MINNESOTA
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MINNESOTA FARM AND HOME Science

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May, 1954

About Our Cover . . .

The honeybee on the cover is pollinating red clover on the Melvin Anderson farm near Bagley, Minnesota. Mr. Anderson's red clover field was used last year by the University of Minnesota Agricultural Experiment Station for experiments on pollination by honeybees.

The experiment is one part of a cooperative University research program designed to solve some of the problems in seed production of alfalfa and clovers in Minnesota.

The picture for our cover was taken by Allan G. Peterson, research associate in entomology, who often combines his photographic hobby with his research work with insects.

Members of the Department of Entomology and Economic Zoology are cooperating with other departments of the University in studying ways to increase seed production through better pollination and control of injurious insects. (See the article on pollination by R. L. Fischer in this issue.) Research on varieties, cultural practices, and weed control is centered in the Department of Agronomy and Plant Genetics. The Department of Soils is contributing to the project through research on soils and fertilizers. Studies on plant diseases in relation to other phases of seed production are under way in the Department of Plant Pathology.

Research by this team of scientists is coordinated through a technical committee composed of University staff members of the participating departments and an advisory committee of seed producers and county agents.

Minnesota's Men of Science

Editor's Note—This is the fourteenth in a series of articles introducing scientists on the St. Paul Campus of the University of Minnesota. Here we present J. B. Fitch, head of the Dairy Department.

J. B. Fitch, head of the University of Minnesota Dairy Department, knows dairy cattle and he knows the everyday problems of the dairy farmer. That intimate down-to-earth knowledge helps him direct research and teaching in a field of immense importance to both agriculture and the entire economy of the Upper Midwest.

Fitch is best known as a dairy cattle judge and as a welder of a team of dairy scientists and teachers who have achieved national and international prominence in the field.

As one of the nation's top dairy cattle judges, he has judged dairy cattle in the National Dairy Show 10 times, the Dairy Cattle Congress 12 times, the Eastern States Exposition, the Canadian Royal, and at state fairs and shows in practically all midwestern states, Oregon, and California. He also helped set up the type classification for both the Holstein-Friesian Association and Jersey Cattle Club of America and the Canadian Jersey Club.

Born on a farm near Huntertown, Indiana, Fitch was graduated from Purdue University in 1910. After graduation he worked for a short time on a certified milk farm in Indiana before joining the staff at Kansas State College. In 1918 he became head of the Kansas State Dairy Department. He served in that capacity for 17 years before coming to the University of Minnesota as head of its Dairy Department in 1935. During his years at Kansas State, Fitch served as both secretary and president of the American Dairy Science Association and as official U. S. delegate to the World's Dairy Congress in London in 1928.

At Kansas State, Fitch was one of the pioneer researchers in the use of sorghum crops for silage and of grass silage, starting work in this subject in 1917. Later he continued some of this work at the University of Minnesota and has been joint author of several bulletins on grass silage.

As head of the Dairy Department he has provided the leadership and guidance making it possible for members of his staff to achieve national and even international recognition in several fields. During the years, the department has been recognized for its work in milk secretion, managed milking, nutritional studies, development of new cheese varieties, developments in dried milk products and other dairy processing techniques, and milk sanitation.

The department has also taken the lead in using new techniques aimed at speeding research. It now has the second largest collection of identical dairy twins and triplets in the world and is among the first to use the secrets of atomic energy in research.

In addition to teaching and research work, Fitch assisted in standardizing dairy herd management practices in public-owned institutions in Minnesota.

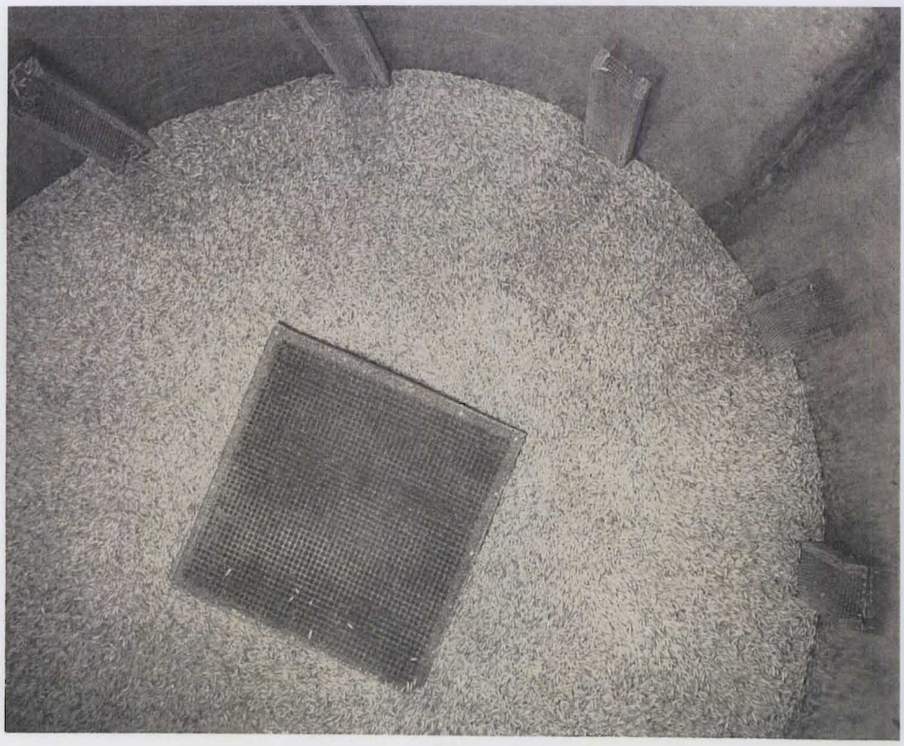
Fitch is the author of several bulletins on dairy feeding and management. He is a member of the American Association for the Advancement of Science, American Society of Animal Production, Dairy Science Association, and Sigma Xi.

Drying Grain

with

Low Volume Unheated Air

JOHN STRAIT AND R. V. KEPPEL



Model bin showing the central discharge box duct system for drying grain.

IF YOU ARE thinking of artificially drying your grain crops, you'll find a wide variety of equipment and processes which may accomplish the job with varying degrees of satisfaction.

The simplest form of a drying system consists of a fan which is used to force air through suitable ducts and through the grain. In this system unconditioned air may be circulated in sufficient volume to give rather quick drying under favorable conditions, or in smaller volumes which will dry the grain over a period of perhaps two or three weeks.

A more positive type of drying installation would employ heated air to accomplish the drying of the crop in a relatively short time. Whether or not it is feasible to use unheated air to dry grain depends upon the time of the year at which the drying operation is attempted and the amount of moisture which must be removed as well as the speed at which the grain must be dried.

A number of experiment stations have reported the successful drying of wheat and oats where these grains were combined with a moisture content of from 16 to 22 per cent and dried by circulating a small amount of unheated air through the grain. In this article, we will review some experiments on the drying of combined grain with low volume unheated air which have been conducted at the Agricultural Experiment Station at Rosemount during the past three harvest seasons.

John Strait is associate professor and Robert V. Keppel is instructor in agricultural engineering.

Advantages

With a low volume unheated air drying system, the grain may be combined direct without swathing and at an earlier date than is possible if the grain is to be stored without drying. It would also be possible to extend the length of daily operation of the combine by permitting an earlier start in the morning and later work at night.

The cost of equipping a bin for this type of drying is reasonably low. The materials for the duct system cost about $25.00 per thousand bushel bin and an 18-inch fan and one horsepower motor cost about $225.00. With proper management the fan and motor can be used for more than one bin.

Equipment Requirements

Use a fan capable of delivering approximately 3 cubic feet of air per minute for each bushel of stored grain. Since the resistance to air flow increases as the depth of the grain increases, limit the maximum depth of the grain to about 5 feet.

With wheat 5 feet deep or oats 6 feet deep and with the fan delivering 3 cubic feet of air per minute per bushel of grain, static pressures of approximately 1.7 inches of water will be encountered. A fan should, therefore, be selected which will deliver the required volume of air against the resistance pressure of 1.7 inches of water.

Suitable fan types include the propeller type of fan, axial flow fan, and the backward and forward curved blade centrifugal fans. If a forward curved blade centrifugal fan is to operate efficiently, the speed of the fan must be adjusted to the motor size and resistance pressure encountered. Once adjusted to full motor capacity, this fan has a tendency to overload the motor with a decrease in the resistance pressure.

An 18-inch propeller type fan or its equivalent driven by a one-horsepower electric motor will provide sufficient air to process a bin of grain containing about 1,000 bushels, providing the depth is within the previously specified limits.

Almost any farm grain storage can be adapted to low volume air drying. It is essential only that the duct system be of such nature that air is fairly uniformerly distributed to all parts of the grain. A perforated floor raised about 8 inches above the permanent floor is perhaps the best design for supplying air uniformly to all parts of the bin.

Other duct systems which are less costly to build and perhaps more easily maintained may be used. One of these systems is a main air supply duct with lateral ducts in the form of inverted troughs attached to it.

Another duct system suggested by some model studies (see figure) consists of a rectangular central discharge box extending to within 5 feet of the bin wall and vertical air ducts spaced around the bin wall and extending from the floor to a height of about two-thirds

(Continued on page 4)

Drying Grain . . .

(Continued from page 3)

the depth of the grain. This system gave very good air distribution in the model studies and performed well when installed in the full-size grain bin last summer.

Operation of the Fan

The motor should be in operation whenever the temperature and relative humidity of the air are sufficiently favorable that moisture will be removed from the grain. It may or may not be desirable to equip the motor with automatic controls which would govern the operation of the fan and motor according to the temperature and relative humidity of the air.

The degree of automatic control may vary. For complete control the circuit may include a humidistat, preset to start or stop the fan at specific values of the relative humidity of the air; a thermally operated switch governing the operation of the motor according to a predetermined minimum temperature of the air; and a thermostatically operated switch to be placed in the grain mass so that the fan would be started if the temperature of the grain should reach predetermined value in order to prevent overheating of the grain during prolonged periods of low atmospheric temperatures or high relative humidities.

In many instances the humidistat and the thermostatically controlled switch to prevent overheating of the grain could be eliminated. If the bin is located convenient to the farmstead, these automatic controls are ordinarily not justifiable.

Results of Our Experiments

The results obtained at Rosemount during the past three harvest seasons illustrate what the farmer may expect from low volume unheated air drying system. The grain bin used was a 1,000 bushel steel bin which is circular in cross section and last year was equipped with the central discharge box type of duct system. An 18-inch propeller type fan driven by a one horsepower electric motor delivered about 2,600 cubic feet of air per minute when working against a resistance pressure of 1.7 inches of water. This gave an air flow of slightly less than 3 cubic feet of air per minute per bushel of grain.

Oats which was combined direct was placed in the bin with a moisture content varying from 22 to 16½ per cent. The average moisture content of the 900 bushels of oats was 18.4 per cent. The final moisture content was 14.3 per cent. The fan operated a total of 140 hours during a period of 32 days.

