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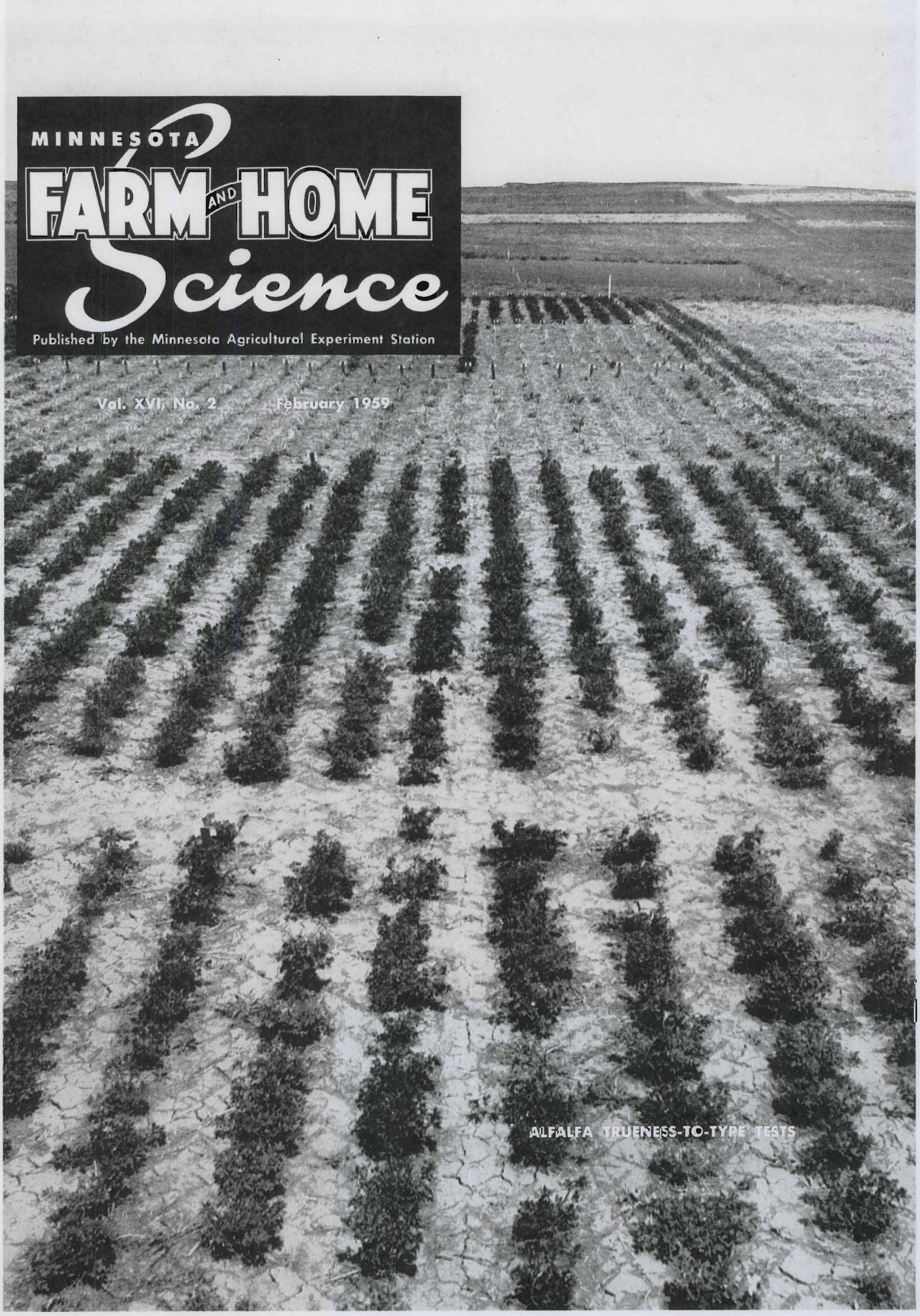

ALFALFA TRUENESS-TO-TYPE TESTS

MINNESOTA FARM AND HOME Science

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February 1959

THE COVER—A Trueness-to-Type test in which 400 alfalfa seed lots were being studied for trueness to varietal performance and winter kill. See the article on Trueness-to-Type tests on page 4.

Minnesota's Men of Science

Editor's Note—This is the twenty-eighth in a series of articles introducing scientists of the University of Minnesota Institute of Agriculture. Here we present T. Schantz-Hansen, director of the Cloquet Forest Research Center and the Itasca Forestry and Biological Station.

When T. Schantz-Hansen and his wife visited Sweden, Finland, and other European countries last fall, they were greeted by a host of friends. These friends had come to admire and respect Schantz-Hansen as a gracious, friendly individual and as a forestry authority. His colleagues on the University staff, his neighbors in Cloquet, and his many former forestry students could well understand this reception because of their long acquaintanceships and pleasant relationships with him.

T. Schantz-Hansen

Schantz-Hansen today serves in a dual capacity as director of the University's 3,700-acre Cloquet Forest Research Center, which is part of the School of Forestry, and as director of the Itasca Forestry and Biological Station. At Cloquet he is in charge of a large forestry research program and supervises classes of forestry students from the St. Paul Campus each spring quarter. At Itasca he directs research and coordinates the many courses provided for teachers, students, and other groups who spend part of the summer at the Station.

Schantz-Hansen is a native of Cedar Falls, Iowa. He attended Iowa State Teachers College at Cedar Falls and later the University of Minnesota School of Forestry where he received his B.S. degree in 1915.

After graduation from the University he worked for two years as a forestry assistant for the U.S. Forest Service at Priest River, Idaho, and Flagstaff, Arizona. In 1917 he received Master of Forestry degree and in 1935 his Ph.D. at Yale University.

After serving in the U.S. Army in 1918, Schantz-Hansen joined the University staff in 1919 as an instructor in forestry at Cloquet. In 1924 he was placed in charge of the Cloquet Research Center which he developed into one of the finest in the world. He became director of the Itasca Forestry and Biological Station in 1940. From 1933-38 he was also in charge of the Civilian Conservation Corps work on the Cloquet Forest.

His research and publications in the field of silviculture and forest management have given him a world-wide reputation. His fundamental studies on jack pine, an increasingly important pulpwood tree in Minnesota, are regarded as among the best studies of this type in the U.S.

During the past 10 years he has also initiated studies in the marketing of pulpwood on a weight basis. This work has resulted in the purchase of wood on weight basis by several companies in Minnesota and other parts of the nation.

Schantz-Hansen has reported his work in more than 100 articles and papers and has also written two books.

His contributions go well beyond those made through the University, however. He served for many years as chairman of the Cloquet School Board and helped build the city's fine elementary and secondary school system. He was chairman of the forestry committee of the Arrowhead association for many years and served as chairman of the Minnesota Section of the Society of American Foresters. In 1955 he received the Keep Minnesota Green "Senior Conservationist Award" for his outstanding contributions to forestry and other areas of conservation.

He has been a member and leader in several other civic and professional groups including Sigma Xi, Alpha Zeta, and Xi Sigma Pi.

Gibberellins:

New Growth Regulating Compounds

A. J. LINCK and T. W. SUDIA

GIBBERELLINS, a new family of plant growth substances, may play an increasingly important role in Minnesota agriculture. These substances were discovered by Japanese plant pathologists prior to World War II.

They were found associated with *Gibberella fujikuroi,* a fungus disease of rice, which causes seedling stems to lengthen more than usual.

Scientists found that the chemicals isolated from this fungus had marked effects on many plants in addition to rice. As with other plant hormones, minute quantities of gibberellins produce effects. Under 100 parts per million and as little as 1 part per billion may produce noticeable effects on plants.

There are at least four known gibberellins which differ slightly chemically, but are similar in their effects. One of the gibberellins, gibberellic acid, is produced by several pharmaceutical houses and can be obtained commercially.

In general, the gibberellins, including gibberellic acid, exert their most striking effects by speeding up new shoot growth, flowering, and seed germination. In some plants it eliminates dormancy of buds and tubers and in several cases reverses dwarfism.

Gibberellic acid is applied to plants in several ways. The most common is in a water spray, with a wetting agent, or in a lanolin paste. Generally gibberellic acid is applied to the tops of plants, but it may be applied to the roots or to seeds. This latter method is not altogether satisfactory for gibberellic acid is broken down in soil.

The effects of gibberellic acid on plants have been reported from many parts of the world. Here are some examples.

Stems of cucumber, eggplant, peppers, corn, tomato, barley, clover, flax, potatoes, oats, soybeans, red beets, sugar beets, wheat, and many other crops have been lengthened more than usual by applying gibberellic acid. Pinto bean and garden pea are especially sensitive to gibberellic acid and noticeable effects may be produced by as little as one part per billion.

The stems of Chrysanthemums, geranium, and snapdragon lengthened markedly over untreated controls, but in some cases the growth was light green and weak. Some reports indicate that increasing fertilizer levels will overcome this.

Roses, azaleas, poplar, sugar maple, white spruce, and other woody plants also respond to gibberellic acid. Greater increases in stem length of woody plants were noted with applications to wounded rather than intact bark.

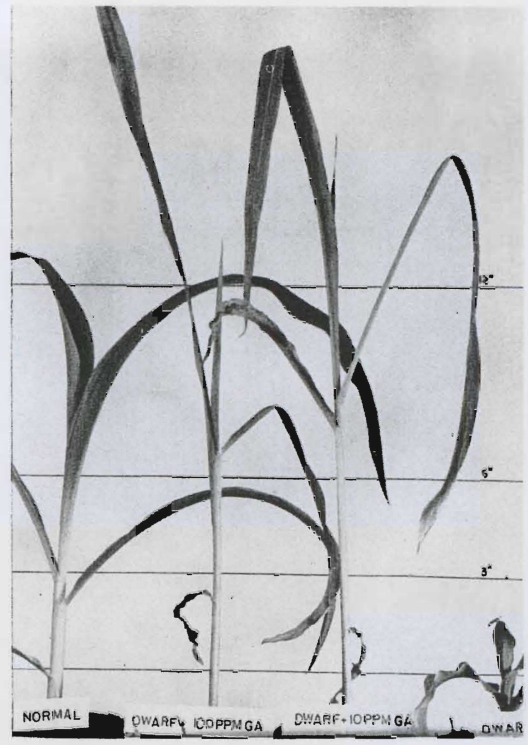
The roots of most plants are held back by gibberellic acid. Even in plants such as red beets, sugar beets, and carrots, whose tops are stimulated and increased growth occurs, root growth may be inhibited severely.

Gibberellic acid causes radish, head lettuce, leaf lettuce, broccoli, endive, and cabbage to bolt. In some cases as with the turnip, however, bolting occurred without flower formation.

Flowering in China-aster, larkspur, Canterbury-bells, stock, and dahlia was hastened from several days to several weeks depending upon species and dosage. Tomatoes set fruit without pollination and produced seedless fruits when treated with gibberellic acid.

Seeds of morning glory, sunflower, sweet pea, kidney bean, lima bean, rutabaga, lettuce, onion, pea, radish, alfalfa, corn, and sugar beets treated with gibberellic acid germinated faster than untreated seeds. There was no effect on seeds of nasturtium, cucumber, tomato, rye, and wheat.

Dormancy of dahlia tubers, gladiolus corms, and onion bulbs was not broken by treatment with gibberellic acid. However, tuber dormancy of potato was affected and sprouting of treated seed pieces increased over nontreated ones. This may vary considerably with the variety. Treating



the tops of potatoes with gibberellic acid increased top foliage but decreased the yield.

When some corn plants which have inherited a dwarf characteristic are treated with gibberellic acid, they lose their dwarf habit (figure 1). This observation led to the idea that some plants may be dwarfs because of their inability to produce gibberellins or gibberellin-like substances.

A search for gibberellin-like substances in higher plants led to their discovery in bean seeds, pea seeds, young pea shoots, and corn kernels at mild stage. Dwarf crab apple, bush bean, dwarf peas, as well as dwarf corn all show remarkable response to gibberellic acid. Bush beans develop climbing stems and lose the bush habit. However, some dwarfs, including some types of dwarf corn, are not affected by gibberellic acid at all.

Some people believe the future for gibberellic acid is bright, others are skeptical. There are apparently many areas in agriculture where gibberellic acid may be useful and certainly it could become increasingly important to the nurseryman, horticulturist, seed producer, and home gardener. There are, however, conflicting reports about gibberellic acid and in some cases results of research are not conclusive enough to make recommendations. As more research reports are written, the field of operations is being narrowed to the most basic and useful applications of gibberellins.

(Continued on page 19)

A. J. Linck is assistant professor and T. W. Sudia is research fellow, Department of Plant Pathology.

Trueness-to-Type Tests

Give Added Protection to Alfalfa Growers

LADDIE J. ELLING

SEED QUALITY is an important factor to consider when buying seed. Germination, crop mixtures, or weed contamination can be easily determined in the laboratory. However, it is much more difficult and expensive to determine the genetic quality of the seed, but new developments along this line are rapidly making more information available to Minnesota farmers.

Agronomists in many states are studying the variation among seed lots of certain crops in "Trueness-to-Type" tests. In the "Trueness-to-Type" tests seed lots are observed for performance for one or more characters which are representative and for which varieties or seed sources vary. Agronomists can rapidly and efficiently evaluate the seed lots for specific characters with these tests. For example, the varieties and types of alfalfa vary for winterhardiness. This character gives a good evaluation of the trueness to type of the seed lots studied.

Minnesota Trials

In Minnesota, alfalfa "Trueness-to-Type" tests were conducted in 1953, 1955, 1956, and 1957. Farmers and seedsmen have been invited to observe these studies in the field and they have given of their time to do so.

Nonhardy alfalfa plants will continue to grow until frozen in the late fall after being clipped in early September. This is in contrast with hardy alfalfa plants that become dormant and make slight growth during the same period. This easily identified and observed characteristic is particularly adapted to alfalfa trueness-to-type tests in Minnesota.

Winterkilling was also studied, although there is less certainty that this will be observed each year. Because snow cover, winter temperatures, and additional factors affect winterkilling, this character is somewhat uncertain.

Bacterial wilt reaction studies require more elaborate and expensive procedures to conduct. Therefore, this limitation must be recognized.

