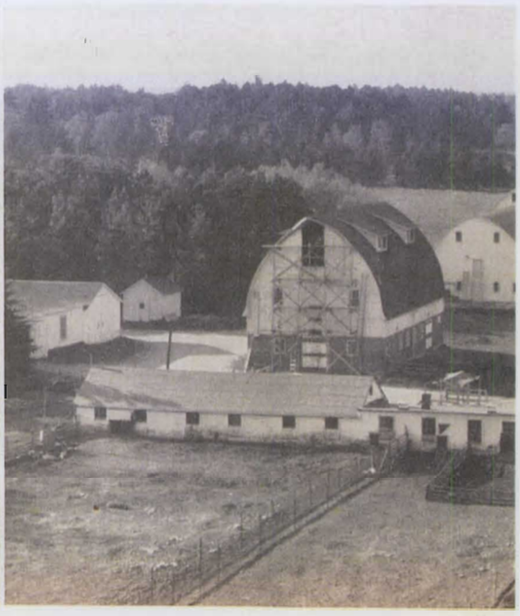
Work on a herd of No. 2's was also carried on at the University's Northeast Agricultural Experiment Station at Duluth, under the direction of Mark Thompson, superintendent.

The new hog originated from a cross of a Canadian-bred Yorkshire boar with females of two inbred Poland China lines. Main value of the No. 2 line will be in developing superior market swine through crossbreeding with other hogs.

Dr. Winters declares that the No. 2's were developed primarily for crossing with Minnesota No. 1 hogs and with the experiment station Poland China inbred lines.

The No. 2 is a black and white, lean type of hog. It does not have as long a body as the No. 1, but has longer legs.

Mrs. Deloris Dahl, Dassel, Minnesota, breaks a bottle of buttermilk over a yearling boar in dedication ceremonies for the Minnesota No. 2 hog. Looking on is Northwest Experiment Station animal husbandman, Homer Fausch.



The North Central School and Experiment Station

DONALD L. DAILEY

IF MINNESOTA were divided into halves, and diagonal lines drawn from opposite corners of the north half, these lines would intersect near Grand Rapids. That is why the name North Central was given to the branch Agricultural School and Experiment Station of the University which was located there in 1896.

Fifty years ago, nearly one-third of Minnesota was pine forest or cut-over land originally in pine. This area, including all of the territory within 100 miles of the experiment station at Grand Rapids, presented a problem to the state. It was decided to experiment with agriculture in the region.

Dailey

This branch station was established to study the problems and carry on work both in forestry and farming. Later, a forestry experiment station was started at Cloquet, and another agricultural station at Duluth to deal with the different soil types that prevailed near Lake Superior.

Today the North Central Station is fundamentally an agricultural station. It does, however, have approximately 180 acres in a wood lot containing about one million board feet of timber. The station also includes one forestry research project which dates from 1900.

The farm contains 454 acres. At the time of purchase 70 acres were in crop; today 140 acres are under cultivation. In addition, there are approximately 115 acres of pasture and 20 acres in farmstead, barnyards, school grounds, and roads. The farm was well chosen for it contains marked soil variations similar to those which characterize this large pine region.

Time, experience, and research work are evolving a pattern of land use for this northern country. About one-third of the land is suited to farming. The remaining two-thirds can, at present, best be used for forestry and conservation. The land is productive. Acre for acre, except for extremely sandy areas, the productivity is exceeded only by southern Minnesota soils. Hay, pasture, and small grains are best adapted, with potatoes, legume seed, and in some cases, flax, serving as cash crops. More than 80 per cent of the farm income of this area comes from dairying. The region is ideally adapted to sheep production, but wolves and black bears make this enterprise risky in many communities.

Farms are small, with less than 40 plowable acres on the average, but there are many acres yet to develop. This is the only area in the state that has an increasing number of farms and a growing farm population. The big problems for most of the farmers are the clearing of land of brush and stumps, and in some cases stone, and the providing for adequate drainage so that the farms can be made large enough for a sizeable business.

Farm ownership is high. Ninety-five per cent of the 30,000 farms are owner operated. Forestry is important because the small farmer supplements his income by selling from his wood lot or by cutting pulp wood or saw logs on national or state forest lands.

The problem of the area hinges around the small farm in a cold climate, with an annual rainfall of about 24 inches and a frost-free growing season of 100 to 110 days. These problems of the area are the problems of the experiment station.

In 1926, a school of agriculture was established to enable the farm boys to fit themselves more fully for successful farming in the cut-over region. The school was started with one 80-bed dormitory and one small classroom building. Construction of another classroom building has since been started, but the school needs additional buildings, such as a gymnasium and livestock judging pavilion. In spite of limited teaching facilities, this school has been

Left—M. C. Hildreth, shepherd, and Donald L. Dailey, superintendent, show one of the Minnesota 100 sheep, a new line bred for production in northern Minnesota.

Middle—a litter of the Minnesota No. 1 hogs, developed at the North Central station.

Right—a view of the Chapman Plantation, begun in 1901 by Superintendent H. H. Chapman.

running at capacity attendance. When the school was established, the staff was enlarged, making it possible to expand the research program and to render additional services. At present, there are five full-time staff members and the superintendent.

Forty-five different experimental projects are being carried on. Some of these are further broken down into subprojects, which make a total of more than 70 different research studies covering phases of agricultural engineering, field crops, fruits and vegetables, soils, livestock, poultry, and wood lot management.

In agricultural engineering, studies in land clearing and drainage have received much attention, especially in the early years. Crops investigations have followed the conventional pattern of variety testing for adaptability and yield in the region. Hay and pasture studies have been increased in recent years. Station horticulturists are searching constantly for extra-early, extra-hardy varieties, but little success has been attained with the tree fruits.