The outside air thermostat was set at 50° F. and the humidistat setting varied from 75 per cent relative humidity in the early stages of the drying period to 55 per cent during the latter stages of drying. One hundred seventy kilowatt hours of electrical energy were consumed by the motor, and at a cost of 4 cents per kilowatt hour, the cost of electrical energy for operating the motor was about .8 of a cent per bushel of grain processed.

The oats was sold without any reduction in grade and there was no noticeable deterioration in any part of the bin.

When You Use Low Volume Unheated Air . . .

The following general recommendations may be made for drying grain with low volume unheated air:

1. **Maximum moisture content should not exceed 22 per cent.**
2. **The maximum depth of grain should be limited to 5 or 6 feet.**
3. **Three cubic feet of air per minute per bushel of grain should be supplied by the fan.** The fan should be capable of operating against a static pressure of about 1.7 inches of water at this rate of air flow.
4. **Little drying will be accomplished when the temperature of air is less than 50° F.** The relative humidity should be low when the fan is in operation during the later stages of drying. In order to remove the last bit of moisture required to bring the the grain down to about 13 per cent moisture content, the relative humidity of the air should not be above 50 per cent. The relative humidity may be higher during the earlier stages of the drying period.
5. **Corn and soybeans harvested late in the fall will not normally dry satisfactorily with this system.**

Experiment Station Schedules Eight Field Days

Every summer the University of Minnesota has field days at its branch experiment stations and at several experimental plots on farms throughout the state. Here visitors can see for themselves how different grain varieties, fertilizers, and management practices work and how many other experimental results affect everyday farming.

Eight Experiment Station Field Days are planned during July at the locations indicated on the map.

Dates and locations follow:

July 7, Agricultural Experiment Station, Rosemount

July 8, West Central Experiment Station, Morris

July 12, Southwestern Minnesota, William Poulsen farm, southwest of Redwood Falls

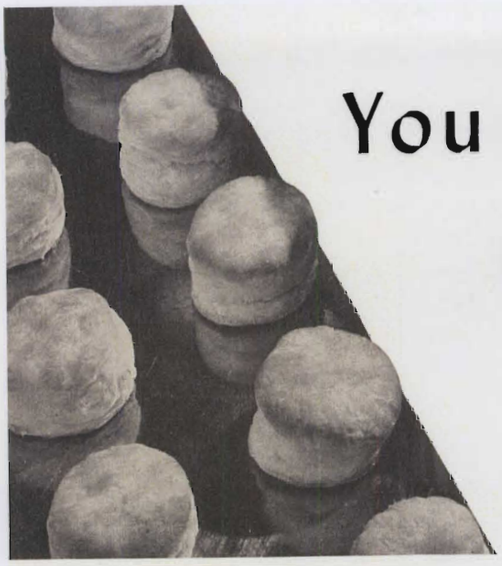
July 13, Southern Experiment Station, Waseca

July 22, Northwest Experiment Station, Crookston

July 23, Northern Minnesota, Roseau

July 27, North Central Experiment Station, Grand Rapids

July 28, Northeast Experiment Station, Duluth



You Can Make Your Own Quick Bread Mix

ELAINE ASP AND ISABEL NOBLE

YOU CAN MAKE a mix which will help you prepare quick breads that are really quick—and economical too.

Although muffins and biscuits are termed "quick" breads, many homemakers don't find them quick to prepare and serve piping hot from the oven. Measuring the ingredients, mixing the dry ones, then the liquid ones, and finally the liquid ones with the dry, requires precious meal preparation time that many homemakers cannot afford for that purpose.

A quick bread mix that you can prepare when you are not busy with meal preparation and can store in measured amounts ready for making muffins and biscuits is a real time-saver. The mix is convenient when unexpected company drops in. And it's an economical and easy way to add both food value and variety to family meals.

The quick bread mix given here was developed to produce high quality muffins and baking powder biscuits. The characteristics of high quality quick breads are:

Muffins—Ideally, muffins are symmetrical in shape and have slightly rough or pebbled crusts that are a golden brown color. Ones that have peaked tops and smooth crusts or very rough crusts with bits of uncombined dry ingredients showing are not of high quality. Muffins double in size during baking and are light in weight in relation to their size. The cells of the interior are even with no evidence of large elongated holes or tunnels.

Baking powder biscuits—High quality baking powder biscuits rise evenly, have straight sides that are not bulged or cracked, and level golden brown top crusts. They double or triple in size during baking. The interior is creamy white in color with no yellow or brown spots, and so flaky that the layers can be peeled off in thin strips.

Certain ingredients used in developing this recipe for quick bread mix were chosen for their keeping qualities and economy. Nonfat dry milk solids were used because they have excellent keeping qualities and are economical and convenient. When nonfat dry milk solids are used, you need to add only water for the liquid in muffins and biscuits prepared from the mix. However, you can use fluid milk if you wish to enrich the products.

Lard was chosen as the shortening because it is economical and many homemakers want to use it more extensively for their baking. The particular lard used in testing the recipe was a commercial product which had been stabilized to keep its flavor and texturated to keep its creamy consistency without refrigeration.

Home rendered lard can also be used successfully, especially if it has been treated to reduce the undesirable flavor changes that develop during storage. Directions for treating home rendered lard can be obtained from your local food locker plant.

The following recipe for quick bread mix will make muffins and baking powder biscuits of high quality.

Quick Bread Mix

All-purpose flour, sifted	8 cups
Nonfat dry milk solids	1 cup
Salt	2 teaspoons
Double-acting baking powder	4 Tablespoons
Lard	1½ cups

Measure all the ingredients accurately. Sift the flour, milk solids, salt, and baking powder together three times, and place in a large bowl. Blend the lard into the dry ingredients with a pastry blender until it is evenly distributed and the mixture resembles coarse meal. This recipe makes approximately 10 cups of mix. One cup of the mix makes 4 muffins 2½ inches in diameter or about 5 biscuits 1¾ inches in diameter.

Decide upon the amount of mix you will need each time you make muffins or biscuits and measure that amount into pint or quart jars for storage. Take care not to pack the mix into the measuring cup. Cover the jars tightly, and store at room temperature in a dark place or in a refrigerator.

This quick bread mix may be stored successfully at room temperature in a dark place or at refrigerator temperature. When stored at room temperature, the mix keeps about 4 weeks. When stored at refrigerator temperature it keeps approximately 6 weeks without deterioration.

Muffins and biscuits have been prepared from freshly prepared mix and from portions of the mix that were stored 1, 2, 3, and 4 weeks either at room temperature in a dark place or at refrigerator temperature. The products prepared from the freshly prepared mix possessed all the characteristics of high quality muffins and biscuits, and those prepared from the stored mix were of just as high quality as muffins and biscuits prepared at the same time from freshly combined ingredients.

The following recipes give the directions for using this mix in muffins and biscuits.

Muffins

Quick bread mix	2 cups
Sugar	2 Tablespoons
Egg, beaten	1
Water or milk	⅔ cup

Measure the sugar and mix with the quick bread mix in a 2-quart mixing bowl. Make a well in the center of the dry ingredients. Combine the beaten egg and water or milk in a small mixing bowl. Add immediately to the dry ingredients. Mix until the dry ingredients are just dampened and the batter is pebbly. Carefully place the batter in greased muffin pans with as little

(Continued on page 17)

Elaine Asp is instructor and Isabel Noble is profesor of home economics.

Breeding Wheat by International Cooperation

E. R. AUSEMUS

THE DEVELOPMENT of wheats resistant to disease is now being done cooperatively on an international basis. During the early period in the United States there were no wheats resistant to the dreaded stem rust disease. The release of Thatcher in 1934, and later the release of the Hope and Timstein derivatives such as Lee, Rival, Pilot, and Mida, brought stem rust under control in the spring wheat area until 1950, when a new race known as 15B became prevalent over a large area.

Regional cooperation of the state experiment stations and the United States Department of Agriculture was started about 1900 and expanded after World War I. Canada joined in the work in 1919 and cooperation with Mexico began in the mid-1940's. By 1950, many other countries were cooperating in the exchange of breeding materials, and information, through the growing of uniform international tests.

At the present time special tests for rust resistance and other desirable characteristics on 650 varieties and strains from World Collection of Wheats and 75 domestically produced varieties are being grown at Pullman, Washington; Denton, Texas; Manhattan, Kansas; Layfayette, Indiana; Madison, Wisconsin; St. Paul, Minnesota; Fargo and Langdon, North Dakota; and in Gainesville, Florida.

They are also being tested at Winnipeg, Canada; and in Eucador, Bolivia, Argentina, Brazil, Uruguay, Paraguay, Egypt, Turkey, Kenya, Spain, India, Japan, the Virgin Islands, and Puerto Rico; at two locations each in Mexico, Colombia, Chile, Australia, and South Africa; and at three locations in Peru.

World Collection of Wheats

The USDA's World Collection of more than 14,500 varieties and strains of wheats are the basis of the wheat breeding program. These wheats have been collected from every wheat growing country during the past 60 years. Most of these wheats have been tested under stem rust epidemics at one or more experiment stations in this country and at two or more stations in Mexico. Approximately 10,000 of these wheats were tested also at St. Croix in the Virgin Islands, and at Mayaguez, Puerto Rico.

The results are tabulated, summarized, and mimeographed by the USDA and distributed to the cooperating agencies. It is extremely valuable to the plant breeding research, to have the same varieties tested uniformly under so many growing conditions and to the different diseases in the cooperating countries.

Two Crops a Year

Breeding also is accelerated by the growing of two crops a year, particularly a winter crop at Brawley, California, and in Mexico. Breeders working in the United States and in Canada and growing a crop during the winter in the Imperial Valley of California have developed two spring bread wheats, Selkirk and Willet, which have shown resistance to stem rust race 15B.

Selkirk was developed by the Canadian workers and over 100,000 bushels of the variety is being distributed to growers in Canada this year. Six thousand bushels of seed of this variety is being allotted to the three spring wheat producing states of North Dakota, South Dakota, and Minnesota.

Willet was produced by the Minnesota Agricultural Experiment Station in cooperation with the United States Department of Agriculture. Seed of this variety is being grown under contract and will not be available for distribution before 1955.

Other resistant varieties are being developed by the cooperating stations and should be available in the near future.

E. R. Ausemus is professor of agronomy and plant genetics and USDA senior agronomist.

ARGENTINA
AUSTRALIA
BOLIVIA
BRAZIL
CANADA
CHILE
COLOMBIA
EGYPT
ECUADOR
INDIA
JAPAN

KENYA
MEXICO
PARAGUAY
PERU
PUERTO RICO
SOUTH AFRICA
SPAIN
TURKEY
URUGUAY
VIRGIN ISLANDS

International cooperation is the keynote in breeding disease-resistant wheat. In this program trials are conducted at the points indicated on the map and in the countries listed on either side.