Source of Samples

Samples for these studies were obtained from those collected in commercial channels by the official State

Results of trueness-to-type tests in Minnesota and other states support the recommendation that farmers purchase certified seed. Certified seed of recommended varieties is the farmers' best assurance of obtaining known performance in the seed they purchase.

Department of Agriculture Weed and Seed Inspectors. They routinely collect samples for analysis in the State Department of Agriculture Seed Laboratory. After analysis for germination, weed mixtures, and other crop mixtures, the samples are stored. From these the agronomists draw small samples for the trueness-to-type tests. A few grams of seed are enough because one gram of alfalfa seed contains about 500 seeds.

Methods

Half-gram samples are seeded in single-row plots 30 feet long with the rows spaced 18 inches apart. Each seed lot is replicated two or more times in each seeding.

After the plants are well established the stand is thinned to a single plant per linear foot of row. Weeds are controlled during the summer to give the alfalfa plants ample opportunity to make maximum development. It is essential that a high level of root reserves be produced for rapid recovery after clipping.

The plants are uniformly cut back during the first week of September and the crop residue removed. Thereafter, they are permitted to make regrowth during the cool-day, short-night conditions of fall. The differences in fall growth among or within seed lots can be attributed to the differences for fall dormancy.

General observations are made during late October or early November. Plant height measurements all are recorded at this time to give more precise information for seed lot performance.

Winterkill and winter injury information is obtained in the field the following spring. Each plant is classified as normal, injured, or dead. Since the September clipping predisposes the plants to winter injury, there is better assurance of obtaining winterkill information than under normal conditions.

Results

These tests have shown that alfalfa seed being sold in Minnesota is generally of good genetic quality and a high percentage of the seed lots will perform as expected for the variety indicated on the tag. However, there have been too many cases where the seed was either mislabeled or did not perform uniformly as for the variety indicated on the tag.

In the 1956 test only noncertified lots were included in the hardy group. Of the 85 lots included in this test, 35 percent were either off-type or contained plants that were off-type.

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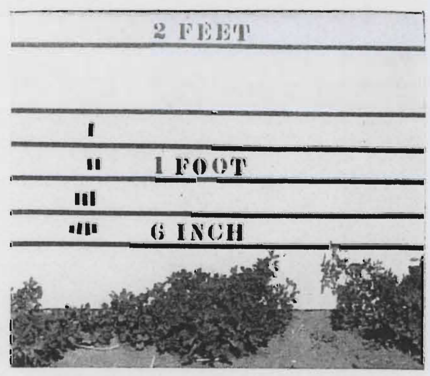


Fig. 1. Typical recovery of hardy alfalfa plants after early September clipping.

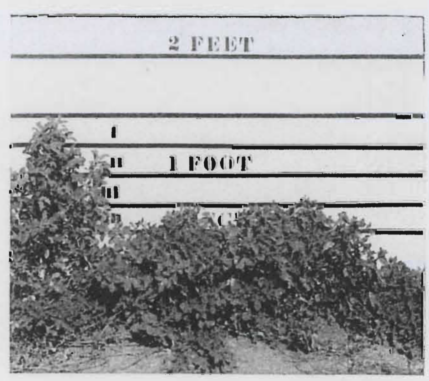


Fig. 2. This seed lot contained several types of plants. Note plant on left is 18 inches tall, two in center are 9 inches tall, and one on right is 4 inches tall.

L. J. Elling is associate professor, Department of Agronomy and Plant Genetics.

Cheddar Cheese for Cooking

H. A. MORRIS, R. W. WEIK, and W. B. COMBS

THERE IS NOTHING SO DISAPPOINTING to a good cook as having cheese curdle or not melt properly when she is preparing a cheese dish. Cheese processors and cheese manufacturers are interested in this situation, too.

Our research indicates that, with practice, you can estimate how long it will take and how well Cheddar cheese will melt. This article tells about this research.

Much of the University's Dairy Department's interest in how Cheddar cheese melts was stimulated by inquiries from both housewives and men in the cheese industry. Then, too, in 1955 the National Cheese Institute published a report of a survey they made on how cheese is eaten. Cheese was used for sandwiches, for snacks, for one-dish meals, for salads, and for desserts, in this order. Approximately 13 percent of all cheese consumed was eaten in a cooked dish.

The American Dairy Association, in another survey, found that about 35 percent of the Cheddar or American cheese was used in a cooked or baked dish, and about 6 percent was used in either grilled or toasted sandwiches. It is not readily apparent whether the cheese used in the cooked dishes or on grilled or toasted sandwiches was natural Cheddar or process cheese.

The research we are reporting here was done on natural Cheddar cheese. Natural cheese, as you may know, is the cheese made directly from milk. It becomes more flavorful with age and has a different body and texture than does process cheese. The process cheese is a blend of natural cheeses that have been ground up, some special salt added, mixed, and heated. This mixture is then packaged hot.

We have found a few samples of process cheese that were difficult to melt, but generally the process cheese melts better and has a more homogenous appearance when melted than does the natural cheese.

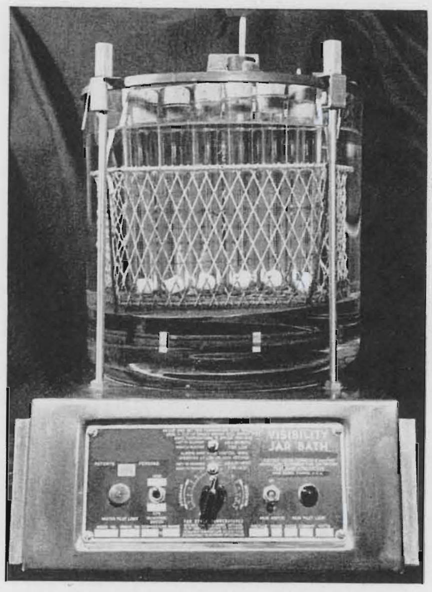


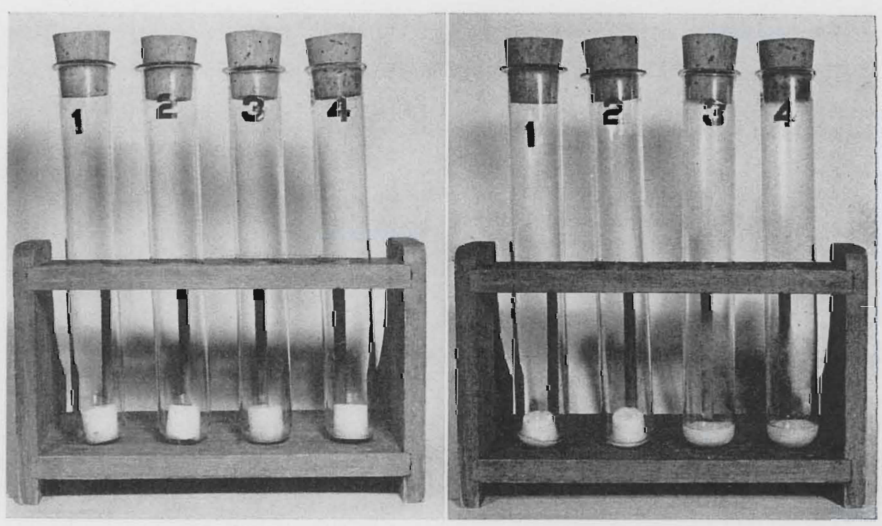
Fig. 1. Melting time was determined by placing test tubes containing cheese samples in this constant-temperature glass water bath held at 176° F.

Since natural Cheddar cheese generally is more flavorful than the process cheese, many housewives prefer to use the natural cheese in their cooked dishes and also on sandwiches. However, because the natural cheese when melted is often stringy or sometimes won't melt at all, its use at present may be limited. There are some dishes, such as pizza or lasagne, where a stringy cheese is desirable. However, for most purposes, a cheese that will melt rapidly and be smooth, not stringy, with just a small amount of fat separation, would be ideal. The question, then, became one of evaluating melting quality.

The melting quality was determined as follows: A standard cylinder of cheese was placed in a test tube. The test tube with the cheese in it was placed in a 176°F. water bath as is shown in figure 1. The amount of time it took for the cylinder of cheese in each test tube to melt completely was measured and recorded. In this method, the stringiness and the appearance of the melted cheese could be observed. However, the stringiness was not measured quantitatively.

Generally speaking, the melted cheese samples requiring the least heat treatment to melt them were soft and easily stirred. Somewhat the opposite was observed, though, for samples requiring a longer time to melt. Although some of these finally melted, these samples were difficult to stir and generally were quite stringy. Some cheese samples would melt very rapidly, and others would not melt at all. This can be seen in figure 2 by comparing four samples before placing in the water bath and after they had been heated. Notice that samples 1 and 2, after 510 seconds in the 176°F. water bath, had not melted very much, whereas samples 3 and 4 had completely melted.

An obvious question is, what is the reason for this variation in melting properties? The composition, that is, the amount of moisture or fat in the cheese, had only a minor effect on the



Before After

Fig. 2. Cheese samples before and after heating for 510 seconds at 176° F. Samples 1 and 2 melted only slightly, whereas samples 3 and 4 melted completely.

H. A. Morris is associate professor, R. W. Weik is research fellow, and W. B. Combs is professor, Department of Dairy Husbandry.

melting. The acidity of the cheese, which was another factor studied, had a greater effect than moisture or fat on the melting quality. However, these factors still were not the main things that influenced the melting. The softness or hardness of the cheese was the most important factor of those studied.

The hardness or softness was measured by taking a standard block sample of cheese cut from either a 40-pound or 70-pound Cheddar cheese. The sample was then placed on the pedestal of the scales shown in figure 3. The force it took to cut the cheese with a fine steel wire was measured. The harder the cheese, the higher the reading on the scale, and the softer the cheese, the lower the reading.

The measured hardness or softness and the melting time of many samples of cheese were then determined. After analyzing the results statistically, a high correlation was found between the hardness and melting time of the cheese. The harder the cheese was, the longer it would take to melt.

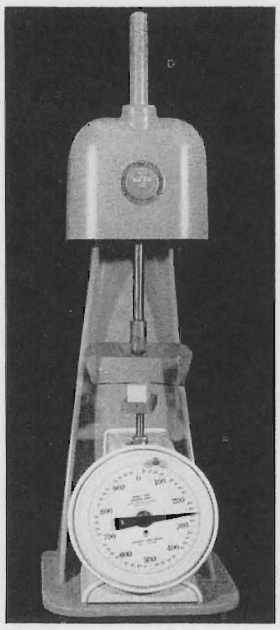


Fig. 3. Hardness of a standard-size cheese sample was determined by measuring the maximum resistance to cutting by a fine steel wire being forced through the cheese at a constant rate. The constant rate or pressure was supplied by a motor housed in the top of the apparatus. The resistance to cutting was obtained by reading the position of the scale pointer.

Based on this information, about 80 percent of the time, the melting time of a particular cheese can be predicted by how hard or how soft it is. This means that the cheese industry, and perhaps even the housewife, can use the relative hardness or softness of cheese as an indication of the ease of melting when heated. Relative hardness of cheese can be judged by squeezing or pressing it with the fingers. For accurate determinations by the cheese industry, however, an instrument similar to the one shown in figure 3 is recommended.

Investigations are now in progress on more technical phases of the effect of heat on cheese and also on manufacturing procedures that will produce a cheese having better melting properties. By obtaining more fundamental knowledge than we now have, it may be possible for cheese manufacturers to use this information to consistently make a natural Cheddar cheese with the delicious flavor that most people like, and still have the melting properties that make this cheese valuable in cooked dishes, on toasted cheese sandwiches, and in the processing of cheese.

Trueness-to-Type Tests

(Continued from page 4)

In the 1957 test approximately 400 seed lots being sold in Minnesota were studied. These 400 lots included all available lots, except that the number of certified Ranger lots was limited. Of 61 lots labeled Grimm included in the study, 13 were inferior for winterhardiness. As a comparison 76 Ranger lots were included and only one of these was below the standard for this variety. This lot was suspected of having been mistakenly mixed with nonhardy alfalfa since a high percentage of the plants were of the nonhardy type.

The performance typical of hardy alfalfa plants is illustrated in figure 1. All of the plants in this lot were true to type and made little growth after the early September clipping.

The plants shown in figure 2 illustrate the variable performance that has been observed in some seed lots. This seed lot was sold in Minnesota as a hardy alfalfa. The plant on the left was 18 inches tall and obviously nonhardy. The two plants in the center were 9 inches tall and intermediate for winterhardiness. Normally they would winterkill during a severe winter, but probably would survive with some injury during an average winter. The plant at the right was 4 inches tall and of true hardy type. Differences like this are difficult to observe under normal conditions in a broadcast seeding.

The two seed lots in figure 3 represent the differences that sometimes occur. The two lots were included in the 1956 test. They represent the risk that must be considered in purchasing noncertified seed. Both lots were grown in the same state, processed by the same company, and labeled as Cossack alfalfa. They differed greatly for fall dormancy, and it is apparent that one is not of the Cossack type.

The seed lots shown in figure 4 were both labeled as Grimm alfalfa. The row on the left performed as Grimm and the plants survived the winter with slight injury and no plant loss. The plants in the row on the right were much taller and suffered severe winter injury with 16 percent of the plants being killed.

These are not the only important results from these tests. Other incidents are equally important. A few seed company representatives have stated to the writer that they would recommend a change in their company procurement policies on the basis of results from these tests.

Fig. 3. Both of these seed lots were labeled Cossack alfalfa. The seed lot on the left is obviously off-type.

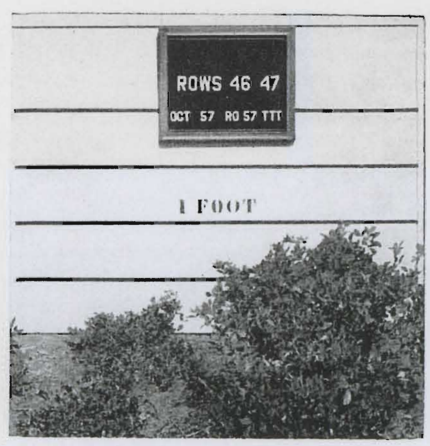


Fig. 4. These two seed lots were labeled Grimm alfalfa. The one on the left performed as Grimm, the one on the right is off-type.