Soils work has developed suitable crop rotations. Rates and ratios for commercial fertilizers have been determined and the value of barnyard manure demonstrated. In the station's 52 years, several pieces of work are particularly significant. In chronological order, these are:

The Chapman Plantation—The Chapman Plantation is a planting of four different species of pine trees. Begun in 1901 by Superintendent H. H. Chapman, this planting is the oldest such project in the United States on which continuous growth records have been kept. It has provided valuable information on reforestation to foresters in the Lake States area. The Norway or Red Pine has been demonstrated to be the most desirable tree for replanting, except on very sandy sites, where Jack Pine grow to better advantage.

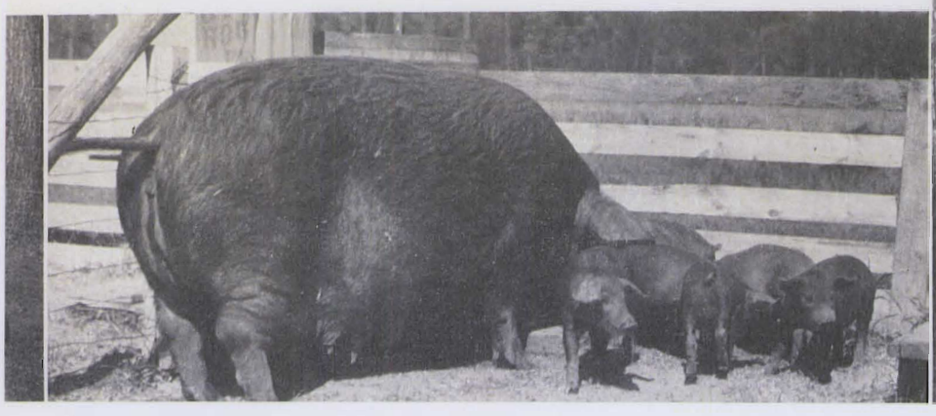
Plot Proves Valuable

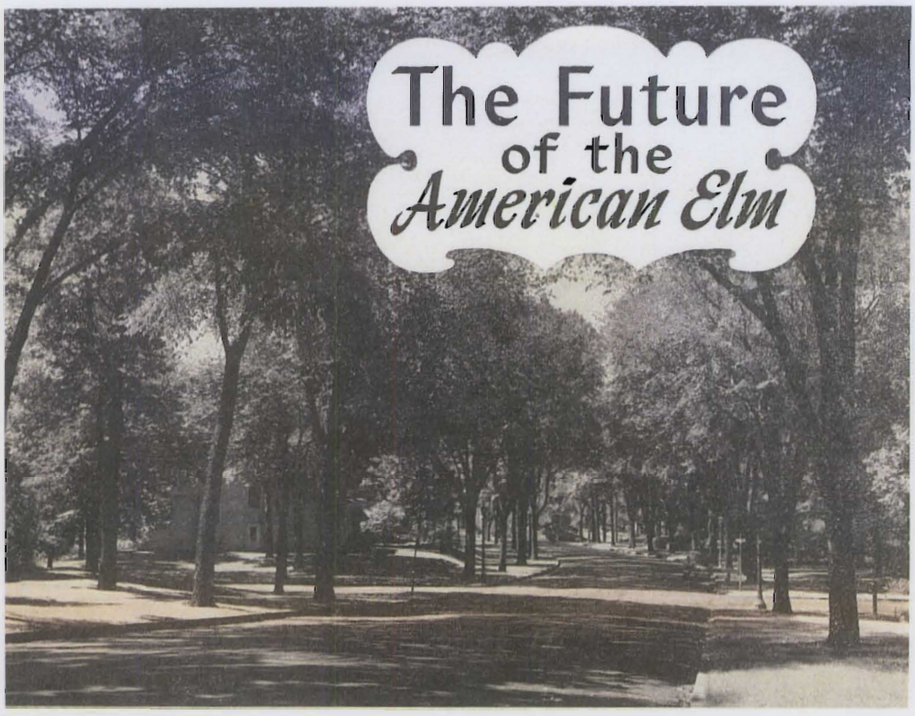
Today, one of the better plots is grown in 566 trees per acre, with an average height of about 65 feet. Many of the trees are of saw log dimensions. There are 24,000 board feet of lumber per acre, and the plot is increasing at a growth rate of 1,100 board feet per acre per year. If this stand were to be harvested, it would bring returns of more than $1,200 per acre from land that is too rocky to be tilled.

The Chapman Plantation stands as a reminder that forestry and farming will go hand in hand in the development of north central Minnesota. It further points out the value of intensified forestry and the profit that can be realized from intelligent and careful wood lot management. It is also an example of a valuable, long-time research project The final story on this research work may not be written for another 50 or 75 years.

The Improvement of Dairy Cattle with Purebred Sires—This project was initiated by A. J. McGuire, superintendent of the experiment station from 1904 to 1914. Today, we accept the use of purebred dairy sires and production records as elementary in dairy cattle improvement. In the early 1900's, however, when this project was started, it was fundamental research, necessary for gathering information and demonstrating to dairymen the improvement that could be achieved from generation to generation through the continued use of purebred sires.

(Continued on page 11)





The Future of the American Elm

F. H. KAUFERT

THE AMERICAN ELM has long been a favorite for city boulevard and farm plantings. Yet today this popular tree faces grave threats to its future because of disease problems and other shortcomings. These problems are important because the street and boulevard plantings of most of our midwestern cities are almost exclusively American elm, with about a million of them in the Twin Cities alone.