Honeybees Aid Production of

ALSIKE CLOVER SEED

ROLAND L. FISCHER

ALL of our clovers and alfalfa must be cross-pollinated to produce a seed crop. Cross-pollination is the transfer of pollen from the flower of one plant to the flower of another plant. Without cross-pollination little alsike clover seed can be produced.

Bees are our most effective cross-pollinators of legumes. When bees visit flowers they do so in search of both nectar and pollen to feed their young. As a bee moves from one flower to another, pollen grains stick to her and are carried from flowers of one plant to flowers of other plants.

Observations during 1950 and 1951 indicated that there are not enough wild bees in northern Minnesota to pollinate alsike clover adequately. Experiments were conducted during 1952 and 1953 to determine the value of the honeybee as a pollinator of alsike clover and to determine the species of native bee pollinators and their abundance.

In 1952, four alsike clover fields were selected for the experiments, and honeybees were placed on the borders of these fields at rates of zero, two, four, and eight colonies per acre. One of these fields is shown in figure 1. In 1953, six fields were selected, and honeybees were used at rates of zero, two, and four colonies per acre. Small areas in the fields were caged to keep out bees.

In these experiments, 93 to 97 per cent of the pollinating insects visiting alsike clover were honeybees (see table 1). Native bees, including bumblebees, digger bees, and leafcutter bees, contributed a relatively small amount to the pollination picture of alsike clover.

More Bees—More Seed

Results of these studies indicate a direct relationship between the numbers of honeybees present and the resulting seed yields. In other words, **the more bees, generally, the more seed.**

Roland L. Fischer was formerly research fellow in entomology and economic zoology.

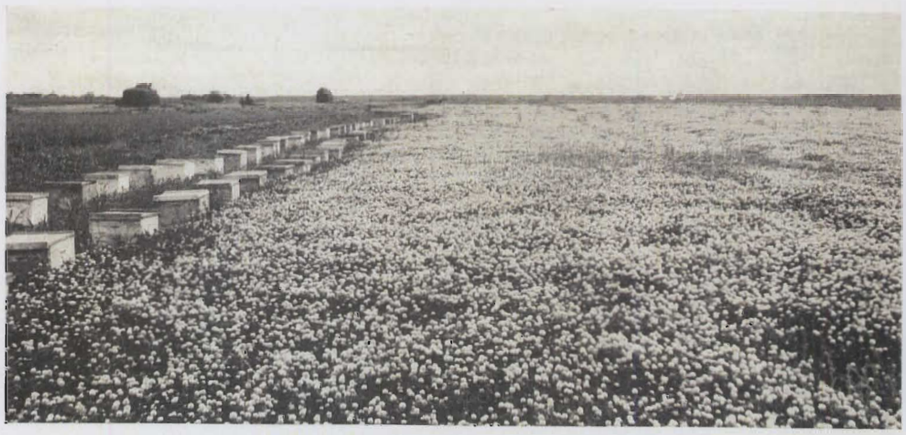


Fig. 1. One of the alsike clover fields used in these experiments.

Table 1. Percentages of Different Kinds of Bees Visiting Alsike Clover in Northern Minnesota During the 1952 and 1953 Seasons

Group of bees	1952	1953
	per cent	
Honeybees, *Apis mellifera* L.	92.9	96.9
Bumblebees, *Bombus* spp.	1.3	0.8
Digger bees, *Lasioglossum* spp.	5.5	1.9
Leafcutter bees, *Megachile* and *Osmia* spp	0.2	0.3
Others	0.1	0.1

This was demonstrated in one of the 1952 fields where there were eight colonies of honeybees per acre. Increased concentrations of honeybees resulted in progressive increases in seed yields (table 2).

Results of the 1953 experiments are presented in figure 2. Areas which were caged to exclude bees had average yields of only 20 pounds per acre. Fields which had no honeybee colonies near by averaged 317 pounds of seed per acre; however, there was a considerable number of honeybees in these fields from distant colonies. Fields with two colonies of honeybees per acre averaged 334 pounds of seed per acre, and those with four colonies per acre averaged 446 pounds of seed per acre. **Thus, areas open to bee activity averaged from 16 to 23 times more seed than did caged areas in which bees were excluded.**

Table 2. Alsike Clover Seed Yields (Pounds Per Acre) from Square Yard Plots of Observed Concentrations of Honeybee Activity. Roosevelt, Minnesota

	Number of honeybees per square yard per minute					
	No. bees (cage)	0.9	1-1.9	2-2.9	3-3.9	4-4.9
Seed yields in pounds per acre	30	no data	157	261	427	602

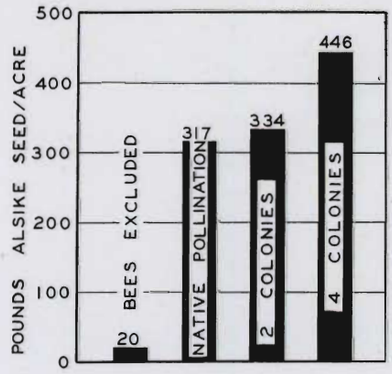


Fig. 2. Average yields of alsike clover seed from fields with different rates of honeybees per acre. All fields were treated with a preblossom spray of DDT at 1½ to 2 pounds actual DDT per acre to control injurious insects. The yields of 317 pounds per acre attributed to native bee pollination actually resulted from pollination by native bees and a considerable number of honeybees foraging from colonies more than one mile away.

In no area of northern Minnesota thus far studied, are native bees abundant enough to be relied upon for the

(Continued on page 9)

Soilage vs. Rotational Grazing

Which is the best way to use pasture crops?

THOR W. GULLICKSON, HUGH G. LIVINGSTON, AND DAVID E. JONES

BY FEEDING pasture crops as soilage, only 30.6 acres were required to feed a herd of 35 cows as compared with 50.9 acres when it was grazed. However, the soilage plan, which involves cutting, chopping, and feeding green crops, required considerably more labor and equipment.

These were among the more importane results obtained from an experiment conducted last summer by the Dairy Department of the University of Minnesota at Rosemount. The experiment was designed to obtain information relating to the feeding of green crops as soilage and also to compare this method of using crops with the daily rotational plan of grazing.

The experiment started June 18 and continued through September 1. The dairy herd of 70 cows was divided into two equal and similar groups. One group was fed soilage while the other was pastured according to the daily rotational plan of grazing.

Hay was available to cows in both groups alike all the time. Milking cows in both groups were fed grain at the rate of 1 pound per 6 pounds of milk produced daily.

How the Systems Differ

The two systems of pasture crop utilization differed considerably in their operation and in the equipment required. The rotational grazing plan required only the electrical fencing equipment needed to confine the group to the area to be grazed each day. The fence was shifted to a new area each evening while the cows were being milked.

The soilage group was fed soilage cut from the same plot as was used by the pasture group. The equipment consisted of a forage harvester, a mobile feed box, and a three- or four-plow tractor. Twice a day, the soilage was hauled from the field to the feed lot for cows in the soilage group. Each cow often consumed as much as 200 pounds of soilage daily.

Thor W. Gullickson is professor, Hugh G. Livingston is former research assistant, and David E. Jones is a graduate student in dairy husbandry.

Milk Production of Cows in Each Group and Acres of Different Crops Utilized

Pasture crop										
	Previous treatment			Group fed soilage				Group on pasture		
Kind*	Grazed	Cut for hay	Days fed	Acres	Total milk	Milk per acre	Days fed	Acres	Total milk	Milk per acre
Control or preliminary period										
——	No	No	17.5	——	19,008	——	17.5	——	20,407	——
Experimental period										
Alfalfa-brome and oats	No	No	10.5	2.5	12,025	4,810	10.5	5.0	12,440	2,488
Oats	No	No	9.0	1.3	9,948	7,652	9.0	5.0	9,819	1,964
Orchard grass-ladino	No	Yes	4.5	5.8	5,220	900	4.0	3.9	4,412	1,131
Alfalfa-brome	No	No	11.0	11.0	14,501	1,318	11.5	12.0	13,114	1,093
Alfalfa-brome and sudan†	No	No	39.5	10.0	35,958	3,596	29.5	15.0	29,301	1,953
Alfalfa-brome‡	No	Yes	——	——	——	——	10.0	10.0	8,560	856
Total or average			74.5	30.6	77,652	2,538	74.5	50.9	77,646	1,525
Average milk per day					1,042.3 lbs.				1,042.2 lbs.	
Average acres required per day						0.41				0.68

* Adjustments in kind of pasture fed or grazed had to be made occasionally for short periods because of rainy weather or soft ground.

† Some of the sudangrass utilized by the soilage group was regrowth after first cutting.

‡ Group on pasture ran out of sudan grass pasture ten days before soilage group exhausted its supply, hence an additional 10 acres of second crop alfalfa-bromegrass was utilized.

Milk Production

Data summarizing the milk production of both groups and acres of different crops required to feed them are presented in the table.

Both groups produced almost exactly the same amount of milk, but only 30.6 crop acres were required to feed cows in the soilage group as compared with 50.9 acres for the pasture group. The milk yields per acre were 2,538 for the soilage groups and 1,525 pounds for the pasture group. Only 0.41 crop acre was needed per day for cows fed soilage as compared with 0.68 acre by the group on pasture.

Feed Value of Crops in Study

Not only do different crops differ in feeding value, but also they may have a different value when utilized as pasture than when cut and fed as soilage. Cows did well when on oat pasture but even better when this crop was used as soilage. However, as the oat crop approached maturity, it became less palatable to both groups. Sudangrass was about equal to oats for pasture, but only about half as valuable for soilage.

The stage of maturity and height of crop when harvested appear to be the most important factors affecting the value of any crop when utilized either as pasture or as soilage. The cows in both groups showed a definite preference for young plants over those more mature. The data indicate that the height of the plants when harvested greatly affected crop yields and milk production per acre. For example, second growth orchard grass harvested at 8 inches was low in crop yield and milk production, but excellent in palatability.

When to Cut Soilage

For use as soilage, most crops should be chopped at the early hay stage and not at the usual pasturing height which is somewhat lower. The data indicate that yield per acre is not increased by using short palatable crops, such as the orchard grass-ladino clover crop, as soilage instead of for pasture. The cows pastured on this crop actually outyielded those fed soilage. Evidently the yields of such crops are increased by being grazed down more closely than they can be clipped by the forage harvester.

More Feed Wasted in Pasture

The pasture group wasted more forage than the soilage group. At least 25 per cent loss of crop occurred when orchard grass-ladino clover was used as pasture. When young oats were first grazed, losses were at the rate of about 2.5 tons of green material per acre. In more mature and taller oats and sudangrass, the waste was even greater, often reaching 40 per cent of the total crop.

Waste of forage when fed as soilage was quite negligible except when fermentation in the green mass of feed in the feed box caused it to heat and become unpalatable. The heating developed within a few hours after the material was cut and blown into the feed box. After a comparatively few hours in the box the material often became so hot as to be almost unbearable to the hand.