New Fruit Introduction —
The 'Earlimore' Strawberry

A. N. WILCOX, T. S. WEIR, J. D. WINTER, and SHIRLEY TRANTANELLA[1]

The "Earlimore" is a June-bearing strawberry which ripens extra early, then continues its high production through a longer than average season. The fruit size, medium large at the start of the season, is well maintained. The berries are attractive, with a bright red color which holds well in the boxes. They are firm but juicy and have a pleasant, aromatic flavor.

A number of commercial growers, especially in the Excelsior area, who have tested this variety in comparison with other selections and with Howard 17 (Premier), Dunlap, and Robinson, have reported a special satisfaction with the "Earlimore." Its total crop has been high and its early yield has given it a price advantage since it is the first home-grown berry on the market. Its brightness in the boxes, even after shipping, has had sales appeal and its dessert quality has brought repeating orders. The growers have expressed surprise that such an early variety would maintain its satisfactory size of fruit for so long.

In spite of a similarity of name, do not confuse the "Earlimore" with the "Evermore," an everbearing variety that was introduced by this station in 1945. The "Evermore" found its principal favor westward from Minnesota to Washington.

The 'Earlimore' Strawberry

The "Earlimore" has been tested only under the matted-row system of culture, which is standard in Minnesota with the June-bearing varieties. The plants are set in early spring, usually 2 feet apart in rows that are 3½ to 4 feet apart. The plants are allowed to develop runners and the rows are usually, but not always, restricted in width late in the season. They are mulched over winter.

(Continued on page 8)

A. N. Wilcox is professor, Department of Horticulture, T. S. Weir is associate professor and assistant superintendent, Fruit Breeding Farm, J. D. Winter is associate professor, and Shirley Trantanella is instructor, Department of Horticulture.

[1] The first two of these authors have been primarily concerned with the breeding and field testing of this variety and the latter two with the processing tests. The Department of Horticulture of the Minnesota Agricultural Experiment Station acknowledges the cooperation of the United States Department of Agriculture through its Fruit and Nut Crops Research Branch in the Minnesota fruit breeding project, which is also a part of a national fruit breeding program. Through this cooperative arrangement the part-time services of a federal agent are available to assist in the fruit breeding work in Minnesota. Grateful acknowledgment is also made to the Agricultural Extension Service, to the branch experiment stations, and to the private individuals who have cooperated in the testing program.

New Chrysanthemums for 1959 —
Prairie Moon and Tonka

R. E. WIDMER and R. A. PHILLIPS

1959 Introductions

The two new garden chrysanthemums for 1959 increase to 39 the total number of varieties introduced by the Agricultural Experiment Station and the Department of Horticulture, University of Minnesota, since 1941.

The new varieties, Prairie Moon and Tonka, like other University of Minnesota varieties, were bred to perform well under Minnesota growing conditions. However, reports from other states where they were tested indicate that they should do well over a wide area.

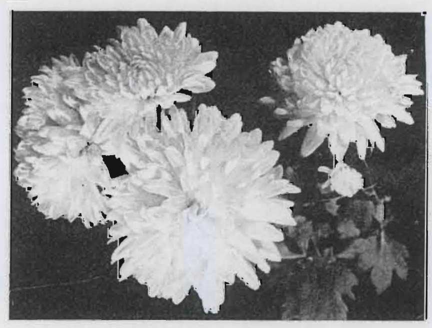
R. E. Widmer is associate professor and R. A. Phillips is assistant professor, Department of Horticulture.

Prairie Moon (Minn. No. 54-128-81)

Prairie Moon is a creamy-white, large (4-inch), double flowered chrysanthemum. When the flowers are fully open, a gold center is usually visible. Prairie Moon blooms abundantly. The willowy plant has clean, rich green foliage and presents a neat appearance throughout the season. Plant height is 24 to 30 inches so it should be used toward the rear of the flower border; plant spread is about 18 to 24 inches.

Prairie Moon begins blooming in the first half of September and the flowers remain in good condition until frost.

Prairie Moon originated as an open pollinated seedling of the variety Eggshell.



Prairie Moon

Tonka (Minn. No. 54-44-2)

Tonka is a large flowered (3½-inch), fully double, deep yellow variety. The flowers and the clean, rich green foliage are borne on stiff, sturdy stems. An exceptional feature of Tonka is that an open center is never visible in the flower. The plant height is 20 inches, and the plant spread is up to 30 inches.

Tonka begins blooming in early September and ends with hard frost.

Tonka and the novelty flowered type, Golden Fantasy, fulfill the need for good yellow flowered varieties in

(Continued on page 8)

The 'Earlimore'

(Continued from page 7)

The "Earlimore" develops a wide row of vigorous but not unusually tall plants, which tend to be well spaced. Plant survival the following spring has been consistently high. "Earlimore" has been remarkably free from foliage diseases. In spite of the early season of fruit ripening, the blossoming season is not unusually early.

The fruit of the "Earlimore" is most suitable for fresh dessert use. It has been fair to good for freezing—better than many commercial sorts but not equal to the Marshall and Burgundy varieties nor to the best unnamed selections that have been tested for this purpose. The growers have considered it firm enough for shipping moderate distances but it has not been tested for long-distance shipping.

Plants of this variety can be bought from nurseries in the spring of 1959. They will not be sold by the University of Minnesota.

Breeding History

The "Earlimore" strawberry was developed at the University of Minnesota Fruit Breeding Farm from a cross made in 1940. The maternal parent was a selected seedling, SYS305-46, from self-pollinated Campbell (Campbell's Early). The pollen parent was Howard 17 (Premier).

A program of inbreeding and selection for the purpose of developing better parents for use in strawberry breeding was begun on a small scale at this station late in 1922 and was considerably enlarged in 1927. The variety Campbell was added later and its self seed was planted in 1930. One selection was made from its progeny and this, like other inbred selections, was crossed with Howard 17 for progeny-testing purposes. The cross progeny was generally characterized by early ripening fruit of high flavor. The average for firmness was not high. Three seedlings, however, were considered suitable for further testing as potential new varieties, and one of these, Minnesota No. 1636, is now being introduced under the name "Earlimore."

This selection has been under test as a clone at the Fruit Breeding Farm since 1941. Tests for freezing quality were begun in 1949 at the Food Processing Laboratory. The selection was first distributed for trial in other parts of Minnesota in 1950.

Technical Description

The "Earlimore" is June-bearing. The plants make a wide row, well spaced; are vigorous but not unusually tall; are hardy; apparently have very high resistance to leafspot and high resistance to scorch. The fruit production is high.

The foliage is medium size, the leaflets are elliptic, serrate with medium size serrations, and there are 8 to 10 on each side of the terminal leaflet. The upper surface is medium green, rather smooth, with scant pubescence, and depressed veins; the lower surface is gray-green, with pubescent veins. The petiole is green, of medium length and medium slender, occasionally with leafy bracts, and pubescent especially toward the leaflets. It blossoms in midseason with perfect flowers.

The fruit is attractive; medium large to medium size and it holds well through season; the shape is a blunt rounded wedge-shape to rounded conic, not necked; the primaries are sometimes slightly creased. The outside color is bright red, and the flesh color is red. The achenes are small, set in depressions, but the outer surface is usually raised slightly above the surface of the berry. The calyx is medium small, rather deeply set, partly recurved, bright green, with entire sepals; the pedicels are long, slender, and green. The berries are firm to medium firm; the flesh is juicy, slightly acid, and aromatic; the flavor is very good.

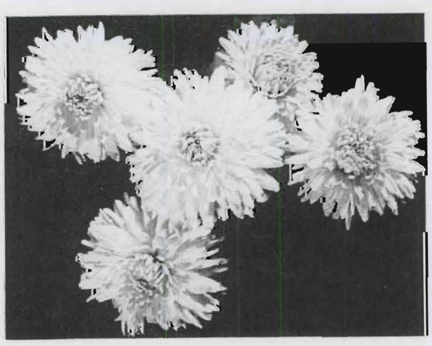
Prairie Moon and Tonka

(Continued from page 7)

the University of Minnesota's introductions.

Tonka originated from a cross between Corona and Minnesota selection 45-275-5.

A detailed paper on the culture and varieties of garden chrysanthemums for Minnesota may be obtained by writing to the Department of Horticulture.



Tonka

Most Popular University of Minnesota Varieties

Variety	Color	Plant height*	Time of bloom†
Chippewa	Aster-purple	Tall	Midseason to late
Dee Dee Ahrens	White	Medium	Midseason
Dr. Longley	Bright rose-pink	Medium	Early to midseason
Glacier	White	Medium	Early
Golden Fantasy	Golden-yellow	Medium	Midseason
Harvest Bronze	Apricot-bronze to straw-yellow	Low	Early
Minnbronze	Vivid bronze	Low	Midseason
Minnpink	Rose-pink	Low	Early
Prairie Sunset	Bright rose-pink and gold	Medium	Early
Purple Star	Bright dahlia-purple	Medium	Midseason
Redgold	Bright reddish-bronze	Medium	Early
Violet	Purple	Low	Midseason
Vulcan	Dark red	Medium	Early
Wanda	Raspberry-pink	Medium	Early
Wenonah	Light lavender	Medium	Early
Minnehaha	Rose-tinted salmon	Tall	Midseason
Princess	Old rose with gold	Medium	Early

* Low—up to 12 inches; medium—12 to 18 inches; tall—over 18 inches. These measurements refer to plants properly spaced and grown in full sun.

† Early—starts blooming before September 1; midseason—starts blooming September 1 to 15; late—September 15 on.

Boulevard Trees Are Damaged by Salt Applied to Streets

D. W. FRENCH

APPLYING SALT to streets in the winter in many Minnesota communities has caused injury and defoliation to many boulevard trees, especially the American elm. Salted streets make driving easier in the winter, but the damage to a large number of trees must be reckoned with the following summer.

Indirectly this damage might affect all elms even though not in cities. The reason is that the beetle that spreads Dutch Elm disease breeds in dying or injured elms. This threat will be discussed later in this article. First though here are some facts about salt damage.

In July, 1954, many boulevard trees in St. Paul had yellow to brown discolored leaves. In some cases they were almost completely defoliated. All species of trees in boulevards were similarly affected. A survey, in August, 1956, of the main streets in St. Paul showed that 9.4 percent of the trees were affected and of the total 1,914 trees examined, 31 had few leaves and 5 were dead.

Symptoms

Affected trees appeared to be normal in the spring except for dieback which had occurred in previous years. The new leaves were green and of normal size. In an average year the yellow to brown foliage became evident late in June and coincided with the coming of hot, dry weather.

In 1956, the weather in the first two weeks in June was hot and dry, and the symptoms were evident on some trees before June 15. The margins of the leaves turned yellow and then brown and the discoloration progressed toward the center of the leaf (figure 1). Leaves curled and dropped from the tree as the discoloration developed.

D. W. French is associate professor of plant pathology and botany.

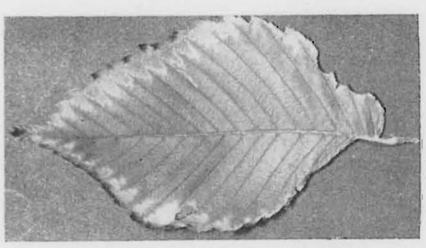


Fig. 1. An elm leaf from a salt-injured tree, showing marginal yellowing.

Fig. 2. An American elm with extensive defoliation and dieback. The foliage remaining on the tree showed typical marginal yellowing.

In 1954, on trees that were severely defoliated, some new leaves appeared later in the summer. Symptoms usually became more obvious as the season progressed. Typical leaf symptoms and appearance of an affected tree are shown in figures 2 and 3.

Trees affected were most commonly at intersections or on streets where salt was applied often during the winter months. Usually more damage occurred on the side of the tree toward the street (figure 3). Trees on sloping streets were more severely injured than those on level streets probably due to heavier salt application and the fact that any one tree might be subjected to more salt moving over the area where its roots were located.

Development in Specific Trees

Fifty-six trees were observed at monthly intervals and the progress of defoliation and dieback recorded. Examples are as follows: An American elm was 100 percent defoliated on September 15, 1954. On June 28, 1955, only a few living branches remained and by September 28, 1955, the tree was dead.

A Norway maple had no defoliation but 30 percent of the foliage was partially brown on June 28, 1955. There was very little change in July but on August 23, 70 percent of the foliage was affected, and by September 28 (still in 1955) there was 10 percent defoliation. On June 15, 1956, part of the crown was without foliage but

(Continued on page 22)

Fig. 3. A Norway maple with extensive dieback. The right side of the tree is toward a main thoroughfare. The foliage on the left side of the tree had brown margins and that part of the tree was not defoliated.

DDT Doesn't Control or Kill House Flies

L. K. CUTKOMP

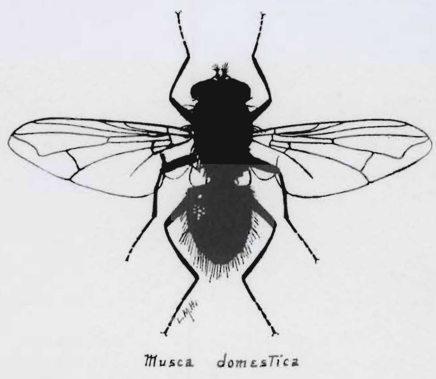
IT WOULD BE SURPRISING to find a farm today where house flies could be controlled with DDT. This problem of insecticide resistance became newsworthy about 10 years ago. The insecticide, DDT, and the abundant, pestiferous, disease-carrying house fly teamed up to provide the story. This was only the beginning, of course. DDT, the prize insecticide, was showing signs of weakness against the house fly as early as 1946 and 1947 in Sweden, Italy, and some spots in southern United States. Not until 1950 and 1951 did the northern states appear to have a problem in practical control measures. Now house fly resistance to DDT persists at a high level throughout the United States.

What do we mean when we use the word resistance? The term describes cases where insecticide dosages that were formerly effective now fail to kill or control the pest. The phenomenon not only is widespread, but is fraught with many involved, yet intriguing aspects. Some of these should be considered.