What has made the American elm so popular that other species are almost excluded in many cities? Its spreading form and beauty are recognized attributes and have contributed much to its general adoption. But other factors have also added to its popularity.

The American elm is native to most of the eastern United States, it is an abundant seed producer, it is easily and cheaply grown into saplings, and it is readily transplanted. The native American elm in river bottoms and lowlands provides a local source of seed and eliminates questions of hardiness or adaptibility to local conditions. Its vigorous growth under unfavorable growing conditions make it cheap to establish. With relatively little investment, cities and towns can obtain attractive elm archways.

These advantages more than overbalance the undesirable qualities of this elm. There are factors, however, that have long caused many to question the wisdom of widespread elm planting.

The species is expensive to maintain. The necessary frequent and heavy pruning is costly and objectionable to city dwellers. Periodic epidemics of the canker worm make expensive spraying and banding necessary. Aphid infestations produce a sticky, dust-catching ooze that ruins an automobile polish.

In cities, elms have damaged sidewalks and street pavements. Their shade and soil-sapping root competition make it hard to maintain foundation plantings, lawns, and flower beds.

In spite of these drawbacks, we probably would continue to plant American elm on the same wholesale scale if it were not for its susceptibility to the serious Dutch elm and "phloem necrosis" diseases.

Diseases Threaten

Introduced from Europe, Dutch elm disease is caused by a fungus and is spread by insects. Although it has caused serious damage in New York, New Jersey, Connecticut, and Ohio, its westward spread has been relatively slow. The recent report of a case in Kansas City, however, is disturbing.

Phloem necrosis is caused by a virus and poses a more direct threat. It has caused serious damage in Ohio, Indiana, Illinois, and Missouri and has been reported in southeastern Iowa. In Columbus, Ohio, this disease has stripped entire streets of beautiful trees.

The only protection we can offer our older elm plantings against these serious diseases is to maintain them in as vigorous a growing condition as possible, guard against the introduction of the diseases, and attempt to detect and eradicate infections if they occur.

In case of future street plantings, however, we have another important safety measure—diversification, or mixing of species. The planting of miles of American elms with no intermixing of other species provides almost ideal conditions for the spread of both the Dutch elm and phloem necrosis diseases and of the canker worm.

Mixtures on the same street are impractical and unattractive, but a district can be broken up, with certain streets planted to one species and others to a second or several species. In the face of this disease threat, this procedure is essential, even though the cost will be greater and the substitute species are less attractive.

What species can be used for diversification? Foresters and horticulturists believe that hackberry should be high on the list. Hackberry is native to this territory and consequently is hardy. It also possesses many of the desirable characteristics of the American elm. Although it grows more slowly and is not as spreading as the American elm, it suffers little damage from sleet and wet snow, is less damaging to sidewalk and street pavement, and is not subject to serious insect and disease damage.

Some people object to its small "witches brooms" or excessive branching (often called "birds' nests"). Actually, during the winter months these brooms sometimes add to the hackberry's interest and appearance.

Hackberry Is Possibility

The hackberry "leafs out" late in the spring and drops its leaves rather early in the fall. But many people consider early dropping of leaves a blessing. The late-spring leafing habit is objectionable when there is an exceptionally late spring frost. The plantings on Doswell, Raymond, and Summit avenues in St. Paul are convincing proof that the hackberry has real potentialities and should be used more extensively.

Green ash and sugar maple also deserve some attention as possible substitutes for the elm. Both are native to the midwest. Green ash is a fairly rapid grower and is as cheap to establish as elm. Because of its narrow crown and smaller size, it fits best where houses are close to the street and where dense shade is not desirable.

Sugar maple is expensive to establish, and it takes many years to acquire the spreading form it has in forests and woodlands. Although subject to damage by a number of fungus diseases and insect pests, it appears to be relatively safe for future planting.

Basswood and northern pin oak have been planted to some extent in place of the American elm. Although basswood is subject to defoliation by several insects, more effective insecticides and cheaper application methods could make it promising for diversification.

Northern pin oak is slow-growing and expensive to establish. It is subject to the oak-wilt disease, which has taken a heavy toll of our native oak and appears to be increasing in intensity. These factors make pin oak plantings a definite gamble.

The much maligned Siberian elm, often mistakenly called Chinese elm, deserves further trials. The majority of these trees grown in this region suffered very severe winter injury in 1940 and again last winter. Many were so severely damaged that they died last spring, and others suffered such injury that they will be left misshapen and unattractive. The survival of an occasional Siberian elm without damage, however, indicates the existence of hardy strains.

Developing Hardy Strains

There also appears to be considerable variability in the branching habit of this species, and trees with strong crotches exist. It is encouraging that several prairie research stations in the northern United States and in Canada have been successful in developing more hardy and satisfactory strains of Siberian elm. The fact that this species is not affected by either the Dutch elm or phloem necrosis diseases also must not be overlooked.

Another elm with possibilities for this territory is the Japanese elm. Unfortunately, relatively few Japanese elms have been planted in Minnesota. Several of these trees were planted in 1928 at the University's Cloquet Experimental Forest, and have survived the unusually severe winters without snow or sleet breakage or low-temperature damage. Siberian elms grown under the same conditions have been killed and even the American elm has not been completely hardy.

The Japanese elm also has many characteristics desirable for shade trees. It does not become as large as the American elm and is resistant to both of the serious elm diseases.