The heating problem was eliminated by distributing the material in thin layers in bunks, but this involved more labor. A better plan would be to use a mechanical unloader to deliver the chopped grass into the feed mangers. After the losses from heating were eliminated, waste seldom exceeded 200 pounds daily for the soilage group. Weather conditions such as high temperature and humidity tended to cause an increase in waste for both systems.

No bloating was observed in animals in either group and, therefore, no conclusions can be drawn as to whether or not the feeding of soilage reduced bloat risks. It appears that when rations include a considerable percentage of grasses, little bloating is likely to occur.

Cost of Equipment and Labor

The cost of equipment and the amount of labor required was much greater for the soilage than for the grazing plan. The entire cost of the electric fencing equipment for the grazing plan probably did not exceed one hundred dollars. For the soilage plan, on the other hand, the forage harvester alone cost $1,000 and the mounted feed box about $350. Only a part of the cost of the tractor needed to operate these units should be assessed against the soilage plan because this type of tractor is standard equipment on most farms.

In regard to labor, the entire operation of walking out to the pasture, shifting the 200 feet of fence to enclose a new grazing area and returning to the barn took about 20 minutes and this was done only once daily. However, in some awkward shaped fields, as much as a day was taken to subdivide them so as to make daily shifting of the fence simple and easy. Driving the forage harvesting equipment to the field, harvesting a full load of soilage, and bringing it to the feed lot also took about 20 minutes, when no mechanical breakdowns interfered. This operation generally had to be performed twice daily.

Risks in Soilage Plan

Management mistakes and weather conditions make the soilage plan of utilizing pasture crops much more risky than any grazing plan. The soilage system leans very heavily on efficient machinery maintenance. Cows are less likely to break down than the machinery required for the soilage system.

During the season little trouble was encountered so long as pasture soil was dry and firm, but during rainy weather the soilage system became a constant struggle with equipment. Harvesting of either oats or sudangrass during rainy weather was nearly impossible because the equipment mired. The wet weather also was responsible for frequent breakdown of machinery due to clogging. If the system is to work satisfactorily, a spare forage harvester should be available for use whenever needed.

During the progress of the experiment the hammer mill type of forage harvester which was purchased for the experiment broke down and was replaced by another type of machine which chopped the material more finely. Following this change the cows seemed to prefer the shorter cut material. This observation needs further study.

To operate the replacement machine the days' ration first had to be cut with a mower and the material windrowed. Following this the crop was picked up, chopped, and blown into the feed box by the field chopper. Considerable time and labor was involved in the hitching and unhitching of the two units required. Unless you have a forage harvester which cuts, chops, and elevates or blows the material into the feed box all in one operation, you probably won't find the soilage system economical.

Of course, some of the advantages of the soilage system of pasture crop utilization cannot be evaluated in terms of money. Its main advantage, however, is the greater feed production that can be obtained under proper and intelligent management.

It is certain that if you have a herd of less than about 25 cows it will take some close figuring to make the soilage plan of utilizing pasture crops pay. This experiment is being continued and further results will be reported later.

Honeybees and Alsike Clover . . .

(Continued from page 7)

adequate pollination of alsike clover. The native bees should, therefore, be supplemented by the use of honeybees. The number of honeybee colonies to use per acre will vary to a certain extent from area to area, depending upon the available bees in the vicinity and presence of competing crops. Use at least two colonies of honeybees per acre to assure adequate pollination of alsike clover.

There are two factors which may cut down the pollination of alsike clover. These are bad weather and plant competition for the attention of the honeybee. In periods of bad weather a higher rate of honeybees per acre near the alsike field to be pollinated will be a safeguard, for bees do not usually forage very great distances during poor flying weather.

Bees show marked preferences for certain plants. For example, they forage on sweetclover in preference to alsike clover. Ordinarily, there is but little overlap in the flowering period of alsike clover and sweetclover. But it's a good idea to plant alsike clover seed fields three miles from sweetclover, if possible, to avoid competition.

The use of honeybees for the pollination of alsike clover should be made a community effort. It is to the mutual advantage of all growers in a given community to contact the beekeeper and to aid him in the selection of sites for locating his bees. This should be done preferably the season before the crop is to be harvested, for many beekeepers look for locations for their bees a year in advance.

Apply Insecticides Carefully

Injurious insects may reduce seed yields, and the use of insecticides is recommended to control these harmful insects. Remember that many of these insecticides are as toxic to beneficial pollinating insects as they are to injurious insects. Follow the recommendations of the experiment station. Do not apply insecticides during the flowering period unless absolutely necessary, and then use only toxaphene or methoxychlor and apply it at night in order to avoid harming bees.

Cold-Soaking Treatment Increases

Service Life of Fence Posts

L. W. REES AND JOHN R. NEETZEL

FENCE POSTS are needed frequently on every Minnesota farm. More than half of the 179,000 farms in Minnesota have woodlots and nearly all have trees in windbreaks and shelterbelts which, during the past, have furnished a large part of the fence post needs.

When durable woods like white and bur oak, eastern redcedar, and northern white-cedar were available, farm-produced posts gave a service life of 10 to 15 or more years. Since the supply of more durable woods has decreased, more posts are being cut from less durable woods, such as red oak, aspen (popple), paper birch, elm, cottonwood, and ash. Untreated, these posts will last only a few years.

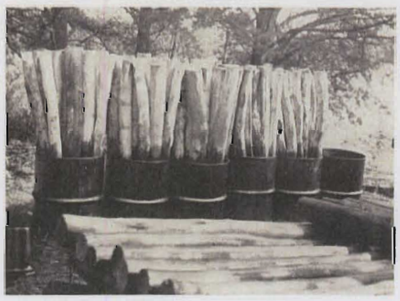
Chemical treatment of posts can greatly increase the service life. For many years the School of Forestry has been interested in preservative treatment of wood. The February 1947 issue of *Farm and Home Science* describes different methods for treating fence posts and other wood material.

Of the different methods described, however, that of cold soaking in an oil solution of pentachlorophenol appears to be the most feasible method of treating wood products on the farm. The results of such treatment of 856 fence posts from seven Minnesota tree species are reported here.

Producing and Treating the Posts

Aspen, cottonwood, black ash, paper birch, red oak, white oak, and jack pine posts were cut from green timber during March, 1942, and peeled during April. In addition, the paper birch and black ash were shaved with a draw knife just prior to treatment. All posts were 6 feet long with a top diameter of 3 to 5 inches. Most of the posts were round but a few split cottonwood and oak were used. After peeling, the posts were loosely cross-piled and left until August when the moisture content was between 20 and 25 per cent.

The posts were treated with a penta (pentachlorophenol) solution, using a 4 to 1 concentrate in aromatic oil diluted with kerosene to make a 5-per cent treating solution. The posts were treated erect in 55-gallon drums with an initial solution level of 38 inches. For the 24-hour schedule the tops were first soaked for six hours followed by an 18-hour soak period for the butt end. For the 48-hour cycle the tops were soaked for eight hours followed by a 40-hour soak for the butts.



Treating the posts.

The treated posts, along with 420 untreated controls, were set in test plots at Cloquet, St. Paul, and Waseca during the fall of 1942. The amount of chemical absorption and the effectiveness of the treatment after 10 years of service life are indicated in table 1.

Results of the Treatment

The aspen and cottonwood posts absorbed the greatest amount of the preservative solution. Paper birch and black ash also absorbed large amounts. The total absorption of preservative by these four species, and especially by the aspen and cottonwood, is not necessarily an indication of the effectiveness of treatment since the solution for unknown reasons does not always penetrate the wood uniformly. For example, some parts of the aspen posts had an inch or more penetration and a high concentration of the solution while nearby areas had little penetration or absorption. Penetration of the preservative into the pine, oaks, and black ash was more uniform.

Results of the Post Plot Service Tests

Untreated posts—In the 10 years that these posts have been set in test plots all untreated aspen, cottonwood, black ash, and white birch have failed, giving an average service life of about four years.

As would be expected, most of the oak posts were servicable after 10 years in the ground. The average life for the

Table 1. Service Record of Fence Posts Treated by Cold Soaking with a 5 Per Cent Oil Solution of Pentachlorophenol

Species	Length of treatment	Average absorption of preservative solution	Posts	Posts failing after 10 years	
				Number	Per cent
	hours	pounds per cubic foot	number		
Jack pine	24	2.27	70	0	0.0
	48	2.62	69	0	0.0
	0	0	69	60	87.0
White oak	24	1.48	30	0	0.0
	48	1.39	30	0	0.0
	0	0	30	13	43.3
Red oak	24	1.47	60	2	3.3
	48	1.39	60	0	0.0
	0	0	51	19	37.3
Black ash	24	2.99	70	1	1.4
	48	3.60	70	0	0.0
	0	0	70	70	100.0
Paper birch	24	3.02	70	10	14.3
	48	3.54	70	2	2.9
	0	0	70	70	100.0
Cottonwood	24	3.24	59	11	18.6
	48	4.17	60	10	16.7
	0	0	60	60	100.0
Aspen	24	3.69	69	29	42.0
	48	3.24	70	24	34.3
	0	0	70	70	100.0

L. W. Rees is professor of forestry; John R. Neetzel is research associate in forestry and forester, Lakes States Forest Experiment Station.

81 red and white oak control posts is estimated at 13 years.

Due to a greater than normal proportion of the more durable heartwood, 9 of the 69 jack pine controls are still serviceable. However, many of the jack pine conrols failed during the first few years, indicating an average service life of about eight years. Normally we do not expect more than about four to five years of service from untreated jack pine posts.

Treated posts—In all cases the cold soaking in a 5-per cent solution of penta greatly increased the service life of the posts.

None of the jack pine or white oak posts given a 24- or 48-hour cold soaking in penta has failed, and all were sound at the time of the 1953 inspection. The increased durability of the treated jack pine posts is especially significant.

Red oak and black ash were also effectively treated with the penta preservative. Only 3 of the 260 posts have failed during the first 10 years. Most of the posts still in service appear to be sound.

The poorest results were obtained with treated aspen posts with 38 per cent failing during the first 10 years. The failure in the treated aspen posts is no doubt the result of the poor distribution of the preservative.

There have also been numerous failures of cottonwood and paper birch during the 10-year period, due probably to nonuniform penetration of the preservative.

Failures of all posts observed in this study have been by decay at or near the ground line.

The results obtained provide a basis for the prediction of the service life of the treated and untreated posts for the species studied (table 2).

Fence post durability test plot at Cloquet Experimental Forest.

Table 2. Estimated Service Life of Untreated and Treated* Wood Posts

	Untreated	Treated
	years	years
Aspen and cottonwood	3.8†	10-12
Paper birch	4.1†	12-15
Black ash	4.5†	15-18
Red oak	13 (est.)	18-20
White oak	15 (est.)	20 or more
Jack pine	8 (est.)	20 or more

* Cold soaking for 48 hours in 5 per cent penta solution.

† Based on 100 per cent failure.