The development of DDT-resistant strains of flies is inherited from earlier generations which have been exposed to DDT, or a chemically related insecticide. A fly does not develop resistance within its lifetime. Some of the first flies treated could stand a stronger dose of DDT, and the survivors had many offspring which were resistant to DDT. But it is quite striking that house flies all over the world have, with the possible exception of the China mainland, shown resistance to DDT.

An even more fascinating aspect of the problem is that many other kinds (species) of flies have not developed resistance or have shown only a mild tolerance. This is true of the horn fly on cattle and in most cases of the biting stable fly. Even the dreaded tsetse fly in Africa, carrier of the sleeping sickness parasite, continues to be susceptible to DDT.

From a practical standpoint one serious problem is the so-called "cross-resistance" of house flies. This term refers to the fact that DDT-resistant strains may be resistant to other insecticides. Possible insecticide replacements, notably methoxychlor, chlordane, dieldrin, lindane, toxaphene, and TDE, have not proved to



Common house fly

be very useful because the flies become resistant to them, too. Materials which are not close chemical relatives are now used—the amount of "cross-resistance" from DDT is almost nonexistent for these newer insecticides. They are the organic phosphates, malathion, Diazinon, Korlan, and Dipterex. They are the current fly-killers.

One other interesting, but very nanoying, feature of field resistance of house flies has been its persistence through several generations. In addition, in cases where a resistant strain of flies finally became susceptible, they reverted to a resistant population as soon as they were again exposed to DDT or related insecticides.

The matter of changes of resistance within a fly population has led researchers into the study of why this occurs. The findings have uncovered a number of answers, but also some complexities in the results obtained.

One very significant finding in house flies has been evidence of biochemical differences between resistant and susceptible strains. An enzyme capable of destroying DDT has been found in 11 resistant strains, but is absent in susceptible strains studied. The enzyme, called DDT-dehydrochlorinase, occurs in the blood and in the central nervous system. The nerves from resistant flies behave differently than those in susceptibles. Precisely how the enzyme developed in the resistant strains in such quantities is not clear. Despite this obviously important difference between strains there are still some resistant strains from Switzerland which do not break down DDT much better than normal strains. Perhaps they do not use this enzymatic mechanism to survive doses of DDT.

One other chemical difference between fly strains is the type of fatty material on their feet. Some resistant strains can dissolve more DDT in the fats presumably preventing the insecticide from reaching sensitive areas such as the nervous system.

In our laboratory we are studying the production and survival of offspring in three DDT-resistant strains and one susceptible strain. These flies have been compared with other flies from the same populations which have been treated with very small doses of DDT. So far, at least, we find that reproduction and survival in the resistant strains is less than in the susceptible strain. This is true whether the adults were exposed to small doses of DDT or not. Why this occurs and what it may mean is not clear. But don't take this difference too seriously. All strains of the house fly are capable of producing enormous numbers of offspring. The season or the weather can have a much more profound effect on the numbers of flies that swarm around your picnic table.

There are other puzzling features about this much-studied problem of fly resistance. In Georgia, the application of dieldrin to latrines resulted in enormous increases in the numbers of DDT and dieldrin-resistant flies. One Illinois strain of resistant flies showed unusual behavioral habits — they rested on lower untreated spots in the barn rather than on the ceilings and upper walls. For the most part, however, the resistant strains behave much like susceptible strains. The strains also look alike and do not differ in respiratory rates or in enzymatic activity, except for the enzyme DDT-dehydrochlorinase.

The matter of the inheritance of insecticide resistance in house flies has been difficult to study. Genetic

(Continued on page 11)

L. K. Cutkomp is associate professor, Department of Entomology and Economic Zoology.

Vegetable Cookery Methods

JOAN GORDON and ISABEL NOBLE

THE CONTRIBUTIONS vegetables can make toward meeting our nutritional needs have been recognized for many years. Yet recent dietary surveys have shown that at least 25 percent of American diets fail to meet the recommended daily allowances for vitamin C and 29 percent fail to meet those for calcium.

The tendency of vitamin C to be destroyed by heat and exposure to air has also been known for a long time. Since these are conditions which occur in cooking vegetables, the effects of different cooking methods on the retention of this vitamin have been studied.

However, any choice of cooking methods for vegetables must consider also the attractiveness of the vegetable—both in color and flavor. It is all too easy to recall the brownish green color and strong flavor sometimes present in vegetables of the cabbage family. The question might well be asked then as to what causes such changes and how can they be controlled. Research in the School of Home Economics has been planned to help answer some of these questions.

Joan Gordon is associate professor and Isabel Noble is professor, Department of Home Economics.

Common Methods of Cooking

The common methods of cooking can be most conveniently divided into those which use steam and those which use boiling water. Baking, of course, does not fit into either method but it is used for some vegetables.

Methods using steam may involve either cooking in a small amount of water (usually just enough to prevent scorching) in a tightly covered pan, in a steamer, or possibly in a pressure saucepan. In the latter, of course, the temperatures are higher than those found in ordinary steaming methods but, as a result, cooking times are shorter. In any case, in steaming methods the vegetable acids are not diluted nor do they have an opportunity to escape from the utensil. We shall see that this has important effects on the quality of some of the cooked vegetables.

Methods which involve cooking in boiling water, on the other hand, provide the possibility both of diluting vegetable acids and, since the utensil is usually uncovered or only loosely covered, of allowing some of the vegetable acids to escape.

Cooking Methods Affect Flavor and Color

Both the color of green vegetables and the flavor of vegetables of the strong-flavored group reflect these differences in cooking methods. In general, green vegetables cooked in boiling water are as green, or sometimes even greener, than the raw vegetable. Those cooked in steam tend more toward yellow and may lose their green color entirely. A possible exception is vegetables cooked in a pressure saucepan. Both cabbage and green beans cooked in this way resembled the raw vegetables more closely than did those cooked by other steaming methods. The changes in color reflect the chemical changes which occur in the green pigment, chlorophyll, as a result of the combined action of plant acids and heat.

The flavor of vegetables of the cabbage family also responds to differences in cooking methods. It tends to remain mild when these vegetables are cooked in boiling water. A characteristic strong flavor develops, however, under the conditions of steaming. In fact, this flavor is sufficiently pronounced that judges experienced very little difficulty in distinguishing between samples of vegetables cooked by the two methods. For most, but not quite all, of the vegetables of the cabbage family, the flavor of samples cooked in the pressure saucepan was milder than that of samples cooked by other steaming methods. Apparently, the short cooking time tends to lessen the effects of the high temperature of the cooking medium.

But what are the consequences, in terms of retaining vitamin C, of choosing a cooking method which results in mild flavors and a bright green color? In general, since vitamin C dissolves readily in water, we might expect that losses might increase as the amount of water used in cooking is increased. Thus, steaming methods might be expected to result in greater retention of vitamin C than cooking in boiling water. However, not all steaming methods show this pattern. Neither is the difference between cooking methods the same in all vegetables.

For example, in some steaming methods, primarily because of the design of the pan, the vegetables cook very slowly. Then the retention of vitamin C is less than in vegetables cooked in boiling water.

So we see that in choosing methods of cooking vegetables our concern is threefold. We want to choose methods which give us good retention of nutrients yet result in vegetables which are attractive both in flavor and color. For some vegetables, the cooking methods which result in satisfactory retention of nutrients also result in attractive products. For those vegetables for which a decision has to be made as to the relative importance of color, flavor, and nutritive value, these studies help to form the basis for that decision.

House Flies

(Continued from page 10)

studies on inheritance have been helpful, but research workers still disagree on some things.

The need for further research in many aspects is apparent. The practical answer to solving the chemical control of house flies is not so apparent. Currently used organic phosphates don't seem to be the long term answer, because fly resistance to some of them has been noted in several states south of Minnesota and in parts of Europe. A different approach to the selection of chemicals seems desirable. Some workers are trying to develop chemicals that are more potent on the resistant strains than on the susceptible flies. Perhaps compounds of this type will be more valuable for longer periods. Certainly the research workers have problems confronting them. Let us hope their imagination, skill, and efforts will be sufficient to cope with this wily character, the house fly.

Strengthen Your Buildings Against Wind

JESSE POMROY

ARE WINDSTORMS AND TORNADOES doing more damage today than 50 years ago? Are there more tornadoes today?

There definitely is more damage and destruction today for many reasons. A high percentage of buildings are old and are steadily growing older, and, therefore, becoming more susceptible to wind damage. In addition, the total number of buildings is always growing. Most towns, large and small, are expanding with suburbs reaching out for miles. Thus more buildings are in the path of any storm. A storm that may have rolled across an empty field 10 years ago might pass through the center of one of these fast-growing suburbs today.

The number of tornadoes in the United States, however, is probably constant. We read of more every year because there are more people in a position to observe these storms today than 50 years ago. Also, improved communications and forecasting give us better, quicker, and more accurate reports of all storms.

An average of 150 tornadoes was reported each year in the late 1940's. In 1951 there was 300 and by 1954, 690. In 1957 about 1,600 funnel clouds were observed with 961 of them touching the ground. In Texas on April 3, 1956, 58 tornadoes were unofficially reported. For the United States, in one bad week, 237 sightings have been made. Minnesota, while nowhere near the center of the major storm area, is nevertheless close enough so that in no part of the state can you be guaranteed tornado-free weather.

Mark Twain, in his day, realized that there wasn't much that could be done to change the weather. And this is still true today. Advances made in forecasting and the operation of a Severe Weather Warning System, however, have steadily reduced the number of fatalities. Before 1951 about three people were killed for each two tornadoes. By 1956 only one death was reported for each three tornadoes. Although it has been possible to save more lives, the toll in damaged and destroyed buildings continues to climb.

It is not considered practical to construct large farm buildings to resist a direct hit by a tornado. If a building stands directly in its path, the odds are all in favor of the tornado, regardless of the construction.

Then why should we build to resist such winds? The answer is that in every case where a tornado has swept across country many buildings on either side of the funnel have been destroyed. Some of these buildings were 100, 200, or even 300 yards away from the center of the storm. These are the buildings that "might have been saved" if they were properly constructed. Probably more important than the new construction, from the standpoint of the number of people affected, would be an inspection and repair program for all older buildings before a storm strikes.

Building Failures

Failures in farm buildings are most often due to the following structural weaknesses:

1. Inadequate foundations
2. Inadequate anchorage to foundations
3. Inadequate wall bracing
4. Inadequate roof bracing
5. Decay and general deterioration

Foundation—This is the logical place to start. All major buildings require concrete foundations and footings. To guard against undermining and overturning, place the footings deep enough (figure 1). Local conditions will dictate the size and depth.

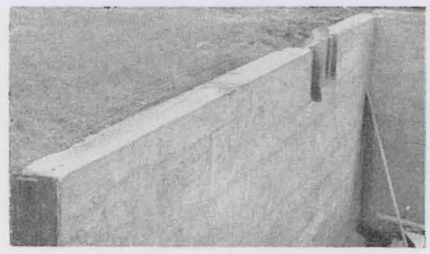


Fig. 2. A foundation wall without anchor bolts.

Anchorage—Next, as foundations are being constructed, provisions must be made to secure the wood frame of the building. Anchor bolts at least ½ inch in diameter are necessary, spaced not over 8 feet apart along the wall. In addition, at least one bolt at each corner and one at each side of each opening such as for doors should prove adequate for most areas of Minnesota. If you are in an area that is often subject to severe winds, shorten the spacing of anchor bolts. Anchorage is of prime importance. If anchors are omitted, the structure is doomed.

Figure 2, taken following a tornado, shows a foundation upon which a house once rested. There was no evidence to indicate that any attempt was made to anchor the structure. Although the house was not in the direct path of the storm, the accompanying winds rolled the structure off the foundation and then reduced it to kindling wood. Had it been anchored, the chances are good that it would still be there.

Wall bracing—A structural weakness in walls often appears in build-

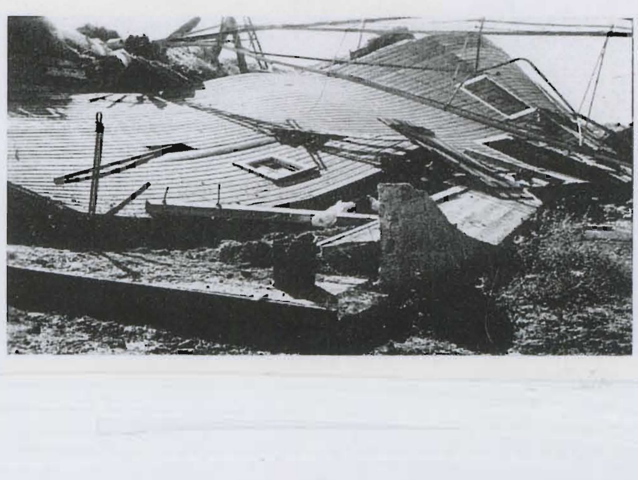


Fig. 1. A shallow foundation wall without footings or reinforcement.

Jesse Pomroy is instructor, Department of Agricultural Engineering.

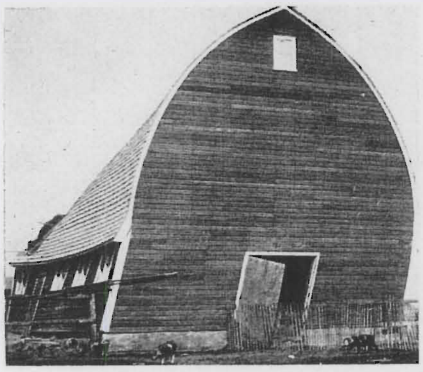


Fig. 3. A barn lacking interior bracing.

ings that may never have been subjected to high winds. The evidence of such a failure shows up in sticking windows, sagging doors, a general leaning or racking with studs, and posts and walls standing out of plumb (figure 3). Frame buildings with horizontal siding on studs (no sheathing) or vertical boards on nailing girts are the worst offenders. If the exterior wall is to be a single covering material, include corner braces, preferably of the let-in type (figure 4). With let-in braces, the studs are notched on the outside to take a 1 x 4 inch diagonal brace. If well fitted, the let-in brace will offer a high degree of resistance to racking because of the fitted wood joints and the nails used. To reinforce a completed building place the diagonal brace on the inside of the studs. This arrangement, while good, is not as effective as a let-in brace because the resistance is limited to the holding power of the nails only. Diagonal sheathing nailed to the studs and over which is nailed the exterior covering material is the best combination to prevent racking.