The Christine Buisman elm, a selection of the European elm, should also be considered. This elm is resistant to Dutch elm disease and, so far as is known, to phloem necrosis. However, its hardiness in Minnesota must be tested before any extensive plantings are made. Selections of our native rock or cork elm and red or slippery elm likewise should receive consideration as American elm substitutes.

Such species as Kentucky coffee tree, spineless honey locust, Bolleana poplar, and Norway maple are sufficiently hardy and promising to deserve further planting in locations where no one objects to the pods produced by the two legumes, the narrow crown of the poplar, and the dense shade of the Norway maple.

Diversification with these species will provide attractive street and home plantings which are more resistant to disease and insect pests than our present almost "pure stands" of American elm. Although they are more expensive, these mixtures are an essential insurance well worth the cost.

The University has recently begun a study of elms and of elm substitutes at the Mayo Forestry and Horticultural Institute at Rochester. Among the materials to be tested are several selections of American and Siberian elm, the Christine Buisman elm, a Kentucky strain of American elm reported to be resistant to phloem necrosis, a selection of American elm reported to be resistant to Dutch elm disease, and selections of hackberry that appear to be free from "witches broom."

An individual hackberry of excellent form and beauty growing in a Twin Cities park.

Such a study, when combined with those our cities and nurserymen are undertaking, will help to determine what replacement materials should be used if our present elm plantings are menaced and what species are most promising for diversification of new plantings.

The North Central School and Experiment Station

(Continued from page 9)

Demonstration of the Practicability of Artificial Breeding of Dairy Cattle—This is perhaps the North Central Station's outstanding contribution to the dairy industry. Ten years ago, C. L. Cole successfully completed artificial breeding of more than 300 cows in the Grand Rapids community, using bulls from the station herd. He demonstrated for the first time in America that it was both possible and practical to use this new technique generally for dairy improvement. Scientists had been experimenting with this breeding practice, but Cole's work took it from the laboratory and put it into action.

The Minnesota No. 1 Hog—Developed at this branch station, this animal has attracted national and international attention. During the past 12 years, the station has raised the pigs, kept the records, and distributed breeding stock. Nearly 700 litters, totalling more than 6,300 pigs have been farrowed and more than 1,700 pigs have been sold for breeding purposes.

Sheep Breeding Work—Completed in 1947, this project is in some ways even more sensational than the hog work. In six years, 685 lambings were made to study various systems of breeding. Crossbreeding was carried on to capitalize on hybrid vigor. Increased production of as high as 57 per cent was demonstrated over breeding practices previously recommended. The project produced more uniform lamb crops that had 4 per cent higher livability, that weighed as much as 21 pounds more at 20 weeks of age, and graded one market grade higher than lambs produced by previous breeding methods.

A by-product of this work has been the so-called Minnesota 100 sheep, a new line, still in the experimental stage, that holds promise of being better adapted to northern Minnesota conditions.

In addition to the research and demonstration work, large quantities of certified seed potatoes and seed grains are distributed to farmers. Approximately 100 students attend the school, and more than 3,000 people visit the station each year. Most of these visitors come to attend the special events such as the spring judging contest, farm women's camp, 4-H club week, farm electric institute, crops and soils day, swine field day and auction, and sheep and potato day. Several civic clubs make periodic visits.

Members of the station staff write articles to be published periodically, speak before numerous meetings in the area, and act as judges at a dozen or more county and district fairs each year. In all these ways, this school and station attempts to carry out a program of research, teaching, and service for the area in which it is located.

Building a *Portable Home Cooler*

A. M. FLIKKE

RURAL ELECTRIFICATION has brought with it a desire for a farm refrigeration plant which will accomodate both fresh and frozen foods. In Minnesota, a unit to meet this need would include a walk-in room kept at 35° F., and a zero box for frozen foods. The cooling room provides storage for eggs, freshly dressed meats, dairy products, fruits, and vegetables. This extra storage would prolong the use of perishable foods in the family and increase the quality of marketable goods.

Many home-built units of this type are now in use and have been found practical and satisfactory. The chief disadvantage of such a cold room and freezer combination is the high initial cost of constructing the room and equipping it with refrigeration apparatus. If one is careful in his choice of building materials and uses good construction principles, however, he can reduce costs to a point where it is economically feasible to build a storage space of this type.

One should analyze his individual farm requirements before deciding upon the size and type of cold room and freezer combination to build. The storage space should be made large because storage requirements increase rapidly as one becomes accustomed to the advantages of a home cooler. The cold room should never contain less than 200 cubic feet, and 6 cubic feet per person in the family is the minimum space necessary for the zero box.

To test the practicability of this type of storage unit, the University of Minnesota, Division of Agricultural Engineering, built a portable walk-in cooler with a zero box. The cooler has been used for the past year. Of 8- by 8- by 9-ft. outside dimensions, the room contains 290 cubic feet, including 40 cubic feet for a zero box for frozen foods. (Under present price conditions and using high grade materials and equipment, the completed unit will cost in the neighborhood of $1,100, plus labor.) After one year of operation the room was taken apart, examined, and found in excellent condition. The cooler was then reassembled and is now in operation.

The cooler room walls are built in sections, making it possible to dismantle the room at any time to move the unit. Building the walls in sections also allows greater flexibility in building units of different sizes.

The panels were constructed as shown in figure 2. In three of the walls and the ceiling, 1- by 8-in. boards are used as spacers, with the outer end 2- by 8-in. board and the center joint made as shown in the illustration. The inner wall of the panel is ¼-in. exterior plywood and the outer surface is 1-in. fiber insulation board. The two floor panels are built similarly to the wall panels, except that 2- by 8-in. boards are used as spacers and 1-in. lumber, instead of plywood, is used for the floor. The two sections including the door casing must be built more substantially to support the heavy door.