Treated posts last longer. No. 1 is an untreated 3-inch jack pine post badly decayed at ground line after 2 years of service. No. 2 is a 3-inch jack pine post which was cold soaked for 48 hours in a 5 per cent "penta" solution and is still sound after 10 years of service.

New Experiment Station Bulletins

Migration in Minnesota - 1940-50—Station Bulletin 422. 16 pages by Charles E. Ramsey, Allan D. Orman, and Lowry Nelson. How fast are we losing people from our farms? Where are they settling? Which counties have lost the most? Are more boys or girls leaving rural areas? These are the questions answered in this new bulletin from the rural sociology department.

A Century of Population Growth in Minnesota — Station Bulletin 423. 40 pages by Lowry Nelson, Charles E. Ramsey, and Jacob Toews. The penetrating eye of the rural sociologist is turned again on Minnesota's population—this time to examine the trends of an entire century. Such points as population growth, national origins, birth rate, age distribution, sex ratios, and migration are studied.

Price Supports and the Potato Industry—Station Bulletin 424. 32 pages by Roger W. Gray, Vernon L. Sorenson, and Willard W. Cochrane. This two-color regional bulletin includes discussions of: the support program and how it operated, the potato market and how it was affected by supports, the development of specialization in the potato industry, farmer's attitudes toward the program, costs and benefits of the program, and a suggested program to fit the needs of the potato industry.

Control of Stored Grain Insects in the North Central States—Station Bulletin 425. 24 pages by North Central Regional Technical Committee on Entomology. Also printed in two colors, this regional bulletin lists recommendations for protecting stored grain in farm storage, in elevators, and in transit.

Weeds of the North Central States—Regional Bulletin 36. 239 pages by the North Central Regional Committee on Weeds. This outstanding bulletin (really it's a book) contains more than 175 weed drawings. Copies of this complete handbook of weeds are available for 75 cents plus 15 cents postage from: Bookstore, University of Minnesota, Institute of Agriculture, St. Paul 1.

Single copies of bulletins other than the weed bulletin are free. They may be obtained from: Bulletin Room, University of Minnesota, Institute of Agriculture, St. Paul 1.

Testing Fertility in Bulls

J. N. CUMMINGS

A PORTABLE APPARATUS developed by a Cambridge, England, professor may well help Minnesota artificial breeding associations to test bull semen for fertility rapidly in their routine operations.

Tests for measuring fertility in bulls used for artificial breeding have been completed by the University's Animal Husbandry Department in cooperation with the Herd Improvement Division of Land O'Lakes Creameries, Inc.

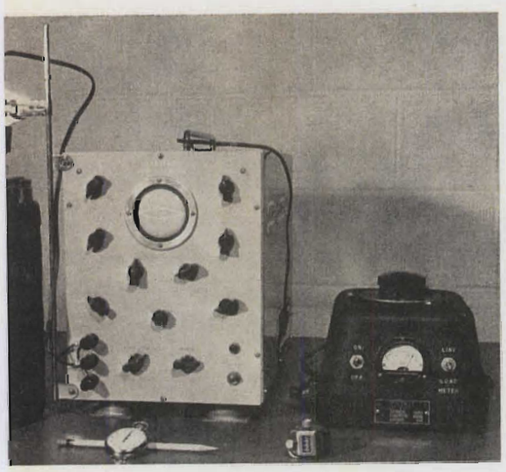


Fig. 1. Equipment used to measure rate of impedance changes in bull semen.

During the past two years analyses were made on 598 semen samples from 56 bulls. The same semen was then distributed to field technicians and used to breed 35,545 dairy cows throughout Minnesota, North Dakota, and parts of Wisconsin. As a result it was possible to determine how well the breeding efficiency of each bull tested could be measured before his semen was used.

The bulls selected for this study were of varying ranges of fertility and do not represent a cross-section of the stud owned by the cooperator.

Rate of Impedence Changes in Semen as a Measure of Fertility

Lord J. Rothschild of the University of Cambridge has develepod a method of measuring motility of spermatozoa in bull and ram semen based on the observation that semen of relatively high sperm concentration, when active, exhibits well-defined periodic changes in electrical impedance. This technique eliminates the error due to human judgment that is found in microscopic examinations.

The portable apparatus obtained from Cambridge, England, consists of a conventional alternating current bridge, energized by a 5 KC. oscillator. The unknown arm of the bridge is formed by a pair of platinized platinum electrodes which are immersed in the fresh undiluted semen sample.

A small amount of semen is placed in a vial. This vial is held in a thermos flask which keeps the semen at body temperature. A small alternating current is then passed through the semen between the electrodes. Then the machine records the reactions on a small oscilloscope, which is similar to a TV screen. The reading indicates the fertility of the bull's semen.

The equipment used is shown in figure 1. No injurious effects to the semen were observed, and the whole ejaculate could be used for testing without any waste. The test requires only three to four minutes per sample.

The study showed that this method was the most practical one yet devised for the rapid appraisal of bull semen in the routine operations of an artificial breeding association. The relationship between breeding efficiency and rate of impedance changes in freshly ejaculated semen is presented in figure 2A. Breeding efficiencies have been expressed as percentages of nonreturns on the 30-60 day basis and 60-90 day basis, i.e., the percentage of the total number of cows bred for the first time with that particular semen that did not return for rebreeding within 30-60 days or 60-90 days.

The 60-90 day nonreturn rate increased from about 47 per cent with an impedance rate of zero to 65 per cent at an impedance rate of 70. At this point no further increase in breeding efficiency occurred with further increases in rate of impedance changes. The 30-60 day curve was about 5 to 6 per cent higher.

It is possible that the reason the curves leveled out at the 65 per cent fertility level is that variations in fertility in the cows themselves tended to block the expression of higher fertility in the bulls. Or perhaps additional information is needed on the semen in order to predict the high fertility rates.

Other Laboratory Tests

Five additional semen tests were run simultaneously on the same semen samples. These included: (1) motility

J. N. Cummings is associate professor of animal husbandry.

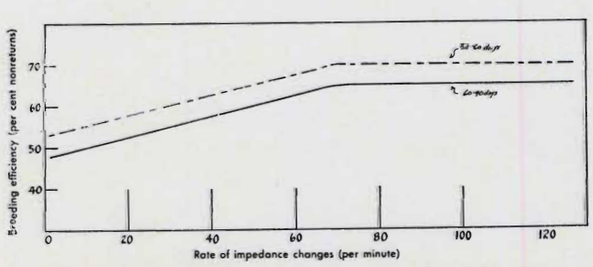


Fig. 2A. Relationship between rate of impedance changes in bull semen and breeding efficiency on 35,545 first services.

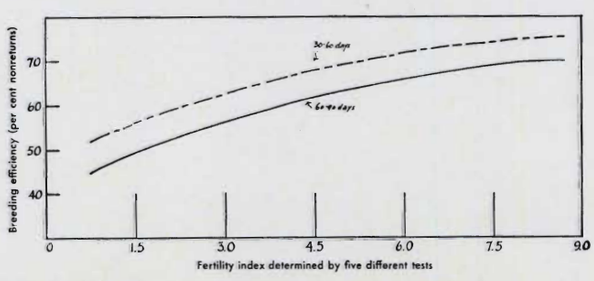


Fig. 2B. The relationship between a fertility index based on five laboratory tests and breeding efficiency of the same semen.

of the spermatozoa after 24 hours' storage using a phase contrast microscope, (2) concentration of sperm cells in the whole semen, (3) respiration rate (rate of oxygen utilization) per unit volume of semen after 24 hours' storage, (4) proportion of live and dead sperm after 24 hours' storage as determined by a vital staining technique, and (5) content of morphologically abnormal sperm.

Motility ratings by microscopic examination on the stored semen gave fairly good results. They were all made by one person, and therefore, may not be as repeatable as the evaluation of motility by the electrical method when done by several different people. Figure 3 shows fresh live bull sperm cells using the phase microscope.

Fig. 3. Fresh live bull spermatoza as seen in a phase microscope.

Respiration rates and the determination of the percentage of live spermatozoa were not as useful in measuring the fertilizing capacity of bull semen as either of the above two testing procedures. Sperm concentration and content of abnormal sperm were both of very little value when used by themselves. When the results of five of the tests were incorporated into a fertility index, a very good relationship between semen quality and breeding efficiency was established (figure 2B).

This index included all ranges of fertility observed. However, its determination involves considerable time and laboratory equipment and therefore cannot be used for day-to-day testing. It would be useful for periodic checking on a bull or as a means of accurately measuring his fertility level before entering an artificial breeding stud.

Response of Flax Varieties to Herbicides

R. S. DUNHAM AND J. O. CULBERTSON

FUTURE descriptions of new flax varieties will include their response to herbicides. The growing use of growth-regulator herbicides makes this information equally as important to the farmer as disease reaction, agronomic characters, and traits of quality.

It will take the same careful testing over a period of years to determine reaction to herbicides as it has for other varietal properties. Spraying trials were begun this year at St. Paul with 23 varieties or new strains of flax that were being tested in the usual way.

The development of new varieties is an important part of any crop improvement program. And testing these varieties is an important step in their development. Testing trials aid the plant breeder in his selection of material and also provide the information for a description of a variety after it has been released to farmers.

Pick up any folder on new varieties and you will find a detailed account of the yield, strength of straw, maturity, disease reaction, and commercial quality of each. These data are the result of carefully conducted tests.

Grown in rod rows and drill plots, these varieties are observed for their yield and agronomic characters. Grown in disease nurseries and under disease epidemics in the greenhouse, they are classified for susceptibility or resistance to the attacks of various pathogens. Subjected to milling, malting, and oil tests, they are rated for commercial value. These facts make up the descriptive history that accompanies the release of each new variety to help the farmer make an intelligent choice for his situation.

R. S. Dunham is professor of agronomy and plant genetics and J. O. Culbertson is senior agronomist with the U. S. Department of Agriculture.

Differ in Response to Herbicides

We think that the response of varieties to herbicides also should be included in these descriptions as rapidly as reliable information can be obtained. That there are varietal differences in response to 2,4-D has been demonstrated in flax, corn, oats, barley, and sorghum.

In some crops, these differences have been considerable. For instance in flax, Redwing has shown no injury from four times the amount of herbicide that reduced yields of Crystal and B5128. Similar or even larger differences exist in corn. Mindo has proved particularly susceptible among oats varieties.

The response of crops to 2,4-D is known to be affected by environment and it may be difficult in many field trials to separate environmental factors from those of genetic origin. Recently, however, a study in Minnesota has shown that varietal response in flax is genetically controlled and can be transmitted according to the laws of heredity.

Furthermore, progenies of flax sprayed each year through four generations and progenies of flax never sprayed have been maintained at University Farm. Spraying both progenies with 2,4-D in the test year has shown no visible change in plant characters due to this continued treatment nor has the sprayed progeny shown any accumulated tolerance or susceptibility to the herbicide.