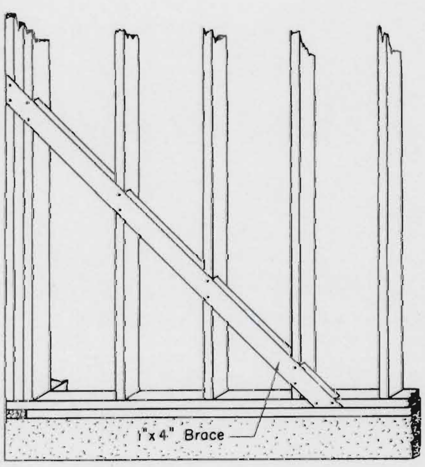


Fig. 4. A let-in brace.

Knee, or diagonal braces, which run from a side wall stud to the ceiling joists or from the wall plate down to the floor joists, are in many cases, omitted because they may interfere with head room or free floor space. This is a serious mistake since these braces help to keep the walls and floor or ceiling at right angles to each other. If this angle cannot be maintained the lower part of the structure will collapse with the upper part settling down on top of it. The damage to the upper half of the barn shown in figure 5 appears minor. However, it will be a difficult job to raise this part of the building to its former position.

Fig. 5. This failure resulted from a lack of knee and wall braces.

Roof bracing—Roof failures occur this way. Wind passing over a roof exerts a pressure on the windward side and a suction or lifting force on the opposite side. The windward side with the weight of the roof plus the wind effect presses downward helping to hold the roof in place. On the opposite or lee side, as soon as the lifting force is equal to the weight of that part of the roof, the stress is then on the nailed joints. When they pull out, the roof fails.

One weak point in roof construction often is the joint at the ridge. Unless a collar beam is placed near the ridge, the two sections of the roof will often part, the windward section remaining and the lee section being carried away (figure 6). At the lower end of the rafters, rafter ties are needed to hold the roof to the wall (figure 7).

Decay and general deterioration—Failure from these conditions is sometimes due to poor building practices, but more often can be traced to a moisture problem from within. Repairs consist of replacing all rotted wood, a costly time-consuming job. The real problem here is to eliminate the cause of this moisture formation.

Fig. 6. This is a typical roof failure due to wind action. The wind direction was from left to right.

To prevent wind damage—

1. Securely tie the frame to a good foundation.
2. Brace walls to prevent racking.
3. Keep the walls and ceiling at right angles to each other with diagonal braces.
4. Anchor all rafters to side walls or floor joists.
5. Use collar beams at the ridge.
6. Maintain a healthy, dry condition within the building.

An inspection of some of your older buildings today followed by a planned repair program like this may save them for tomorrow.

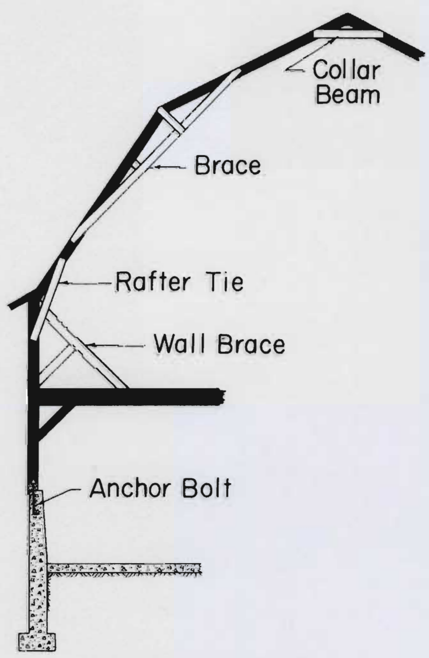


Fig. 7. This bracing is recommended for reasonable structural resistance to wind damage.

Where Do We Stand on Minimum Tillage?

C. J. OVERDAHL, G. R. BLAKE, C. A. VAN DOREN, and R. F. HOLT

MINNESOTA FARMERS and researchers have tried wheel track planting and other forms of minimum tillage for several years. It is time to evaluate which form, if any, is best.

Minimum tillage involves the reduction of normal tillage operations by better timing and by modifying the usual tillage practices and still creating a good seedbed.

Advantages of minimum tillage are obvious to those who have tried it. Fewer tillage operations reduce both time and production costs. Soil compaction which has confronted farmers in recent years, is lessened with minimum tillage. At the same time yields are as good as where soils are tilled more intensively.

Minimum tillage in the field came under study by the University and by USDA workers in Minnesota in 1956. Three years of extensive trials throughout the state in farmers' fields and at state experiment stations have given a good picture of the possibilities of minimum tillage.

Wheel Track Planting

"Garden type" preparation of soil between rows is unnecessary. Only the immediate area where seed is to be placed needs to be worked and carefully firmed to create good soil-seed contact. A poor seedbed of loose soil between the rows is desirable to retard weeds, particularly the annual grasses.

C. J. Overdahl is Extension soils specialist and G. R. Blake is associate professor, Department of Soils, University of Minnesota; C. A. Van Doren and R. F. Holt are Field Station Director and Soil Scientist, Eastern Branch, Soil and Water Management Section, ARS, USDA at Morris and St. Paul, Minnesota.

Fig. 2. Experimental plots on Webster silty clay loam show rough seedbed at left and disked seedbed at right. Yields were the same on both plots.

Field trials in 23 counties in Minnesota show that corn yields average as much or slightly more from wheel track planting than from plantings on land prepared in the regular way. For example, in 49 trials in 1956 and 1957 yields averaged 90.7 bushels per acre for minimum tillage and 88.0 bushels for regular seedbed. The big advantage is not in higher yields but in time saved, reduction of production costs, as well as lessening in soil compaction and erosion.

There were a few cases where yields were seriously reduced by minimum tillage. Soil differences did not seem to account for this. There was little evidence that it works better on some soils than others. However, on fine textured soils, it is probably better to plow in the fall.

There is an important difference in planting in loose ground. Slight equipment adjustments are necessary to insure good planting under these conditions. For one thing shallow planting is best in moist freshly plowed soil. Also it may be necessary to make some adjustments in the normal practice of cultivation. Where a rotary hoe is available, it can be used to level the seedbeds after planting but prior to cultivation.

Plow-Plant

Plow-plant can mean many things. Usually it means plowing and planting in a single operation by mounting the planter on the plow. To others it means plowing and planting in the same day in separate operations, whether in the wheel track or not but with no other tillage. In either case, it involves spring plowing. Planting with minimum disking or dragging to control weeds on fall plowed land can also be done to advantage, and, in fact, can be wheel track planted.

An advantage of planting corn on freshly plowed land, particularly on sandy and medium textured soils, is that germination is hastened because seed is placed in moist soil. Though on the average, stands were equal or better under minimum tillage, they can be lowered by too deep planting or by poor plowing. Often, however, strikingly better emergence and stands were noted with minimum tillage.

Heavy soils, however, may need from a few hours to a day after plowing to partially dry to prevent stickiness and gumming up of the planter. Another advantage on freshly plowed land is that corn gets at least an even start with troublesome grasses.

Farmers with large corn acreages are dubious about delaying their plowing until corn planting time. The plow-plant idea might be modified to a single tilling with a field cultivator or disk on fall plowed land just prior to planting.

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Fig. 1. A rough seedbed between rows retards weed germination and has high moisture intake.

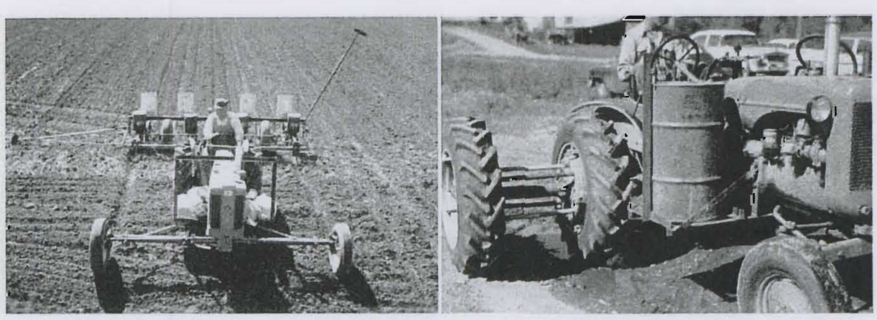

Fig. 3. Four-row wheel-track modification devised by Rollin Dennistoun at the Rosemount Experiment Station. The one at left was used in 1957, the one at right in 1958.

Farm Wives Tell What They Think About
Farm Living in Northeastern Minnesota

MARVIN TAVES and CHARLES MARTIN

NORTHEASTERN MINNESOTA farm wives are relatively satisfied with their lots even though they live in a low farm income area. They do have their complaints, and many are advising their children to seek their fortune elsewhere. These results are evident from the study we're reporting here. An earlier study indicated that men, too, recognized the area's shortcomings but also found much to recommend in it.

This study of farm wives' feeling toward their work, income, social life, and major objectives was made in connection with a study of farming in 13 northeastern Minnesota counties. These counties had been designated as low farm income areas by the U. S. Department of Agriculture. The 431 farm homemakers interviewed were selected by area sampling in such a way that their characteristics and attitudes should reflect those of the farm women of the area.

All but 6 percent of the 431 homemakers report one or more children in the family. Approximately one-third have one or two children, another third have three or four, and the remaining one-third have five to nine children. The most frequently occurring number of children is three per family.

Family income is somewhat under the national average and varies greatly. At least half the farm families supplement farm income with off-the-farm earnings. Almost a third claim a total family income from wages, salary, and farming (net from farming) of less than $2,000, about a third between $2,000 and $4,000, and the remaining third report incomes of over $4,000. Only about 10 percent indicate incomes equaling the national family average.

Although only 1 percent have completed college, 10 percent have had some college training, 40 percent have been graduated from high school, and 61 percent have had at least some high school training. Few have less than four years of education. About one-third reported from five to eight years.

Religiously, over half report a Lutheran preference with lesser proportions signifying Catholic affiliation or preference for other Protestant bodies.

Scandinavians predominate in the area (42 percent), followed by other Northern Europeans (30 percent), British (14 percent) and Central Europeans (4 percent). The remainder are distributed among smaller groupings and include those who consider themselves "of American extraction." Seventy percent of these farm wives' fathers were farmers, while only 30 percent were reared in nonfarm homes.

Over three-fourths of the homemakers were employed before marriage. Of every 10 approximately 2 had been in domestic service, almost 2 in clerical service, and 1 each had worked as teacher, waitress, or factory employee. Less than 2 in 10 had worked off the farm during the last

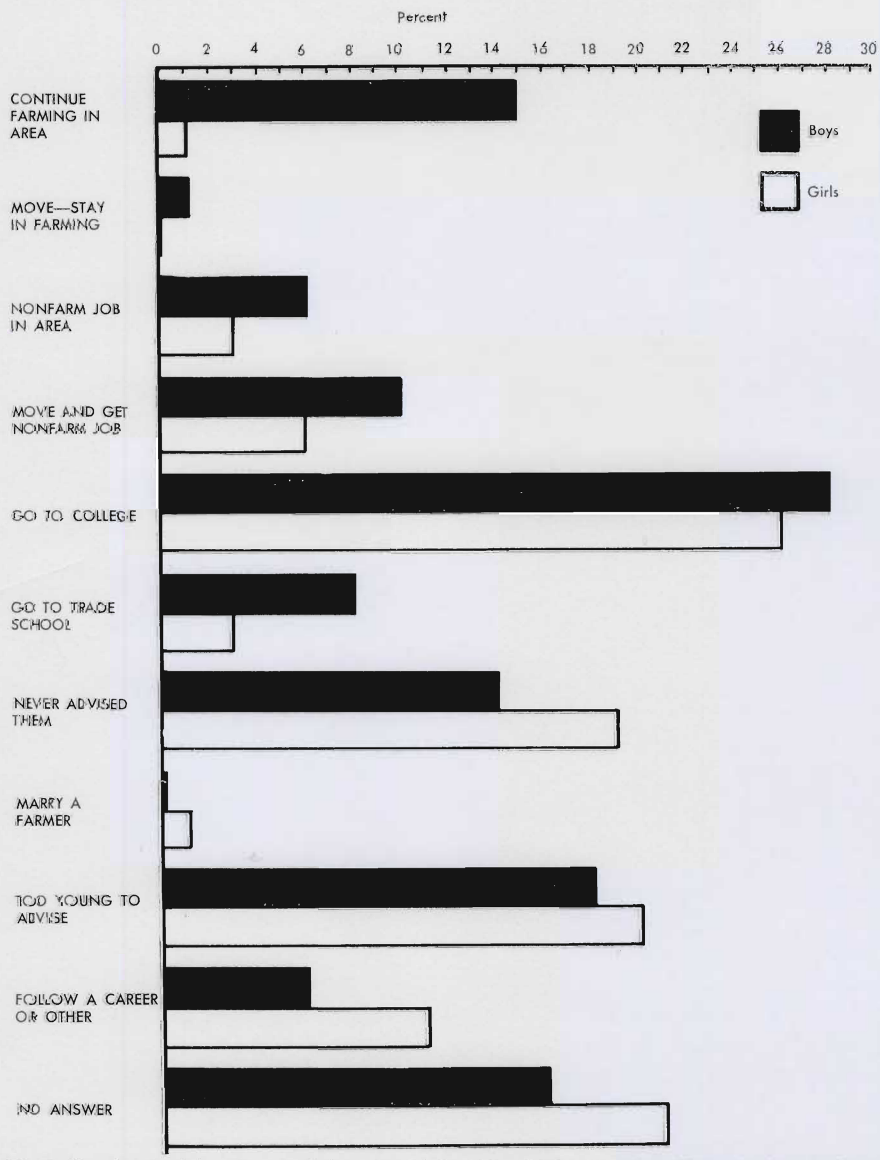

Fig. 1. Vocational advice given to their sons and daughters by Northeastern Minnesota farm mothers.