Use Good Insulation

The space between the plywood and the insulation board is filled with insulating material. Many good commercial insulating materials are available, both as rigid boards and as fill or blanket insulation. Dry shavings can be used, but if they are, the wall thickness should be increased a third. In filling the wall spaces be careful to avoid settling of the fill. Such settling causes air spaces near the top of the panel which reduce the efficiency of the wall.

The first step in assembling the cold room is to fasten the floor together. The panels fit together as shown in figure 2 and are held by screws. The vapor seal is applied on the outside of the fiber board with a 24-in. overlap on all four sides. The ¼-in. 4- by 8-ft.

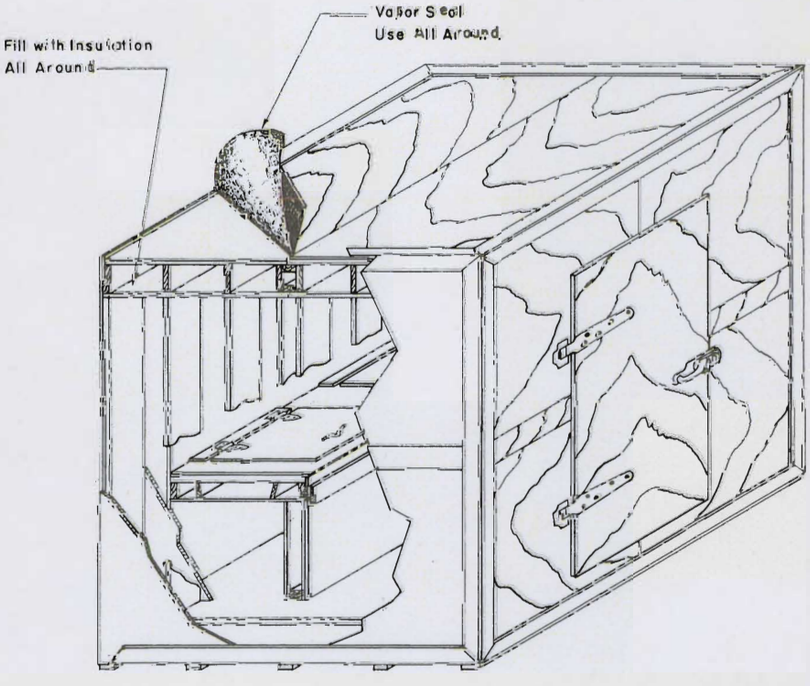


Fig. 1. Cutaway view of the home cooler built at University Farm., showing the cooler room with freezer box.

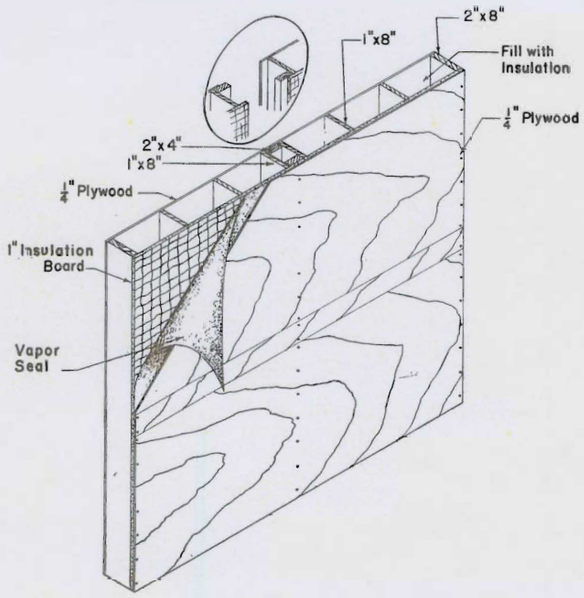


Fig. 2. Diagram of the construction of a wall, showing the spacer boards, the insulation material, and the vapor seal.

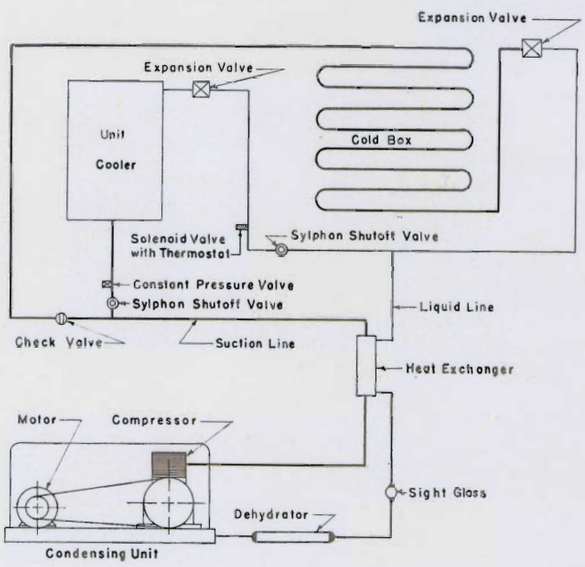


Fig. 3. Diagram of the freezer plates and blower coil for the cooler room, with connections to the refrigeration unit.

plywood is placed across the two sections and fastened to the panels with screws at the center joint and outer ends. The completed floor is then laid on 2- by 4-in. boards for a base.

The vapor seal of the cooler prevents the passage of moisture from the warm side to the cold interior. This moisture condenses in the form of frost and reduces the effectiveness of the insulation. There is a paper made for vapor seal, but in buying it, make certain that it is both asphalt-coated and asphalt-impregnated. Ordinary tar roofing paper will not perform well as a vapor seal. There are also metallic vapor seals which serve the purpose very well. In applying the vapor seal, one layer of heavy paper, or several layers of lighter weight paper are applied with overlapping joints of at least 6 in., and sealed with liquid asphalt.