Test Flax Strains

Knowing that varietal response is genetically controlled and that it has not been modified by continued spraying, we cooperated in a comprehensive test of flax varieties and strains this year. Seven varieties and sixteen numbered strains that had been selected for inclusion in a uniform regional nursery trial were used.

Each selection was sown in rod-row plots replicated three times. Half of each plot was sprayed and the other was left unsprayed. Weeds were controlled on all plots by hand cultivation so that the effect of the herbicide on the flax could be measured. Since MCP has been found to be preferable to 2,4-D for flax, the amine salt of this formulation was used at 4 ounces per acre.

Comparative data for the sprayed and unsprayed plot of each selection were obtained for date of first bloom, date of full bloom, height, lodging, pasmo, weight per bushel, and yield of flax seed. Just as in the case of yield trials, more than a single year's data are needed before it is possible to determine the effect of an herbicide upon a flax variety. It is planned to continue these trials on all breeding material considered promising enough for test.

The response of each strain will be considered in the breeding program to be of similar importance with other agronomic, disease, and quality characters. When a new variety is released, its reaction to MCP will be included as an integral part of its description.

What about . . .

Hybrid Vegetables?

A. E. HUTCHINS AND T. M. CURRENCE

HYBRID VEGETABLES are gaining in popularity. Although their development has been slower than in field corn, a partial survey of seed catalogs shows that hybrids are available in asparagus, cabbage, cucumber, eggplant, onion, pepper, squash, sweet corn, popcorn, tomato, and watermelon and more are being introduced each year.

What Is a Hybrid?

Hybrid, as used here, is the first generation (F_1) offspring of a cross between two inbred lines or varieties which often differ widely in their characteristics. A hybrid is just as definite in its traits as a variety. However, it does not reproduce itself and seed from it produces plants which may range in their characteristics from those of one parent to those of the other.

A hybrid's chief value lies in the production of a single harvest and it usually is not desirable to save seed from a hybrid for planting. However, the increase in yield obtained in an F_1 hybrid is partly retained by its offspring (F_2). Such F_2 plants are used occasionally, in tomatoes for example, when the edible part of the F_2 plants does not differ markedly from the F_1 hybrids.

Advantages of Hybrids

If the proper hybrid is used, the grower can expect considerable increase in yield over standard varieties. Hybrids have increased corn yields about 20 per cent on an average. Similar increases can be obtained by the use of hybrids in many vegetable crops. In investigations conducted at the Minnesota Agricultural Experiment Station, hybrids have been obtained which yielded 22 per cent more in tomatoes, 26 per cent more in squash, and 31 per cent more in slicing cucumbers than the highest yielding varieties in the tests.

Hybrids tend to be more uniform than standard varieties in maturity, plant size, fruit size, and fruit shape or type. Some hybrids are resistant to diseases or insects to which many standard varieties are susceptible. Other advantages could be cited but these are sufficient to indicate the reason why hybrids are here to stay.

Use Hybrids Wisely

All hybrids are not good hybrids for every gardener. Adaptation is as important in hybrids as it is in varieties. Hybrids that produce well under certain growing conditions may be poorer than standard varieties when grown in this area. Until their merits are proved in the locality, grow new hybrids on a trial basis in comparison with proved varieties. Hybrids are potentially vigorous and highly yielding, but if fertility, moisture, climatic, and cultural conditions are sufficient only to produce a small crop, the hybrid cannot perform the miracle of overcoming these conditions.

Cost of Hybrid Seed

One frequent objection to the use of hybrids is that the price of the seed is high. Although hybrid seed usually is higher than that of standard varieties, the extra returns obtained by growing the proper hybrids usually more than offset the additional cost. Development of improved techniques, including discovery and utilization of male sterility, has reduced the cost in some cases and promises lower costs in others in the future.

Why is the cost high? The answer lies in the years of effort that go into the development of hybrids before they are ready for introduction and in the extra effort and diligence required to maintain good commercial seed of the hybrid.

Production of Hybrids

In sweet corn, for example, inbred lines must be developed by at least five years of careful selection and inbreeding. During inbreeding, all pollination is done by hand. Countless plants are discarded for each one selected and perpetuated.

When suitable inbred lines become available, it doesn't mean that a cross between any two inbred lines produces a suitable hybrid. Some crosses produce poor hybrids, others very good. So crosses of inbred lines in various combinations are made and hybrids derived from these are tested under field conditions to determine which ones give best results. This requires several years more and again pollination is done by hand.

Cross pollinating tomato blossoms in the greenhouse to produce hybrid tomato seed.

A. E. Hutchins is associate professor and T. M. Currence is professor of horticulture.

Inbred lines, found by these tests to have the ability when crossed to produce desirable commercial hybrids, are usually maintained in sufficient quantities to furnish foundation stock by continued inbreeding and sib-pollination.

To this point, no seed for commercial use has been produced. In commercial production of hybrid sweet corn seed, the following procedure often is used: One inbred line is designated the male parent; another, the female parent. A plot isolated a considerable distance from any other corn field is selected for the production of commercial hybrid seed. Several rows of the female or seed plants are planted; then one row of the male parent; then several rows of the female parent; and so on throughout the field.

When the plants have reached the stage when tassels are well formed, but before pollen begins to shed, the tassels are removed from the female parent and allowed to remain on the male parent. This insures cross-pollination of the female line and seed produced by the female line will be hybridized and used to produce the grower's crop of hybrid corn.

Vine Crop Hybrids

Squash and cucumbers are similar to corn in that they have separate male and female flowers on the same plant. However, instead of having all male flowers grouped in one inflorescence and very few female flowers, vine crops have many male and female flowers widely dispersed over the whole plant. All male flowers of corn can be removed over a period of a few days, but flowers of vine crops are produced throughout the growing season. While the procedure in producing hybrids of vine crops is similar to that used in corn, these two features increase the difficulty and expense of producing hybrid seed for vine crops.

Other Hybrids

Production of tomato, pepper, and eggplant hybrids is somewhat more complex than is the production of corn, squash, or cucumber hybrids. These crops are self-pollinated and varieties are naturally inbred and correspond to inbred lines of corn. In contrast to corn and vine crops, the male and female parts of the plant are produced in the same flower.

In crossing, the anthers or male portion of the flower must be removed previous to opening of the flower on plants that are to be used as the female parent. Pollen that is produced by flowers on the plant to be used as the male parent is then applied to the stigma or female part of the flower from which the anthers have been removed.

Hybrid seed must be produced by hand-pollination. Since the plant on which crosses are made produces many flowers and fruits throughout the season, all of which obviously cannot be hand-pollinated, each hand-pollinated flower must be tagged to identify the cross-pollinated fruit so that seed will be collected from those fruits only.

Recent Minnesota Vegetable Hybrids

Considerable research has been carried on by the Department of Horticulture of the Minnesota Agricultural Experiment Station with vegetable crops in development of breeding techniques, production of inbred lines, and testing of hybrids, and much more needs to be done if hybrids are to be used to their fullest advantage in vegetable production. Some of our comparative testing and introduction of new hybrids has been conducted in cooperation with the Farmer Seed and Nursery Co., Faribault, Minnesota. Here are some of the hybrids developed through this research:

F_1 Asparagus—An outstanding male plant, designated 3-9, produced vigorous, high yielding progenies in a number of tests. It has been released to a seed company and multiplied by crown divisions. Resulting clones are used to pollinate selected female plants from a variety of different origin. This cross is now on the market designated as F_1 asparagus. A three-year-old planting indicates that it has greater vigor than either the Washington or Paradise varieties.

Hybrid C Cucumber—Early slicer. Vigorous. Fruits 6-9 inches long, fairly slender, straight, symmetrical shape, blunt ends, smooth, medium green. Spines white. Flesh firm, fine grained, thick, white, crisp. Seed cavity medium. Good pickler when small. Heavy early yield maintained throughout the picking season. Appears resistant to mosaic.

Hybrid D Cucumber — Midseason slicer. Later then Hybrid C. Vigorous. Fruits 8-10 inches long, fairly slender, straight, symmetrical, fairly blunt ends, very smooth, practically spineless, dark green. Spines white. Flesh firm, fine grained, thick, white. Seed cavity small. Heavy yield.

Hybrid R Squash—Early. Vigorous. Fruits round-flat, 4-6 pounds, uniform shape, orange color (sometimes small patch of green at blossom end). Skin smooth. Rind thin, very hard. Long keeper. Flesh thick, fine grained, dry, sweet, good flavor, orange colored. Heavy yield. Cucurbita maxima.

Female (left) and male (right) squash flowers on the same plant tied up to prevent pollination by insects preceding hand or controlled pollination.

F_1 Hybrid Pepper—Early. Fruit medium size, about 3½ inches long x 2¾ wide on an average, average weight 0.2-0.3 pounds, shapely, fairly smooth, glossy green turning red when ripe. Flesh firm, fine grained, fairly thick, mild. Matures in season with Harris Earliest but fruits and yields in pounds per plant are larger. High yield. Good for salads, stuffing, baking.

Hybrid E Tomato—This is the cross of the varieties Pritchard by Earliana which was tested and recommended by the Minnesota Agricultural Experiment Station. Large amounts of the seed has been sold by a local company. Outstanding characteristics of the cross are excellent yield, early ripening, and fruit size equal to the Earliana parent. A comparative test in 1953 showed Hybrid E producing a crop valued at 33 cents per plant more than the per plant value of the best variety in the test. There are many problems related to the production of hybrid tomato seeds but the above increase seems to justify attention to them.

Is Youth Rejecting the Family?

CHARLES E. RAMSEY

"I NO LONGER speak of juvenile delinquents; I speak of derelict parents." This statement by a policeman reflects the present belief that juvenile delinquency may be, at least in part, parental delinquency.

An increasing concern over the relationships between parents and their children has been developing in recent years. The depression of the 1930's brought a flood of studies of family problems including children's attitudes toward their parents. And the postwar years have further shown the relationships between parents and children have implications for many of our present social problems.

Although rural delinquency rates are still lower than urban rates, the rural rates have been increasing at a more rapid rate. Insofar as delinquency is caused by difficulties in parent-child relationships, this increase in delinquency means that these relationships are becoming more strained and that perhaps youth is rejecting the bonds of the family. This is consistent with a theory held for many years by social scientists that the intimacy and affection as well as effective discipline have been decreasing in the rural family.

Repeat 1939 Study

Most of the theories connected with changes in parent-child relationships are based on personal observation and impressions with a lack of scientific data. Fortunately, a study of attitudes of youth toward the family was done by a member of the Rural Sociology Department in 1939, and by repeating this study in 1952 it was possible to obtain comparative data on the attitudes of youth toward the family.

The 1939 study was made by Howard Forsythe of the Department of Rural Sociology, and he employed the Minnesota Scale for the Survey of Opinions in obtaining information regarding the attitudes which rural youth in and around Mora held toward various institutions. The Minnesota Scale for the Survey of Opinions consists of 132 questions of favorable or unfavorable attitudes toward the family, law, education, and economic institutions, and questions on morale and inferiority feeling. The specific questions presented in figure 3 are examples of the types of questions included in the whole scale.