Marvin Taves is associate professor and supervisor of rural sociology and Charles Martin is Extension family life specialist.

year. These had been employed as teachers, clerical workers, domestic servants, factory workers, and waitresses listed in order of frequency.

The majority are free of mortgage debt. Of the 38 percent who report a mortgage, about half have a mortgage of less than $2,500.

General Attitudes

Practically all of the women asked are satisfied with the community in which they live. Only 5 percent said they are not satisfied and an additional 5 percent are undecided.

On the other hand, only a fourth feel that the opportunities for social contacts and social relationships are very good. Somewhat over half consider them moderately good, while the rest report them as poor or completely lacking. About half are satisfied with the amount of social activities in which they engage outside the home. Most of the rest would like more. About 1 in 10 report not being engaged in any social activities outside the home.

The women also indicate that on the whole their husbands have either never commented (41 percent) or are happy (45 percent) with the amount of social participation outside the home by their wives. Four percent of the women report that their husbands think they are already too active, whereas 9 percent are being urged by their husbands to participate more. Thus the women feel that up to half of the husbands might not object to more participation in community activities by their wives, and many might welcome it.

When asked where they would like to live if they could live anywhere they wished, 90 percent chose the open country, 6 percent the village, and 3 percent the city—1 percent was undecided. However, only 79 percent would prefer that their children live in the open country. To over half it is unimportant that the children live within 100 miles of their parents, it is very important to 13 percent, and important to 25 percent. When asked whether they wanted their children to be farmers, of every 10 mothers 3 said "no," 2 "yes," and the other half just didn't know.

Specific Attitudes

Food, clothing, shelter, and recreation are essential to happy family living. Many farm women feel that these needs are not fully met. With regard to food 56 percent declare it entirely adequate, the remainder thinking it fairly satisfactory or less. Somewhat fewer find the clothing for their family adequate (35 percent). Slightly over half (55 percent) think it fairly satisfactory.

Even smaller proportions are completely happy with housing and recreation for their families. One-fourth evaluate their housing as adequate, another half as satisfactory, and the remainder view it as unsatisfactory or else wholly inadequate.

The responses relating to recreation follow a similar pattern. About one in every five considers recreational opportunities unsatisfactory for her family; only one-fourth find them adequate. At the same time, most of these homemakers think their family to be about as well off as other's families in their neighborhood; only 1 in 10 expresses a sense of relative deprivation.

The more frequently mentioned complaints regarding their housing are: lacks modern conveniences, 52 percent; needs paint, 47 percent; inconveniently planned, 39 percent; too cold in winter, 26 percent; outside unattractive, 25 percent; too small, unattractive inside, and poorly furnished, 22 percent each. Only 18 percent register no complaints about housing.

About one-third of the women aren't completely happy with their farm work. Of every 10 who responded 1 thought she would like another type of work better, 2 were undecided, and 7 claimed to like it better than anything else they could think of at the time. The work is reported as being too strenuous by one of every 4. Another 9 percent are undecided on this question. A full third feel that the farm ties them down so that they can't get away often enough. These answers may at least in part explain why only 2 of every 10 want their children to be farmers or farmer's wives.

Their children's education and future is the farm homemakers' first concern, according to an earlier study by Minnesota rural sociologists. About half of the Northeastern farm homemakers questioned tend to rate the educational opportunities of their children "good" or "better." Thus, when asked to indicate their opinion of the ability of the teachers in their schools, the ratings were: excellent, 17 percent; good, 46 percent; fair, 17 percent; poor, 1 percent. One-fifth refused an opinion.

There was slightly greater dissatisfaction with the quality of the building and equipment in their schools, as well as with the recreational facilities. On the other hand 7 of every 10 rated the grading of their children's work to be either excellent or good, 14 percent fair, and only 1 percent think it poor.

The opportunities offered for college preparation and the quantity and quality of practical courses provided are each rated excellent by approximately 12 percent, good by 38 percent, fair by 18 percent, and poor by 5 percent: the remainder give no answer, some because they currently have no children in school.

Hopes for Their Children

When asked about what vocational advice they had given their children, one-fifth of the mothers indicated their children were too young for such advice, another fifth had just never tried to counsel them on this point.

Of those offering suggestions, one-fourth had advised their children to go to college. To the boys the suggestion next most frequently made (15 percent) was to continue farming in the area. Very few were advised to try farming in other areas. Only 1 percent of the mothers counseled their daughters to remain in farming either within the area or elsewhere. Three percent advised their girls and 6 percent their boys to try for nonfarm jobs in the area. "Move and get a nonfarm job," or "Go to tradeschool" was recommended to their boys by 9 percent and to their girls by 18 percent of the mothers.

Thus, an overwhelming proportion of those mothers who have advised their children have advised them to seek their future outside the area and outside farming. It may be most significant that only 1 percent have advised their daughters to continue in farming and another 1 percent have suggested that the daughter marry a farmer. To the extent that the girls act upon this advice, the already disproportionately greater number of men than women in the area can be expected to be accentuated. The fact that fewer have counseled their children to enter farming

(Continued on page 19)

Nursery Fertilization and Red Pine Quality

HAROLD F. ARNEMAN and DONALD P. DUNCAN

FOREST NURSERY STOCK has become one of the most popular items on the shopping list for Minnesota landowners. In fact, last fall the nurseries ran out of trees of popular species within a month after they went on sale. This increased demand has made research on more effective production increasingly necessary.

The tremendous increase in demand for forestry nursery stock in the last decade is shown by distribution figures for the state nurseries. These nurseries distributed 2,500,000 trees in the spring of 1948 and 19,000,000 in 1958. Private landowners planted 1,500,000 of these in 1948 and 10,000,000 in 1958.

There are several factors behind this increased planting. They are:

- The appearance in 1948 of state nursery trees produced at cost for private planting to meet windbreak, woodlot, and wildlife objectives.
- More tree planting machines made available by community banks and others.
- Payments for tree planting under the Soil Bank Act.
- The "Tree Farm" movement.
- The growing popularity of Christmas tree plantations.

There is no evidence of a slackening in the rate of increase—in fact, just the reverse is true.

Harold F. Arneman is associate professor, Department of Soils and Donald P. Duncan is associate professor, School of Forestry.

The ultimate goal of any forest nursery production program, of course, is established plantations. With the tremendous increase in quantity production has come concern with the quality of seedlings. As with field crops, tree seedling quality is affected, at least to some degree, by fertility. During the last two years, the University and the Minnesota Division of Forestry have been investigating the effect of commercial fertilization on the growth and survival of the red pine seedlings at the General C. C. Andrews State Nursery at Willow River.

Fertilization Tests

The treatments (see table 1) were applied in May, 1957, to nursery beds with two-year-old seedlings. Plots were selected so that treatments were applied in triplicate in two different sections of the nursery. One bed was in a new portion of the nursery which had not been used. The other was in an area which had been in seedlings for a number of years. The experimental seedlings were observed for growth, color, and density during the summer of 1957.

The change in seedling growth following fertilizer applications was not outstanding. Actually there were more differences between nursery beds than among treatments. Field

Table 1. Fertilizer treatments

Treatment	Plant food applied: Nitrogen (N)	Phosphate (P_2O_5)	Potash (K_2O)
	pounds per acre		
Check	0	0	0
O-P-K	0	100	100
N_1-P-K*	50	100	100
N_2-P-K*	100	100	100
N_3-P-K*	150	100	100
N_2(F)-P-K†	100	100	100
N_2(P)-P-K‡	100	100	100
O-P-K + T§	0	100	100
N_2-P-K + T*§	100	100	100

* Nitrogen from ammonium nitrate.
† Nitrogen from urea-formaldehyde.
‡ Nitrogen from ammonified peat.
§ Trace elements include boron, calcium, copper, iron, magnesium, manganese, and sulfur.

observations during the growing season indicated that those beds receiving nitrogen had a deeper green color and appeared taller than those lacking nitrogen. Actual height measurements did not bear this out. This could result from the fact that the nitrogen application caused some seedlings to grow rapidly stunting others so that average height was not increased. The seedling stand in both beds was from 52 to 64 per square foot which is extremely high density.

Differences in weed growth were noted between beds and treatments. The new bed had an especially serious weed problem up to the end of July when it first was weeded. An estimate indicated 80 to 90 percent ground cover of weeds, the problem being

(Continued on page 23)

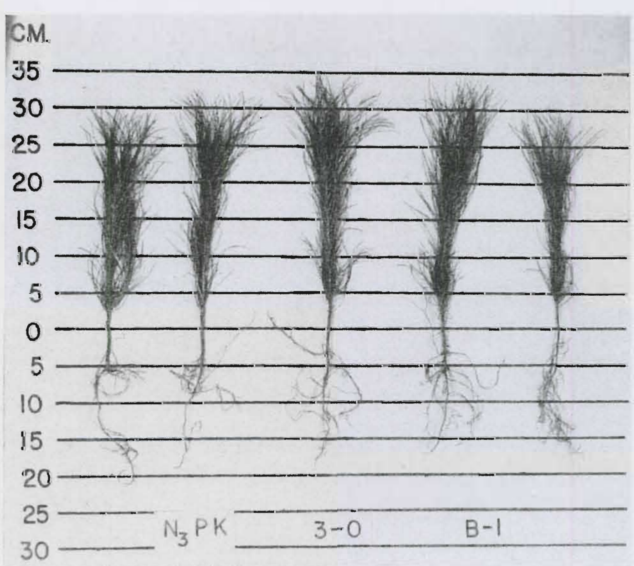

Fig. 1. Dominant seedlings from the new bed with heavy nitrogen treatments.

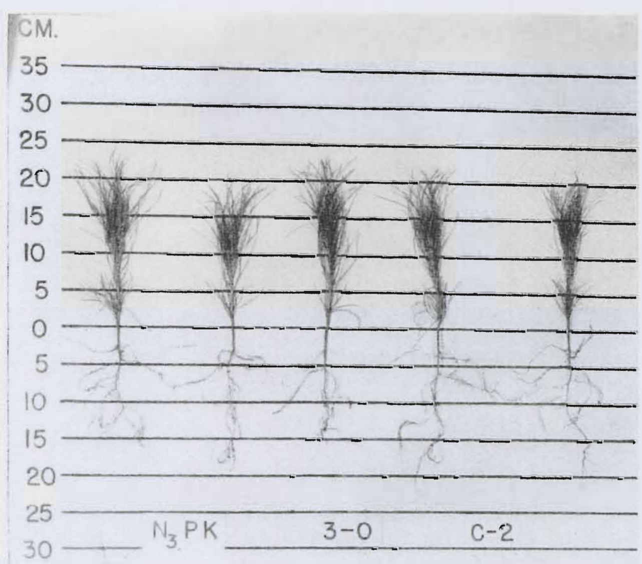

Fig. 2. Dominant seedlings from the old bed with heavy nitrogen treatments.

SILAGE GAS POISONING

RODNEY A. BRIGGS

AVOID SILAGE GAS POISONING

A few simple precautions will help avoid silage gas poisoning. Silage is an excellent feed, and we should continue to use it.

1. During silo filling, watch for irritating yellow or brown fumes in or near the silo. If you see such fumes, get away and stay away from the silo. The poisonous gases, nitrogen dioxide or one of the other oxides of nitrogen, are heavier than air and tend to settle downward and hover around the base of the silo.

2. Let no one enter the silo without first running the blower for 10 or 15 minutes to completely ventilate the silo, chute, and silo room. It is wise to do this during filling, too, and whenever anyone enters the silo during the 10 days after filling.

3. Leave the chute door open at the top surface of the silage. This will prevent gases from accumulating at the top of the silage.

4. Provide extra ventilation at the base of the chute when the silo is attached to the barn. If you have a separate silage room, it is wise to make an outside door for this room, and leave it open during and after filling so that gas can escape at the floor level.

5. Keep children and animals away from the silo area for 10 days after filling.

MANY FARMERS have heard tales of fuming silos and of dangers lurking in and around silos at silo filling time. Until the last decade the exact cause of these dangers was not known. "Old wives" tales and stories of neighbors labeled a silo dangerous at filling time and many farmers heeded these warnings. Unfortunately, however, many did not, and thus in 1955 a number of deaths attributed to silage gas was reported. Consequently, the University started studying the problem.

We found silage gas, especially nitrogen dioxide, is a real and serious danger during the early stages of silage making. Fortunately you can avoid this danger by taking the precautions we've listed above.

Any crop and any silo can produce nitrogen dioxide. It is brown-yellow or reddish and it turns silage a bright yellow or orange. Unfortunately nitrogen dioxide cannot always be seen in dark silo rooms or dark chutes. It may not be concentrated enough to be seen and yet may injure humans.

The frequency and distribution of this toxic gas in Minnesota is being studied by the University's School of Public Health and Agricultural Experiment Station. Funds for this and related research have been supplied by U. S. Public Health Service. This article covers preliminary results on one phase of this silage gas research.

In 1957, we made a detailed study in four areas in each of three counties—Goodhue, McLeod, and Isanti. Since it was impossible to find oats being used for silage in Isanti County in 1957, Wright County was substituted. Interviewers contacted farmers making silage in these areas and filled out a form consisting of 65 questions.

At silage making time our researchers took soil samples from the fields that were to be harvested for silage and then made soil tests for pH, nitrogen, phosphorus, and potassium. They collected gas 6 inches from the base of the silo chute at three times —one, three, and seven days after filling—and measured the concentration of toxic nitrogen dioxide. Since this gas is heavier than air, it collects at the bottom of the silo chute.

Three hundred thirty-one farm silos were studied for gas production, 219 in 1957 and 112 in 1958. Corn silage was made in 180 silos, oat silage in 101 silos, and grass and legume silage in 50 silos. We call this our detailed study.

Because we could make only a limited number of silo visits, we also asked County Agents to give the same questionnaire our interviewers used to farmers making silage. A total of 866 questionnaires were returned in the two years, 74 for grass and legume silage, 106 for oat silage, and 686 for corn silage. We call this our mail survey.

THE DETAILED STUDY RESULTS

All results have not been tabulated, but we do know how frequent toxic

HERE'S WHAT FARMERS SAY

Farmers making silage in Minnesota are aware of silage gas and its action. The following are quotes from questionnaires.