Outer Seal Applied

The side panels are set on the floor and fastened together at the center with screws. The roof sections are placed in position and fastened. Then the entire outer surface of the room is covered with the vapor seal. Here the builder should make sure that all joints in the vapor seal are carefully sealed. One cannot be too careful in applying the vapor seal. The outer sheets of ¼-in. 4- by 8-ft. plywood are placed horizontally across the box and fastened at the center and ends to the panel. These outside sheets of plywood tie the structure together.

The door, 36- by 72-in. in size, should be carefully built, allowing ⅜-in. clearance between it and the casing. The door should be equipped with gaskets to reduce air leakage. Two-inch material is required for the framework, and the vapor seal is placed on the front and four sides of the door. A sheet of ¾-in. plywood is used on the front of the door to give it adequate cross-bracing.

Installing Zero Box

The zero box is made up in two sections, the front and top, and utilizes the walls and the floor of the cooler for the other sides. The sections for the zero box are 4 in. thick and have a vapor seal on the outside. The front panel is 30 in. high. The top is 36 in. wide and has two 22-in. square doors. The sections are held in place by brackets placed along the walls of the cooler.

The unit at University Farm has a three-fourths horsepower condensing unit with cold plates in the zero box and a blower coil in the 35° F. room. This size equipment has been found adequate for cooling the entire room to 0° F. The refrigeration equipment is installed as shown in figure 3. A snap-action suction valve with a strainer can be substituted for the solenoid and the constant pressure valve in the 35° F. room-cooling unit.

An alternative to the method illustrated is to have a compressor for each space. The installation is simpler and is easier to control. It also allows greater flexibility in the operation of the two parts of the plant. The initial cost is higher, but the compressors operate at higher efficiency and will last longer.

Refrigeration System

Freon F-12 is recommended as the refrigerant in the system because it is non-toxic and because it almost always operates at pressures above atmospheric which prevents leaks into the system. The complete refrigeration system should be purchased from a reliable dealer and should be installed by experienced workmen.

The exterior is painted with either aluminum or an odorless paint. The floor in the 35° F. room should be covered with a light-gauge sheet metal pan equipped with a drain. Slatted flooring should be placed on this sheet metal to prevent slipping when walking. The floor of the zero box should be covered with a similar pan to catch any condensation.

HOME FREEZING TIPS

Frozen foods lose quality if kept in the locker or home freezer too long. An important factor in satisfactory home freezing is to maintain a temperature of 0° F. Proper preparation of food and good packaging materials are other essentials.

Left-overs and ice cream will keep for less than one month; most cooked foods and baked goods for two to three months. Usually peas, spinach, and other greens will be good 12 to 16 months.

CALF LOSSES . . .

(Continued from page 3)

drained pasture close enough to the barn to permit the herdsman to keep careful check. If the calf is to be born in the barn, use a well-lighted, disinfected box stall, with plenty of clean, dry bedding (preferably uncut straw). Allow the cow to calve in a place without noise or undue disturbance.

Most cows will calve without help within an hour after noticeable labor begins. If, after two hours, help is needed, apply downward traction to the forelegs during labor efforts. If difficulty is experienced, call a veterinarian.

Care At Birth

The new calf is dried and the blood circulation stimulated by the cow licking the calf. If she refuses, give a hand massage using dry, clean burlap.

The time-honored practice of dipping the navel in tincture of iodine is now questionable. Leading herdsmen get good results without dipping. The reason may be that the navel contains a gelatinous substance that is supposed to prevent bacterial invasion.

Feeding colostrum after birth is the most important item in getting a calf off to a good start. Normal colostrum is high in vitamins A, D, and E, globulin and tryptophan, and in total solids, total protein, thiamine, riboflavin, choline, and minerals.

The vitamin A content of colostrum varies considerably between cows. It appears to be higher from first-calf heifers. Colostrum from cows on good pasture contains six to seven times as much vitamin A as normal milk from cows on the same pasture. There are 7,000 units of vitamin A in a pound of colostrum, compared with 730 units for normal milk on the average.

Routine feeding of vitamins in capsules and other forms is not needed when the herd is fed a balanced ration and when the newborn calf gets colostrum. In experiments with more than 500 calves at the University of Minnesota Agricultural Experiment Station, and the experiment stations at Cornell, Ohio, Michigan, and Illinois, no beneficial effects were noted in feeding capsules containing various dosages and combinations of vitamins A, C, D, E, thiamine, riboflavin, pantothenic acid, pyridoxine, choline and niacin.

Globulin is an easily digested portion of the total protein which averages 18 per cent (five times normal) in colostrum. Globulin gives colostrum its "sticky" consistency. It is high in immune bodies or antibodies which aid the calf in combating infection. The necessary antibodies are not present in the calf's blood at birth, but appear shortly after the calf consumes colostrum. Normal milk is low in globulin and antibodies.

Tryptophan, also a constituent of protein has new significance in dairy cattle nutrition. Its particular amino-acid structure permits its conversion into niacin of the vitamin B complex. About three times more tryptophan is present in colostrum than in normal milk.

To produce normal colostrum, cows should have a dry period of six weeks to two months before calving. If such cows still do not produce colostrum, the newborn calf should receive colostrum from some other source. If quick-freezing facilities are available, freeze a quart or more of colostrum from each normal cow that calves. This can be warmed for the newborn. Where this is not practical, the colostrum produced in excess of the new calf's needs should be fed to other calves and substitutes made available for the newborn.