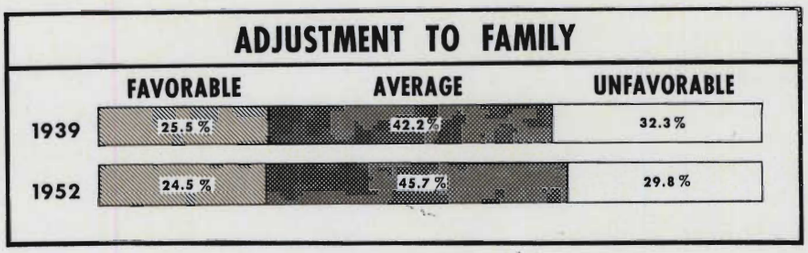


Fig. 1.

This scale was given to all of the juniors and seniors in high school in Mora in 1939 and their total scores as favorable or unfavorable were tabulated. In 1952 this procedure was repeated exactly as Forsythe did it in 1939, thus testing the theory that adolescent attitudes toward the family are becoming less favorable.

The theory was tested for six types of family attitudes:

1. **General adjustment to the family.**
2. **Sense of agreement between parents and child on ideals.**
3. **Home as a pleasant place to spend one's time.**
4. **Feeling that parents expect too much from their children.**
5. **Intimacy—willingness to exchange confidences with parents.**
6. **Sense of obligation to the family.**

The Results

According to the theory described in the first few paragraphs, attitudes such as those described above should be less favorable among the 1952 juniors and seniors than among those studied in 1939. But the results showed no changes in any of the six types of attitudes as reflected in differences between the earlier and the later groups. The general adjustment to the family was the same in 1952 as in 1939, and the same held for sense of agreement, pleasantness of the home, feeling that parents expect too much from their children, and intimacy. There was a very slight decrease in the sense of obligation to the family.

From this it would appear to be safe to say that the theory does not hold for Mora as one example rural area in the time from 1939 to 1952. Although the results cannot be generalized safely to all rural areas, the fact that no changes were found in Mora does throw doubt on the notion that adolescents are rejecting the family.

There is a higher proportion of boys in high school now than was so in 1939. Since boys and girls may differ in their attitudes we wondered if the increase in proportion of 16- and 17-year-old boys in school might hide any changes that actually did occur in attitudes toward the family. Thus the comparisons of attitude described above were made between the girls of 1939 and 1952 and

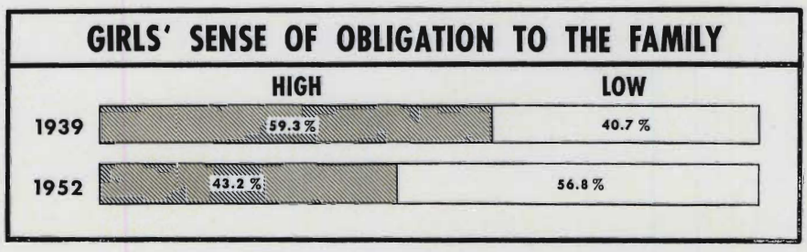


Fig. 2.

Charles E. Ramsey is assistant professor of rural sociology.

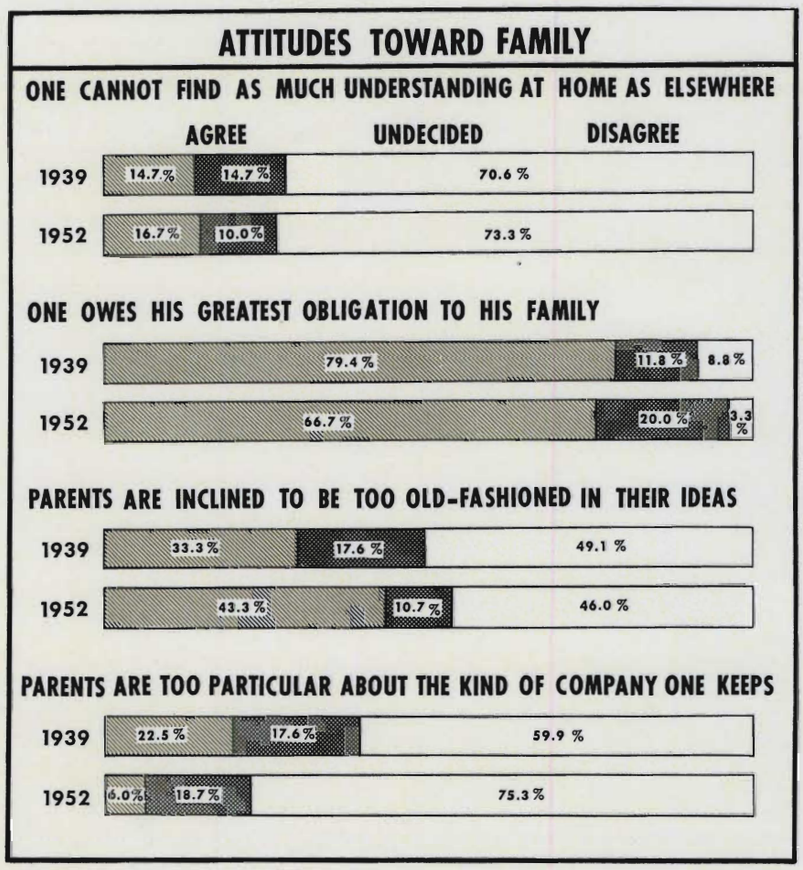


Fig. 3.

again between the boys of 1939 and 1952.

Again there were no changes for either sex with one exception— the girls had decreased somewhat in their sense of obligation to the family (see figure 2).

Since sense of obligation to the family includes such factors as willingness to accept the obligation of care for the aged and dependent, this decrease may be more a matter of adjustment to the society than maladjustment to the family, since private business and the government have developed many pension and insurance plans to provide for retirement and misfortune.

Further interest in the changes led to comparisons of farm children in high school in the two years studied and separate comparisons of nonfarm children. In neither of these two groups were any changes observed in the six types of attitudes toward the family.

Specific Questions

While the study of change, or lack of it, in the six types of attitudes toward the family were based on 22 questions, it may be of interest to see how the juniors and seniors responded to particular questions making up the scale studied. These specific questions are presented in figure 3. There are some differences between the two groups on some of the individual questions but these are mainly chance fluctuations.

Conclusions

We would like to speculate briefly on the possible explanation of the results of the study, since they were contrary to expectations in general belief. Among other factors previously mentioned, the high rate of divorce and separation during this period led many students and other observers to regard the American family as notably unstable, especially the family in the urban environment.

Our first suggestion is that the family is achieving a successful adaptation to urban influences; that whatever changes may take place in other family functions, the basic loyalties and obligations of members to each other are not measureably affected.

The second explanation is that the age group included in this sample is not influenced in attitudes by changes in social climate; their lives are sheltered from the forces which play upon the adults whose responsibilities are such that changes in the economic and social order are immediately reflected in changes in their attitudes. This was verified by the fact that in the other scales of adjustment included in the two studies, the adults in Mora in 1952 were considerably more favorable to the economic, legal, and educational institutions, as well as the family and were higher on morale and had less inferioriy feelings than in 1939. The juniors and seniors in high school changed on none of these factors over the time period studied with the exception of attitudes toward economic institutions. In this case they were considerably more favorable in 1952 than 1939.

Certainly the alarms sounded from press, lectern, and pulpit about the problems of the family have little or no effect in discouraging the youth from entering matrimony. More of them are marrying than ever before and doing so at younger ages, apparently undeterred by the much discussed uncertainties of married life.

Quick Bread Mix . . .

(Continued from page 5)

stirring as posible. Fill the muffin pans two-thirds full. Bake in a hot oven (425° F) until the crusts are a golden brown color, about 20 minutes. This recipe yields about 8 average-size muffins, 2½ inches in diameter.

Baking Powder Biscuits

Quick bread mix	2 cups
Water or milk	½ cup

Place the quick bread mix in a 2-quart mixing bowl. Add water or milk all at once and stir quickly and vigorously until all the dry ingredients are dampened. Continue stirring for approximately 10 seconds or until the dough thickens. Turn onto a lightly floured board and knead gently about 20 seconds (10-12 strokes), then roll to a thickness of ½ inch. Cut with a floured cutter and place on an ungreased baking sheet. Bake in a hot oven (425° F.) until the crusts are a golden brown color, about 12 to 15 minutes. This recipe yields 8-10 biscuits, 1¾ inches in diameter.

How Serious Is

Heat Damage to Protein Foods and Feeds?

IRVIN E. LIENER

HEAT used in processing has an effect on the protein value of some of the foods we eat and the feeds we give to animals. Sometimes this effect is good, but in some foods it cuts down the nutritive value of the protein.

To understand how the nutritive value of protein is affected by heat, let's review briefly how our bodies use protein. First our bodies must digest the protein of the food into amino acids. After absorption from the intestine, these amino acids are then reassembled into proteins used in building body tissue.

Digestion of protein takes place in the intestines through the action of substances called enzymes. Failure to provide the amino acids will obviously cause a break in the chain leading to the build-up of body protein. This effect is readily demonstrated by the failure of rats, chicks, and other experimental animals to grow at a normal rate when some amino acids are lacking in the diet.

With these simple concepts in mind, we can examine a few of the more commonly used processed foods to see in what way their protein value may be affected by heat.

Foods

Milk—Milk is generally subjected to some degree of heat treatment such as involved in pasteurization, evaporation, condensation, or drying. Usually the amount of heat applied in such processes is not enough to cause a significant loss in the nutritive value of the milk proteins. However, when the heat treatment has not been carefully controlled, such as allowing roller dried milk powder to become scorched, appreciable damage to the protein may result.

In such instances the damage is produced by a reaction between the milk protein and the milk sugar. As a consequence of this interaction one of the amino acids called lysine can no longer be set free from the milk protein by the digestive enzymes of the body. With this amino acid no longer available, the build-up of body protein is interfered with and the growth of the young animals is therefore below normal. Storage of dried milk powder for several years at room temperature leads to similar changes in nutritive value, because the reactions between milk sugar and milk proteins also take place slowly at low temperatures.

Breakfast cereals — Many breakfast cereals are subjected to extreme heat treatment such as toasting, flaking, and puffing. Experimental animals such as rats grow very poorly with such foods as the sole source of protein. Here again the unavailability of the amino acid lysine is believed to be responsible for this effect.

But, unlike the diets fed to rats, breakfast cereals are generally served with milk for human consumption. And the milk, unless also subjected to excessive heat treatment, provides sufficient lysine to compensate for the decreased availability of this amino acid from the cereal protein.

Meat—Home-cooking methods of preparing meat dishes such as broiling, roasting, and frying do not seem to cut down the nutritive properties of meat protein. In fact, except for milk and cereal proteins already mentioned, most foods prepared by home cooking or commercial processing suffer little damage to the nutritive properties of the protein which they contain.