"I finished filling the last silo on Oct. 9. Gas was present in the silo chute and in the silage room the day after filling was started. The green silage leaves in the chute turned yellow."—W., Wabasha County.

"We had gas poisoning in 1956. Killed 40 chickens in the barn and caused a new ½-inch rope in the chute to just fall apart."—C.T., Wabasha County.

"It seems that droughty corn gases more than corn that has had normal rainfall."—A.B., Lincoln County.

". . . The walls of the silo seemed to be tinted brown from it."—R.K., Pine County.

". . . The floor of the silo room was stained a yellowish-brown color."—A.S., Olmsted County.

". . . Three years ago corn silage from this same peat ground gave off a terrific amount of amber colored gas and it was very irritating."—R.C., Brown County.

"We filled three silos this year. One of them had extreme amounts of gas the next morning after filling which was of a dark golden color."—D.C., Nobles County.

Rodney A. Briggs is associate professor, Department of Agronomy and Plant Genetics.

Other St. Paul Campus staff engaged in the silage Gas Poisoning project included Joseph Scaletti, assistant professor of Animal Husbandry; J. J. Jezeski, associate professor of Dairy; and C. K. Otis, professor of Agricultural Engineering.

nitrogen dioxide occurred. It was found in 29 percent of all the silos tested during the two years. It was found most frequently on the first sampling following filling. On a few occasions it was found on the second sampling, but never on the third sampling (table 1).

Table 1. Actual and observed occurrence of nitrogen dioxide in silage, Goodhue, McLeod, Wright, Isanti Counties, 1957 and 1958

Silage crop	Total silos sampled	Positive NO_2 test	Gas observed by farmer
Grass or legume	50	11	4
Oats	101	34	15
Corn	180	51	24
Total	331	96	43

Gas Not Always Visible

In less than half (44.7 percent) of the silos where nitrogen dioxide was actually found did the farmer see any trace of the gas. If the same thing occurred in the silos surveyed by mail questionnaires, more than double the silos containing nitrogen dioxide would have been reported.

It is generally thought that some nitrogen dioxide is released in all silos at silo filling time. We were unable to detect nitrogen dioxide in all silos tested as air movement, ventilation, and feed room arrangement made a difference in concentrations.

Table 2. Number of farmers indicating that they have ever seen silage gas and those who saw gas in the silo or surrounding area during 1957-1958, Minnesota

Silage crop	Total questionnaires returned	Have seen gas in the silo	Saw gas in 1957 or 1958
Grass or legume	74	9	2
Oats	106	27	11
Corn	686	191	93
Total	866	227	106

MAIL STUDY RESULTS

The mail study (table 2), of course, shows only how many farmers observed gas. Often they would not detect a gas even though it may have been present because it can be detected only by sampling and testing.

Our map shows that nitrogen dioxide gas occurred more frequently in southern and central Minnesota. The lowest occurrence was on the sandy soils in north central Minnesota.

SUMMARY OF RESULTS

1. Nitrogen dioxide gas was found in 29 percent of the silos actually tested for nitrogen dioxide. It was produced from all crops tested, corn silage, oat silage, and grass silage.
2. Farmers making silage at the 331 silos observed gas less than half (44.7 percent) of the time it was actually present.
3. Farmers making silage at the 866 silos observed gas 106 times.
4. No nitrogen dioxide gas was detected after the third day following filling in farm silos.

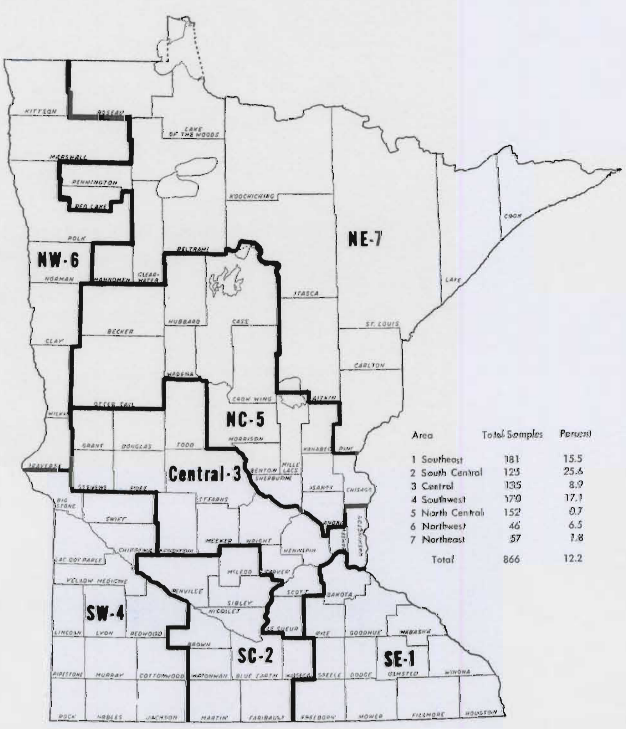

Fig. 1. Occurrence of silage gas by area of state as observed by farmers making silage in 1957 and 1958. All crops.

Gibberellins

(Continued from page 3)

Research at the Minnesota Agricultural Experiment Station deals with several aspects of the gibberellins, including: 1) The effect of natural radiation on the production of gibberellins by the fungus *Gibberella fujikuroi*, 2) The effect of gibberellic acid on certain physiological processes such as water and mineral absorption, and 3) The effect of gibberellic acid on the susceptibility of plants to certain diseases.

As work continues here and elsewhere, recommendations for this new and interesting group of chemicals will be forthcoming.

Farm Living

(Continued from page 16)

than the 20 percent who reported they wanted their children to be farmers or farm wives, may reflect the mother's tendency to be more realistic in her counsel than in her private wishes.

Summary

In general, the Northeastern farm homemakers report moderate sized families, somewhat below average family incomes, average education, and Scandinavian or German nationality background the importance of which is diminishing. Though the majority of the farm women had been reared on a farm, almost a third had not. This most likely reflects this area's back-to-the-land movement during the depression of the '30s.

There is general satisfaction with their community, although sizeable proportions indicate they would really like better housing, food, clothing, recreation, and schooling for their families. The majority of mothers who report having advised their children on the point, have advised them against farming. On the whole, these women report relative satisfaction with their own lot but do not recommend it to their children.

Rosemount Experiment Station Tries
NEW IDEAS IN ANIMAL SHELTER BUILDINGS

JOHN R. NEETZEL and C. K. OTIS

HIGH INITIAL COST limits the opportunities for experimenting with farm buildings. Once constructed, a building must remain serviceable for many years to justify the cost. Consequently we hesitate to take chances on buildings that vary a great deal from accepted construction practices.

This article describes several pole frame building experiments conducted by several University of Minnesota departments and the Lake States Forest Experiment Station at the Rosemount Agricultural Experiment Station. University departments involved include Forestry, Agricultural Engineering, Animal Husbandry, and Poultry Husbandry. Thus the University can observe how well the building features work over the years and give builders an idea which have merit and will give satisfactory service.

HOG FARROWING HOUSE

A 28 foot x 98 foot hog farrowing house (figure 1) was built during the winter of 1954-55. One of the innovations incorporated is the wall construction which, in combination with other features, helps to make the building warmer in winter and cooler during hot summer days.

A cross-section of the wall is shown in figure 2. The main supporting members are especially cut and experimental. They are treated poles set 4 feet in the ground with spacing corresponding to the pen width. Below the grade line they are the same as other poles, which when treated gives them good protection against decay and greater area of contact with the soil. However, above the ground they are rectangular to facilitate double wall construction.

John R. Neetzel is research associate, School of Forestry and forester, Lake States Experiment Station and C. K. Otis is professor, Department of Agricultural Engineering.

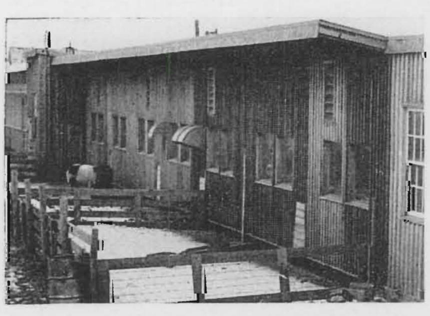

Fig. 1. Pole frame hog farrowing house, insulated and ventilated and built of treated Jack and Red pine poles and lumber.

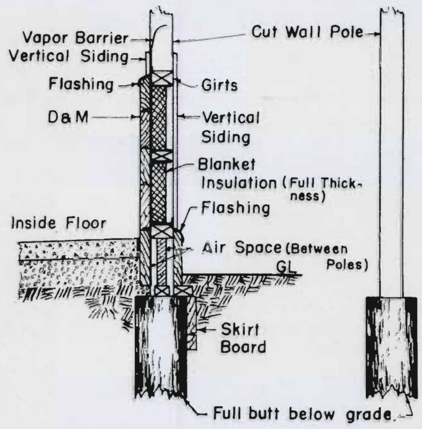

Fig. 2. Wall construction used in the pole frame hog farrowing house.

Winter Warmth

Horizontal girts, spaced to take standard blanket insulation, are used between these poles. The girts rest on spacers nailed to the poles eliminating toenailed joints. During cold weather this arrangement of insulation should reduce transfer of heat by convection within the wall space in comparison to similar insulation placed vertically for the full height of the wall. A vapor barrier of asphalt impregnated and coated paper is provided in addition to that of the insulation blanket.

A special sill section made from treated wood planks gives substantial insulation at the floor line. This helps to provide warmer floor areas next to the inside walls during cold winter weather. Vacuum treated two-inch tongue and grooved lumber is laid horizontally on the inside up to the height of the pen partitions. Vertically placed one-inch tongue and groove boards given a two-minute dip in a 5 percent "Penta solution" complete the interior walls. Treated vertical one-inch boards and battens are used for the exterior. Untreated or control panels are left on both inside and outside walls for comparison.

Resistance to heat flow is measured by the term, resistance value. Looking at these values gives an idea how the various parts compare in the experimental farrowing house. The values are: sill at floor line, 10. 10; lower wall (below windows), 18. 30; upper wall, 17. 20; insulating glass windows, 1. 82; ceiling, 17. 34; doors, 3. 66.

Summer Cooling

The insulation itself wards off summer heat, but other features team up to make this one of the coolest buildings on the station. The overhanging roof shades the south wall and the windows during the hottest part of summer days thus reducing the amount of sun heat absorbed by the wall and the insulation. Sun-excluding screens are placed over the windows during the summer to keep the direct rays of the sun from getting through windows into the building during early morning and late afternoon. These screens are also effective in the spring and fall when hot days occur with the sun too low to be kept out by the overhanging roof.

Ventilation

Since fixed windows cannot be opened for ventilation in hot weather, a special system is provided (figure 3). Openings are provided at intervals along the back (north) wall just below the ceiling. These have doors hinged to the inside and outside surfaces. An insulated panel fits into the space between doors during cold weather and can be removed during hot weather. Ceiling hatches are provided near the front wall. The hatch doors are hinged so that, when open, they form ducts leading to louvers in the front wall above the ceiling, thus providing circulation of air. When the hatch doors are closed the louvers help to ventilate the space between the roof and the ceiling.

TURKEY SHELTER

The 54 x 196 foot turkey shelter (figure 4) has some features in com-

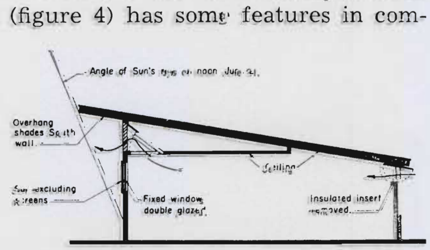

Fig. 3. Schematic sketch of the summer air circulation system used in the pole frame hog farrowing house.

Fig. 4. Pole frame turkey shelter building, 54 x 196 feet, insulated and ventilated and built largely from Minnesota pine.

Fig. 6. A pole frame, uninsulated hog shelter built with treated poles on outside of 2-inch plank walls.

mon with the hog farrowing house. Two important features under observation are the main supporting members and the side wall test panels.

The main supporting members are treated poles set on pads consisting of two pieces of treated 2 x 12-inch lumber placed one on top of the other and nailed at right angles to each other. This provides approximately 1.5 square feet of bearing area on the soil. After setting, the poles are cut to height, and the purlins that support the roof rafters and the purlin splice plates are placed **on top.** This is done so that the weight of the roof plus snow and ice is carried directly by the pole rather than through nails or bolts to the sides of the poles as in conventional pole frames (figure 5). The notched splice plate forms a socket for the top of the pole. The rafter ties keep the purlins from tipping and sliding off the poles and join rafters to purlins and poles to resist uplift from wind forces.

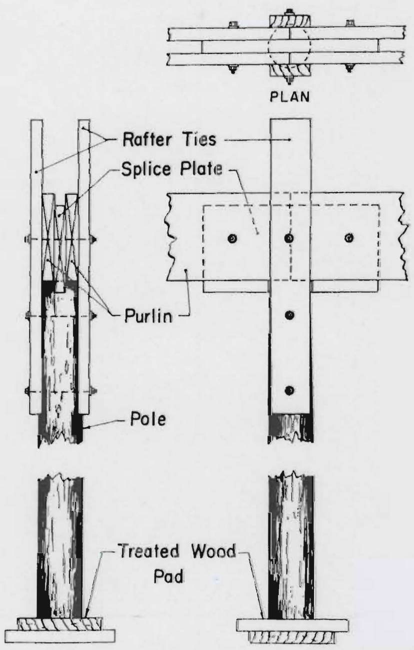

Fig. 5. A detailed drawing of the main supports used in the turkey shelter building.

The wall test panels below the wall openings on the outside of the building (figure 4) are made up of various wall constructions using pine lumber given various treatments. Each panel on the west side of the building is duplicated on the east side to observe the effect of the two exposures. In these tests wood preservatives are being tried alone, with added color pigment, and in combination with paint surfaces. These are compared with regular paint surfaces and with wood having neither preservative nor paint.

Red and jack pine lumber used for panel material:

1. 1-inch vertical stockboards (8 inches wide) S4S with battens.
2. 1-inch vertical stockboards (10- and 12-inch widths, alternating), S4S with battens.
3. 1-inch by 6-inch drop siding attached vertically.
4. 1-inch by 6-inch drop siding attached horizontally.