If colostrum is not available, there are several substitutes. Raw eggs and 20,000 units of vitamin A may be added to whole milk from the herd. The albumin of the egg whites, while not known to possess any immune bodies, adds easily digested protein that prevents the formation of large curds of casein in the stomach.

The dam ordinarily nurses the calf for two to four days, or until the milk is commercially acceptable. After this time, the calf will gain best if placed on nipple pails for two weeks to a month. Allowing the calf to suckle causes the milk to pass directly to the true stomach. When milk is drunk from a pail, some of it passes into the rumen where it ferments abnormally. Nipple feeding can be arranged to allow the calf to drink at frequent intervals.

Calves nursing from infected udders are exposed to harmful bacteria. Allow the calf to suckle only from the healthy quarters of infected cows, at least during the first two days.

Urge calves to eat grain and good quality hay as early as possible. Calves will often start to eat hay at one week of age. Good hay supplies vitamins A and D and promotes the growth of desirable bacteria in the rumen.

When calves become ill many dairymen draw blood from the dam and inject it under the calf's skin at several points. This idea comes from the known value of the globulins found in both colostrum and the blood. The blood contains a relatively small amount of globulin, however. To be effective, a large amount is needed.

Value Is Tested

The value of this method is not well known so far, although a controlled experiment involving a large number of calves is now in progress. The use of 250 to 300 milliliters (about 8 ounces) of the dam's blood injected into the calf shortly after birth had no effect on its well-being as measured by subsequent gain in body weight. The effect, if any, on the prevention of scours and pneumonia was small.

The principal requirements for housing calves are insulated walls and ventilation to prevent drafts. This keeps pens free of excessive moisture. Solid walls for pens make for fewer drafts and also furnish isolation.

Provide plenty of dry bedding for the young calf. Damp quarters lowers calves' resistance to scours, pneumonia, and other infections. Some successful calf raisers also have used wire floors raised 4 to 8 inches off the concrete. Keep young calves in individual pens with about 18 square feet of floor space per calf for the first few weeks.

(Continued on page 15)

In This Issue

VITAMIN C LOST IN STORAGE . . .

(Continued from page 4)

It should be remembered that these potatoes had been in storage for nearly three months before the first analyses were made. Because they undoubtedly had lost an appreciable amount of the ascorbic acid present at time of harvest, the values given in this chart do not represent the initial maximum vitamin content of these tubers. Furthermore, since temperature of storage influences significantly the potatoes' ascorbic acid content, the comparatively low values obtained for these tubers at the end of the first three weeks' storage period would appear to reflect the relatively low temperature of storage in the cellar at Grand Rapids.

Appearance Affects Value

The ultimate value of the potato crop is, of course, dependent upon its acceptability to the consuming public which, in turn, is greatly influenced by the physical appearance of the tubers. Throughout this study a careful record was kept of the physical condition of the tubers following storage at the several temperatures.

After storing for 12 weeks at 47° F., the Red Warba and Mesaba potatoes were firm and showed no signs of shrinkage. Sprouting, however, had occured in all three varieties. When stored at 57° F. and 68° F., all three varieties developed sprouts rapidly and considerable shrinkage occurred after about the middle of January. The potatoes held from mid-December to mid-March at 35.6° F. were outwardly in the best condition. No sprouts developed at this temperature and there was no shrinkage in the Red Warba and Mesaba varieties. The Chippewa potatoes, however, showed some shrinkage, perhaps because this variety had a significantly higher moisture content.

In the tubers stored for six weeks at 68° F. following preliminary storage at lower temperatures, the same situation was found to exist. Here again preliminary storage at 35.6° F. retarded development of sprouts and shrinkage in all varieties. As before, however, Chippewa potatoes deteriorated more rapidly.

As every homemaker knows, sweetness in Irish potatoes detracts seriously from their palatability. This study included, therefore, a plan to investigate the extent and rapidity of the increase in sugar content at the lower storage temperatures, and also to determine the time required to reduce this excess sugar to a normal level by storage at room temperature.

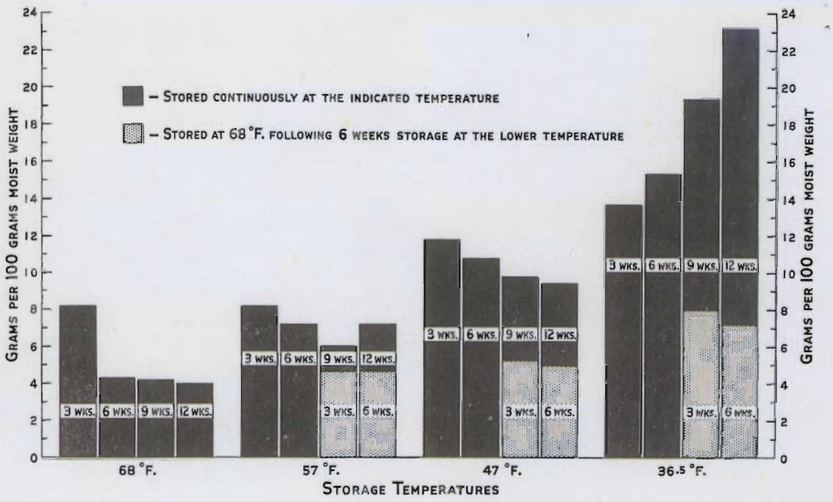


Fig. 2. Mean values of total sugar content for three varieties of potatoes stored at four different temperatures, compared with values for similar potatoes stored under different conditions.