Even if severe heat damage were to occur, its practical nutritional significance would not be very great because the average American diet includes such a wide variety of proteins that an amino acid deficiency caused by heat in one protein would be readily corrected by the undamaged proteins.

Feeds

Proteins of vegetable origin play the most prominent role in the formulation of feeds for farm animals. Many of these proteins such as those in soybean, cottonseed, and peanut oil meals are by-products of various processes designed for the removal of oils from these plants. The application of heat to a varying degree is involved in such processes, and hence some alteration in the nutritive properties of the protein might be expected.

Soybeans—Peculiarly enough, **moderate** heat has been found to improve the nutritional value of soybean protein. The heat seems to destroy a substance in the raw meal which inactivates trypsin, one of the important enzymes involved in the digestion of protein in the animal body. This trypsin inhibitor, unless destroyed by heat, does not permit trypsin to liberate one of the essential amino acids called methionine from the soybean protein. Poor growth is the natural consequence of such an amino acid deficiency.

As with other plant proteins, however, **excessive** heat treatment may damage the lysine in the soybean protein. The processing of soybean oil meal must therefore be carefully controlled in order to insure most effcient utilization of soybean protein by the farm animal.

Cottonseed meals — Although a certain amount of heat is necessary to inactivate a toxic substance called gossypol in cottonseed meal, too much heat damages its nutritive value.

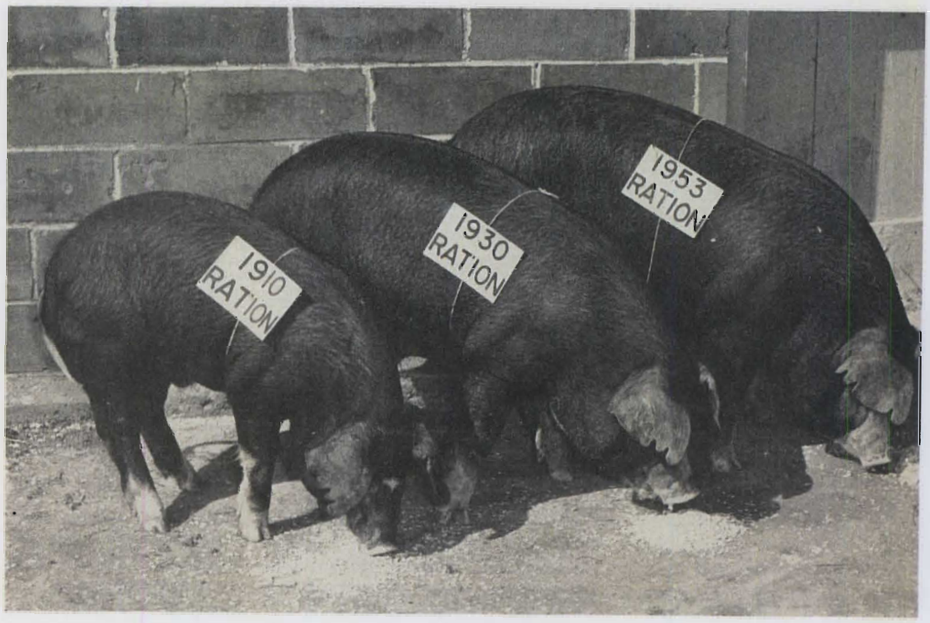
Peanut and sunflower meal — Other meals such as peanut and sunflower seed undergo a depression in protein value in proportion to the severity of heat treatment used during processing. In these cases heat damage to the protein is again connected with a lysine deficiency caused by interaction of the protein with the sugars present in the crude meal.

In contrast to man who usually consumes a variety of proteins from many different foods, the animal is often restricted to proteins coming from only a few sources. Therefore underheated or overheated protein supplements may seriously reduce the nutritional efficiency of animal feeds and thus cause economic losses to the farmer.

Most feed manufacturers are, of course, very much aware of the importance of scientifically controlled heat treatment, and, through extensive laboratory testing, make every effort to produce feeds of the highest nutritional value. In general, the farmer may be reasonably certain that feeds obtained from a reliable feed manufacturer have been processed under conditions which result in a product of high nutritional quality.

Irvin E. Liener is associate professor of agricultural biochemistry.

Modern Hog Rations PAY



You Can Save $14 in Feed Per Pig Over Old Rations

A simple but spectacular demonstration last summer showed the value of feeding modern swine rations and emphasized how important research has been to the hog industry.

This demonstration was carried on by L. E. Hanson, professor of animal husbandry at the University of Minnesota.

It was started May 28 when Hanson placed one pig from each of six litters on a 1910 ration; another on a typical 1930 ration; and a third group on a 1953 ration.

The pigs had just been weaned and averaged 51 pounds each. Except for the rations, they all received the same care. After 2½ months the results were amazing (see picture above). After 3½ months (see chart at right), the modern ration's advantages were even more marked.

On September 9, the 1953-fed pigs weighed 242 pounds; the 1930-fed pigs, 161 pounds; and the 1910-fed pigs a scrawny 118 pounds. And the modern ration took much less feed per 100 pounds gain, too.

That's not the entire story. Additional proof that shifting from old-fashioned to modern up-to-date hog rations often means an almost overnight speedup in gains and drop in costs came later.

On October 20 the hogs on the 1910 rations, all of which were lagging in gains, were shifted to 1953 rations. Before the shift, these pigs were gaining about one-third pound per day, were eating 3 pounds of feed per day, and were averaging 870 pounds of feed per 100 pounds gain.

After the shift, they gained nearly 2 pounds per day, ate 6.6 pounds of feed, and were taking only 335 pounds of feed per 100 pounds gain.

Record of Pigs Fed 1910 Ration up to October 20 and then Fed the 1953 Ration to 200 Pounds

	Results on 1910 ration (Sept. 19 to Oct. 20)	Results on 1953 ration (Oct. 20 to Nov. 24)
Average daily gain (pounds)	0.34	1.96
Average daily feed (pounds)	3.00	6.60
Feed per 100 pounds gain	870	335

Here's what the rations included:

1910 Ration—97 per cent corn and 3 per cent complex minerals plus vitamins A and D, self-fed.

1930 Ration—1910 ration plus tankage.

1953 Ration—Corn plus a modern complete supplement including soybean oil meal, tankage, linseed meal, alfalfa meal, steamed bone meal, trace mineralized salt, B-complex, and traces of B_{12} and antibiotics. This ration was self-fed.

RATION FED	AVERAGE DAILY GAINS (in pounds)	FEED PER 100 POUNDS GAIN		
		CORN (in bushels)	TANKAGE AND MINERAL (in pounds)	SUPPLEMENT (in pounds)
FROM WEANING (51 POUNDS) TO 125 POUNDS AVERAGE WEIGHT				
1910	0.64	9.1	(mineral only) 16	
1930	0.96	5.7	44	
1953	1.70	4.3		59
FROM 125 POUNDS TO 200 POUNDS (1910 RATION) AND 200 POUNDS (1930 AND 1953 RATIONS)				
1910	0.34	15.1	(mineral only) 26	
1930	1.63	6.8	27	
1953	1.92	6.1		45
FROM WEANING (51 POUNDS) TO 200 POUNDS AVERAGE WEIGHT				
1910	0.45*	12.1*	(mineral only) 21	
1930	1.20	6.3	35	
1953	1.81	5.2		52

* Estimate based on record to October 20.

RENVILLE—*A New Soybean Variety*

J. W. LAMBERT

THE NEW SOYBEAN variety Renville is the product of a team that extends from Maryland to North Dakota and from Louisiana to Michigan. The team consists of a group of soybean workers located at various places in the country but coordinated under the United States Regional Soybean Laboratory at Urbana, Illinois.

The specific problems in each state are attacked as the workers located therein see fit. However, workers from all the locations meet periodically at the laboratory to exchange ideas and breeding materials and to plan their cooperative testing programs that are so important in regional recommendations. Moreover, the laboratory with its corps of geneticists, physiologists, plant pathologists, and chemists is in a position to attack problems of a fundamental nature which are common to workers in all regions.

The breeding of Renville illustrates clearly the operation of the coordinated team. Closely paralleling this is the story of the new variety Clark which has the same parentage as Renville but is recommended for parts of the central corn belt. Other older varieties such as Lincoln, Hawkeye, and Blackhawk have also come from the cooperative program.

Back in 1941 at Ames, Iowa, a new promising selection, later named Lincoln, was crossed with the widely-grown variety Richland. During the following winter at the Urbana Laboratory, the new cross was backcrossed to the parent Lincoln. About 700 plants of the first backcross generation were grown at Urbana in 1942. Progeny rows of these 700 plants were planted at Urbana in 1943. A large number of plant selections of various maturities were made in these plant rows.

Seeds of several hundred of the earliest of these plants were sent to the Minnesota Agricultural Experiment Station where in 1944 a corresponding number of progeny rows were planted. Again plant selections were made within the most desirable progenies and were in turn planted in rows in 1945.

It was one of these rows, three selfed generations removed from the backcross, that became the basis for the new variety Renville. The seed from this row was planted in preliminary yield trials in 1946. In 1947 the new selection appeared in the Group I Preliminary Regional Trial and in other trials at St. Paul, Waseca, and Morris. From that time it has been in the regional testing program and in most of the yield trials in Minnesota.

From 14 pounds of seed in the spring of 1952 when the selection was named Renville, the supply was built up to well over 500 bushels in the fall of 1953. This has been allotted to counties in the maturity zones where Renville is adapted. It has been apportioned there to qualified registered seed growers for the next build up of seed to be made available to certified seed producers for planting in 1955.

As a part of the cooperative effort in varietal improvement, the Regional Soybean Laboratory provides chemical evaluations of new and promising strains selected. From the very first assay it became apparent that Renville was superior in oil content. Through years of testing it has been unexcelled by any varieties compared with it.

Renville has a good yield record as indicated in the accompanying table. It matures about midway between Ottawa Mandarin and Blackhawk, hence is recommended in the southern, south central, and central corn zones. It has excellent standing ability, and grows slightly taller than Ottawa Mandarin. The seeds are of medium size and are yellow with a light brown seed scar. The pubescence or hairiness of the stems and pods is gray in color.

Yields in Bushels per Acre of Renville and Other Soybean Varieties at Several Locations in Minnesota in 1950-53

Variety	Blue Earth	Morris	St. Paul	Southwestern Minnesota	Waseca
Blackhawk	36.7	25.8	25.5	25.8	32.5
Capital	35.4	30.4	—	.....	34.0
Flambeau	—	30.2	—	—	—
Habaro	39.2	26.7	—	24.7	33.1
Monroe	—	—	24.4	—	30.9
Ottawa Mandarin	35.7	27.8	26.3	22.2	33.4
Renville	39.3	29.2	34.5	24.6	33.4

In This Issue

J. W. Lambert is associate professor of agronomy and plant genetics.