Treatments used for each of the types of lumber listed above:

1. Control (no treatment).
2. Two coats outside white paint.
3. A 3-minute dip in a 5-percent clear water-repellent penta made with mineral spirits.
4. A 3-minute dip in a 5-percent clear water-repellent penta made with mineral spirits, followed by two coats of outside white paint.
5. A 3-minute dip in a 5-percent water-repellent penta with a dark brown pigment added made with mineral spirits.
6. A 3-minute dip in a 5-percent dark penta made with No. 2 fuel oil.
7. A 3-minute dip in a 5-percent copper napthenate made with mineral spirits.

HOG FEEDING BUILDINGS

One of two 26 x 98 foot uninsulated buildings to be used for feeding hogs is shown in figure 6. The outstanding feature under observation on this structure is the wall construction. Walls of treated 2-inch tongue and groove planks are attached to the inside of treated poles.

Rafters rest directly on the top of the walls and are nailed to the poles when possible. Two by two rafter-ties are used at intermediate rafters nailed to the rafters and to the top wall plank. These ties also act as supports for one end of fillers fitted between the rafters. Hog door openings are reinforced by short poles at the side away from the main support poles. All openings are framed by cutting through the wall and placing a box frame of 2-inch material into the opening, with metal flashing at the top, nailing the frame into the cut ends of the wall planks. Frames are placed so that one side is next to a main support pole.

Corners are made by alternately crossing wall planks from the sides and ends and nailing them to the corner pole. After the walls are completed, an interior fillet is made by ripping diagonally a 6 x 6 timber and drawing it tightly into the corner with bolts extending through it and the corner pole (figure 7).

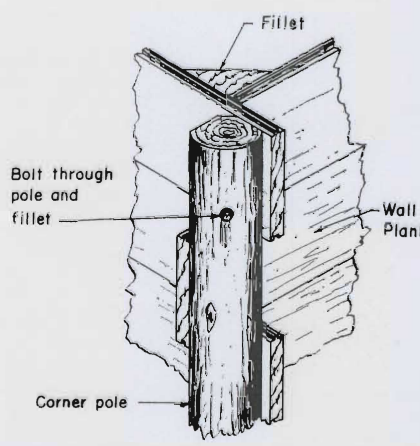

Fig. 7. The corner construction used in the pole frame hog shelter.

It may take many years to determine the effectiveness of the experimental features being used in animal housing structures at Rosemount. Meanwhile, however, they can be observed and compared with construction methods used in more conventional buildings on the station.

Minimum Tillage

(Continued from page 14)

Soil Conservation

Minimum tillage leaves the soil loose. Water penetrates more readily. This drastically reduces runoff and erosion. This was evident in western Minnesota following the "Big Rain" in 1957. Similar observations were made in Steele County in 1957. In the Rochester area in 1958 (following a heavy rain on sloping land) even where corn was planted up and down the hill, virtually no erosion occurred in the planter track. Conservation-minded farmers should seriously consider minimum tillage from the standpoint of preventing runoff and erosion.

Soil Compaction

Tillage packs soils. Even when it appears to be loosening the soil, the weight of the disk is felt somewhere in the soil profile. This is usually a few inches below the loosened layer. Even though the surface soil is dry enough for tillage, it is usually wet underneath so compaction occurs. Reducing the number of trips across the field allows the root bed to remain best suited for healthy plant growth. Actual measurements of soil density showed soil to be less packed under minimum tillage.

What About Other Crops?

If weeds are controlled, minimum tillage works as well on soybeans as on corn. Several farmers regularly plant soybeans by the wheel track method. Experiments with minimum tillage of potatoes are also underway and show promise. Other states have extended minimum seedbed preparation for sugar beets. It is believed that the principles of minimum tillage apply for all crops though techniques for carrying it out will vary.

- **Minimum tillage has distinct advantages in minimizing soil compaction, reducing labor and costs of crop production.**
- **Wheel track planting is the best method of minimum tillage but variations from this technique may be necessary unless new machinery modifications are forthcoming.**
- **Minimum tillage is important in conservation. Loose soil allows for more moisture infiltration and less run-off.**
- **Yields and stands can be maintained by minimum tillage techniques. This assumes that reasonable care is exercised in tilling, planting, and in adjusting machinery to work efficiently in loose soil. It does not minimize the importance of good conditions for seed germination.**

Fig. 4. Four-row wheel-track modification, courtesy Schwartz Manufacturing Co., Lester Prairie.

Boulevard Trees

(Continued from page 9)

there were no discolored leaves. On July 13, there was 25 percent dieback and medium discoloration. On August 13, there was 40 percent dieback and heavy discoloration and on September 21, 1956, there was 60 percent dieback and less than 10 percent of the remaining crown had leaves that were not discolored.

Greenhouse Application

To determine approximately how much salt was required to produce similar symptoms, elm seedlings were planted in the greenhouse and treated with various concentrations of a 4:1 mixture of sodium chloride and calcium chloride. In practice the amount of $CaCl_2$ mixed with NaCl, when applying salt to streets, depends on the temperature. Slight symptoms occurred on trees to which salt was applied once, the equivalent of 2,500 pounds NaCl plus 625 pounds $CaCl_2$ per mile (30 feet x 5,280 feet). A second application of the same amount of salt to the same trees, one month later, produced symptoms similar to those occurring on boulevard trees. Single applications of salt in concentrations two and four times this amount caused wilting and defoliation on some seedlings and typical marginal yellowing on the others. Defoliated seedlings produced new leaves which had marginal yellowing.

Analyses of Soil and Foliage

Soil samples were taken adjacent to severely defoliated trees and from nearby healthy trees. The soluble salts (conductivity) value was 22, near a tree killed by salt, and 15 for a comparable sample from near a healthy tree taken in the same general area at the same time. Samples taken early in the spring, immediately after the ground thawed, gave a maximum conductivity value of 19. These values were considerably below the amount that would indicate excessive salt in the soil. As a general rule there was a higher value for soil beneath damaged than healthy trees, and it is assumed that the salts were leached out quickly.

Calcium and sodium analyses were made of the foliage of four injured and four normal trees. The results are in table 1. The sodium content of the injured elm and Norway maple were above normal, suggesting that there was translocation of sodium and it might be responsible for the damage. The calcium contents of injured foliage were less for each species.

Dutch Elm Disease

Dutch elm disease is transmitted by bark beetles which feed on healthy trees but which must breed in dead and dying elms. In some Ohio communities and in other states the Dutch elm disease was able to develop rapidly because it was preceded by "Phloem necrosis" another elm disease which resulted in a few dead and dying elms in which the beetles could breed. Phloem necrosis was of minor consequence once the Dutch elm disease became established. In the dead and dying elms in this state, resulting from salt applications, we have an ideal situation for the elm bark beetles to build up quickly and, if the fungus were present, many elms would be killed by the Dutch elm disease.

Start Precautions Now

If salt is to be applied as in the past it may be necessary to develop an effective program of pruning, particularly along streets where the damage has occurred. In that it is impossible to predict when the Dutch elm disease fungus will be introduced to the state it would be best to start a sanitation program now, and not wait until the disease is here. Salt, NaC1, does not protect trees from infection by the Dutch elm disease fungus, nor cure such infections.

Table 1. Calcium and sodium content of injured and healthy leaves from 4 species of trees

Sample	Percent based on dry weight basis: Calcium	Sodium
American elm		
Healthy	3.8	.02
Injured	2.4	.13
Box elder		
Healthy	4.4	.04
Injured	3.4	.04
Basswood		
Healthy	4.3	.03
Injured	2.6	.02
Norway maple		
Injured	1.1	.08

Nursery Fertilization and Red Pine Quality

(Continued from page 17)

most severe where nitrogen had been applied. Weed removal could have caused some root injury to the seedlings in the new bed.

In September, trees from each plot were lifted for laboratory measurement and analysis. Seedlings were taller in the new bed than in the old (figures 1 and 2). The top to root ratio, based on oven dry weight, was greater for all treatments in the new bed than for comparable treatments in the old. The third season's growth was greater in eight of nine treatments in the new bed than for similar treatments in the old. No significant differences were measured in the average diameter at the ground line or in dry weight per plant among treatments or between nursery beds.

Tree Survival

Survival qualities of the pine seedlings were tested by randomized replicated field plantings made with a machine in the spring of 1958 at the Rosemount Agricultural Experiment Station. The findings were tabulated by classifying seedlings as alive or dead about mid-August. Results are shown in table 2.

Survival of seedlings from the old nursery bed was significantly better than survival from the new.

In the new nursery bed the seedlings that received 150 pounds of nitrogen had much poorer survival than the others. Fertilizer treatments had varying effects on survival in the new nursery bed, but there were no real differences in the old nursery bed. Some other less striking but significant survival differences among fertilizer treatments also became apparent. Seedlings from the old nursery bed, however, showed no significant survival differences among fertilization treatments.

There are several possible explanations for these results. Weed growth was much more serious on the new bed than on the old and when weeds were removed, there may have been damage to seedlings. The severity of weed competition was greatest in plots having the heaviest nitrogen applications.

Table 2. Average mid-August survival of nursery fertilized red pine seedlings

Treatment	Survival: New nursery bed	Survival: Old nursery bed
	percent	percent
Check	64	87
O-P-K	45	85
N_1-P-K	67	86
N_2-P-K	49	83
N_3-P-K	15	84
N_2(F) -P-K	57	86
N_2(P) -P-K	47	82
O-P-K + T	66	85
N_2-P-K + T	55	86
All treatments	52	84

Three inches of peat were applied to the old bed but not to the new. Perhaps the application of peat materially improves stock quality and reduces ill effects of heavy nitrogen applications.

It is also possible that the excessive growth of tops (see figure 1) following the heaviest application of nitrogen may have caused severe losses following planting. Top to root ratios for the heaviest nitrogen treatments were somewhat higher on the new bed than on the old in the laboratory dry weight determinations.

Research Needs

Foresters need to know what kind of seedlings are required in western Minnesota as compared with the eastern part of the state. It would be very helpful to know whether a better quality seedling is required on difficult sites, even within a particular section of Minnesota, than on the more favorable sites. Research information of this kind would be immediately useful.

Investigations on this whole problem are being continued and their scope broadened in an effort to ascertain the methods which may be used to obtain the product ultimately desired—a vigorous seedling that will show high survival and good growth following field planting.

Feed Additives in Dairy Cattle Rations

J. D. DONKER, A. C. LINNERUD, V. K. SINGH, and H. J. REBHAN

Here University dairy scientists report on tests conducted with three important feed additives for dairy cattle. The results indicate that the additives, as fed by the University, did not harm the animals but at the same time they did not have any feeding advantages.

FEED ADDITIVES today play an important part in feeding our farm animals. These special materials are added to the feedstuffs in small quantity. They include antibiotics, urea, hormones (or hormone-like substances), trace mineral elements, vitamins, and specific drugs of one kind or another. Some have been successful; others have not.

Materials used for dairy cattle must be more strictly supervised than for most other livestock because additives might be transmitted to the milk to be used for human consumption. No drug or insecticide can be used in feed or on the cow, or even in the barn, if traces of the material show up in the milk.

Additives are used for various reasons. All are aimed at increasing productivity in some way. Some, such as antibiotics or hormones, may stimulate the growth processes directly. Certain antibiotics and drugs have their favorable effects through control of a subclinical bacterial or parasitic infection in which, in the main, the animal does not appear to be sick. Obviously sick animals that are treated properly would also show increased productivity.

Two substances which showed considerable promise of increasing efficiency of growth and milk production were tested recently at the University of Minnesota Dairy Farm, Agricultural Experiment Station, St. Paul.

Dynafac

The first substance considered was Dynafac. This material was included in a milk replacer and in a calf starter in calf feeding trials, and the results were in Vol. XV, No. 3, May 1958 **Minnesota Farm and Home Science.** It was also fed to 10 milking dairy cows. Data were collected on milk production, fat content of milk, feed consumed, amount of feed consumed per unit of milk produced, and weight changes of the cattle. After a three-month feeding trial, no differences were noted in any of these. In short, Dynafac was without effect on milking cows. Under different circumstances, such as an insidious disease level, the effect of adding the material may have been beneficial. Only one level of addition of the drug was examined (1.5 grams per cow per day).

Protamone

Thyroid hormone or thyroxine in the form of iodinated-casein (Protamone) was used in a trial to determine whether it could be used to increase growth rate or feed efficiency in growing dairy heifers. The thyroid gland of the body controls metabolic rate, the rate at which various body processes proceed.

There seemed to be the possibility that some amount of hormone above normal levels might stimulate growth in dairy heifers. It was decided arbitrarily to give enough hormone to experimental animals so that their heart rate would be about 10 percent above identical twin mates (five sets were used). At their initial weights of about 600 pounds, this required approximately 7.0 grams of iodinated casein. As the animals grew to 740 pounds, it required 9.0 grams. The animals were fed 2 pounds of concentrate daily and forage was free choice.

The trial was divided into two periods of 6 weeks each. During the first period (November and December), growth rates and feed intakes were not affected. During this time, the heart rates of the experimental animals averaged 7.5 percent above the controls. During the second period (January and February), the difference was increased slightly so that the experimental animals averaged 9.0 percent above the controls. In the second period, the experimental animals ate similar quantities of feed but gained weight more slowly than the controls.

From the results of this experiment, there did not appear to be any beneficial effects of feeding iodinated casein to growing dairy heifers of breeding age. In fact, it was quite conclusive that as the heart rate was increased above the controls approximately 10 percent, growth rate decreased. It should be emphasized that weight gains were measured after initial effects of decreasing intestinal contents had become established.

Stilbestrol

Stilbestrol, an artificial hormone, and other similar products which are now quite extensively used in beef feeding operations, have been test fed to dairy cattle on a small scale. No benefits have been found. However, the levels which are recommended for beef cattle on feed do not appear to interfere with reproductive performance of dairy cattle. Dairy animals, like beef animals, are found to grow faster and use less feed. At this time no general recommendation can be given to feed it to female dairy stock which are in the process of growing and to be used as herd replacements.

Identical twin dairy animals used in dairy research. Animals such as these are very helpful in finding answers to dairy problems. The Dairy Department is continually seeking such animals.

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