Figure 2 shows the results of the sugar determinations on the stored potatoes. Again, the solid black portions of the chart show the values for the tubers stored continously at the several tempertures, and the lighter portions indicate the values for those held at 68° F., following preliminary storage at lower temperatures.

Increase of Sugar

The sugar content of the tubers varied inversely with the temperature of storage. As was anticipated, the most marked increase occurred in the potatoes stored at the lowest temperature. In these tubers, a decided increase in sugar content was apparent at the end of the first three weeks of storage, with further increases after each succeeding storage period. In every instance, storage at 68° F. following preliminary storage at lower temperatures caused a rapid reduction in sugar content to a level which, at the end of three weeks, was little higher than that noted in potatoes stored continuously at 68° F.

This study has shown: (1) that the rate of loss of ascorbic acid in stored potatoes is associated with temperature of storage, increasing markedly with decreasing temperature; and (2) that recovery in ascorbic acid and reduction in sugar content occur in potatoes which are held for a time at room temperature following storage at low temperatures.

To determine conditions of storage which will assure good cooking quality coupled with the maximum retention of ascorbic acid, it will be necessary to undertake further studies employing wider ranges of storage temperatures and additional periods of storage.

CALF LOSSES . . .

(Continued from page 14)

Keeping calves in artificially heated barns has not given good results. Care should be taken, however, to keep weak, sick, and newborn calves warm.

Since the newborn calf's most critical adjustments are those of the respiratory and digestive tracts, the two most prevalent diseases of the small calf are scours (digestive) and pneumonia (respiratory).

The characteristic symptoms of pneumonia are rapid and difficult breathing with coughing and sounds associated with difficult breathing, a temperature of 104° to 106° F. associated with a dry muzzle, loss of body weight, discharge from the eys and nose, and lack of appetite.

Scours, often called infectious or white scours, are characterized by watery feces of a light gray to light yellow color. The large volume of feces because of the high water content increases until the solid material is reduced to a minimum. In severe cases, blood and mucous from the intestinal lining may appear in the feces.

Intestinal Disorders

The so-called "coliform types" (intestinal types) of bacteria in the lower third of the small intestine are also important to the calf's health. With conditions of poor calf health such as presumably result from chilling, lack of vigor, and low intake of certain nutrients, there is a rapid spread of these bacteria toward the upper intestine and a general intoxication results. The earlier the veterinarian is called when either of these conditions appears, the more satisfactory the results.

SCIENCE *Unites Nations*

A WISE OLD teacher of mine once remarked, "If you exchange a dollar with a man you each have just one dollar, but if you exchange an idea with him, you will both have two ideas." It is this spirit which today seems to dominate the system of international cooperation in agricultural research.

Science, as a rule, recognizes no international boundaries. The results of scientific research are usually published in appropriate journals and bulletins—thus becoming available to all who are interested. Scientists frequently sit in international meetings and exchange their knowledge and ideas freely.

Agricultural research, in particular, is organized and handled on an international basis. Most of the agricultural crops grown extensively in the United States have been introduced from abroad. American institutions, public and private, have sent agricultural explorers to many remote areas of the world to collect seeds, cuttings, and other planting material to be tested or utilized in plant breeding processes or in crop production in this country. Plant and animal breeding centers in the United States have sent many of their best productions to foreign lands.

Broad scientific principles and natural laws that have been disclosed by researches on soils, agricultural crops, and domestic animals have also been shared freely by our American colleagues, and foreign workers.

The international nature of agricultural science becomes evident in many other ways. Plant diseases, for instance, recognize no political boundaries. While efforts may be made at times to set up quarantines at international boundaries, the most effective controls may arise from an exchange of knowledge and services that will prevent infectious material from approaching the boundaries between countries. Accordingly, any prophylactic or curative process that will prevent epidemics or eliminate a center of infection is shared promptly with neighboring countries.

Another manifestation of the international nature of agricultural science is the exchange of scholars and students, professors and scientists among many collaborating countries of the world. This exchange has been a prominent feature of the expansion of our various relations with the Latin-American countries in recent years. It will be extended into other major areas of the world, no doubt, under the provisions of the Fulbright and the Smith-Mundt bills. In this way, specialists in various branches of agricultural science will have an opportunity to study and conduct research in the collaborating countries.

This program will stimulate closer relations than we have ever enjoyed before, and, in the aggregate, should add to the knowledge and wealth of all concerned.

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November, 1948

Magazine Wins Honors

A RATING of "very good" was awarded to *Minnesota Farm and Home Science* in a recent competition with periodicals issued by Agricultural Experiment Stations in all parts of the country.

The contest, held at Washington State College, was sponsored by the American Association of Agricultural College Editors. The University of Minnesota had twenty entries in the competition, and in total points was ranked seventh among the 27 states entered.

Farm and Home Science was judged on the May, 1948, issue. Also awarded a "good" rating was the Experiment Station Bulletin 397, "Weed Seedlings," which was entered in the semi-technical bulletin class.

The Experiment Station won further laurels from the "good" rating given to one of the technical bulletins, No. 177, "An Analysis of Some Important Factors Affecting the Results of Fumigation Tests on Insects."

The Authors

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Jane M. Leichsenring, "Do Stored Potatoes Lose Vitamin C?" is professor of nutrition; **Loana M. Norris** is junior scientist in home economics.

Michael G. Boosalis, "Fungi That Poison Soybeans," is a teaching assistant and **M. F. Kernkamp** is assistant professor, Division of Plant Pathology and Botany.

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F. H. Kaufert, "The Future of the American Elm," is professor and chief of the Division of Forestry.

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