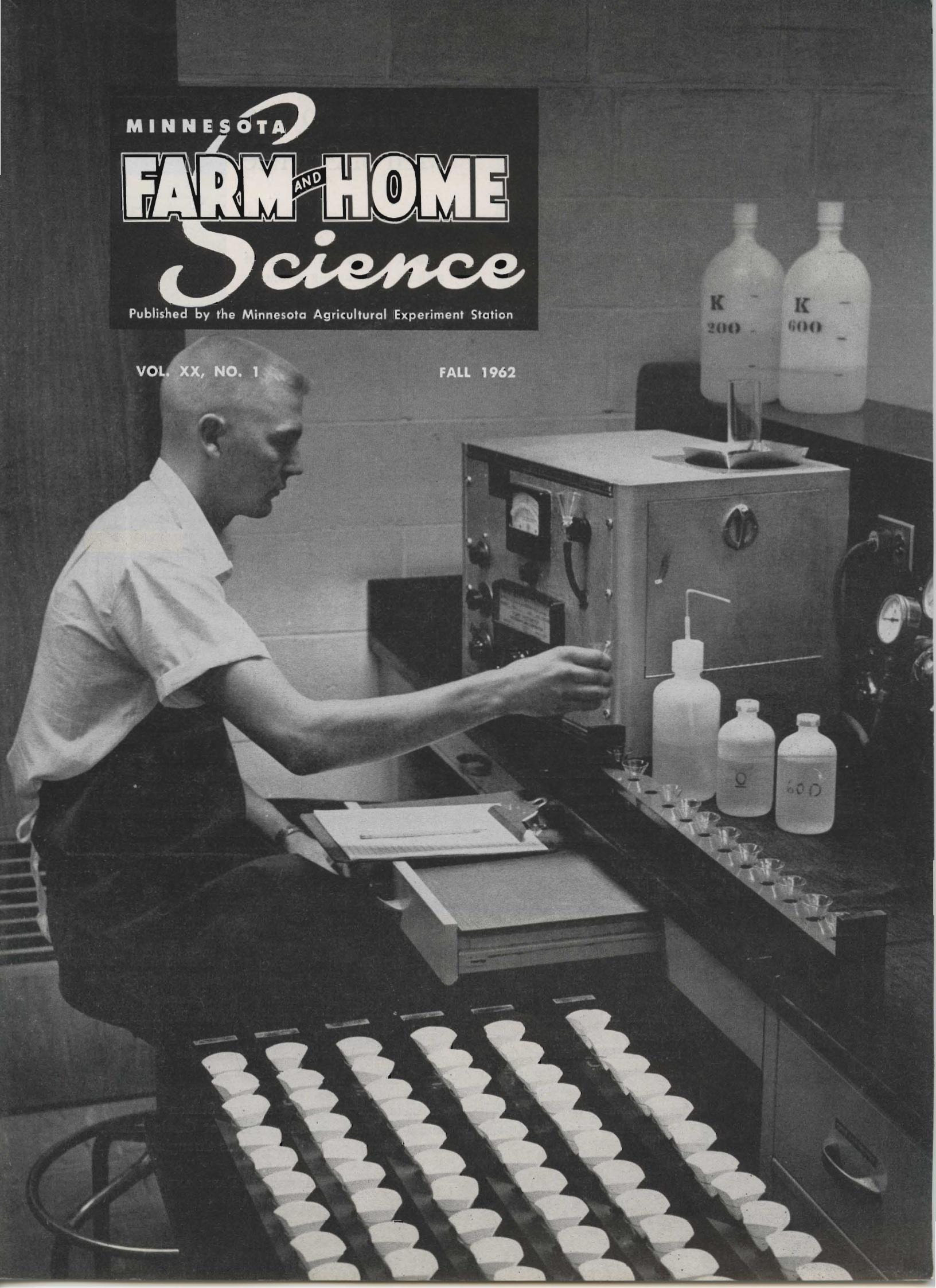
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MINNESOTA FARM AND HOME Science

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Dean of the Institute of Agriculture—H. Macy.

Fall is a busy season in the University's Soil Testing Laboratory. Donald A. Knutson, student in agricultural science and a technician in the Laboratory, uses a flame photometer to test for potassium in soil. Story, page 8.

Minnesota's Men of Science

This is the 38th in a series of articles introducing scientists of the University of Minnesota Institute of Agriculture.

WILLIAM F. HUEG, JR., was named assistant director of the University of Minnesota Agricultural Experiment Station May 16, 1962. With the director he shares responsibility for research in agriculture, forestry, home economics, and veterinary medicine.

Hueg came to Minnesota as extension agronomist in 1957. In this capacity he worked closely with county agricultural agents, farmers, and other leaders in agriculture in the improvement and management of forage crops. He worked closely with the expanding forage seed enterprise in northern Minnesota. He is particularly interested in improving quality of Minnesota forage crops.

He was born in New York State, received his B.S. degree at Cornell University in 1948, and served as assistant county agricultural agent in Herkimer County, New York from 1948 to 1950. He then moved to the State University of New York Agricultural and Technical Institute, Alfred, New York, where he was an instructor in agronomy from 1950 to 1955. During this time he served as crop supervisor of the 900-acre school farm. He also conducted field tests with corn and forage crops.

From 1955 through 1957 he was instructor of farm crops at Michigan State University. He taught undergraduate crop courses with special emphasis on training young men going into elevator and farm supply management. He conducted research in seed processing, legume seed production, and forage species competition.

Hueg was awarded his M.S. in 1954 and Ph.D. in 1959 by Michigan State University. He is a member of the American Society of Agronomy, American Grassland Council, and Sigma XI, society for the advancement of research.

All research conducted by the Minnesota Agricultural Experiment Station is coordinated in the office of the director of the Station. The Station includes the central station and research units on the St. Paul Campus; branch stations at Duluth, Grand Rapids, Crookston, Morris, Lamberton, and Waseca; the Fruit Breeding Farm and Arboretum at Excelsior; the Forest Research Center at Cloquet; the Biological and Forestry Station at Lake Itasca; the Experiment Station at Rosemount; and the Potato Breeding Farm at Castle Danger. Research also is conducted on plots throughout Minnesota.

Agricultural engineers report on . . .

Parallel Terraces for Minnesota

C. L. Larson and R. E. Machmeier

These parallel terraces cover 40 acres. Rows now will run parallel to the terrace rather than up and down hill (as in lower right now). Note outlet waterway, center.

PARALLEL TERRACES are gaining favor in corn-grain areas of Minnesota.

Contour strip cropping, a common conservation practice in the dairy area, requires half the strips in hay, a profitable crop for dairymen. Terraces are better adapted to corn-grain farms because they require less land in hay and still conserve the soil. And parallel terraces avoid the disadvantage of annoying "point rows."

Standard terraces have a constant grade throughout their length, but the spacing between adjacent terraces varies. This results in point rows which are difficult to farm and have become more of an inconvenience as the size of farm equipment has increased.

WHAT THEY ARE

Parallel terraces are the same distance apart at all or nearly all points. If the terrain is quite irregular, a 100 percent parallel system may not be possible. But in all cases the number of point rows can be greatly reduced over standard terracing.

The parallel terrace system uses a V-shaped cross section except for a rounded channel bottom and a rounded ridge, both approximately 3 feet wide. Channel and ridge slopes are built to match the width of four-row equipment. This distance is approximately 13.5 feet for 40-inch equipment.

Standard terraces have a flat bottom 6 feet wide, and a ridge height of 0.7 to 1.2 feet, depending on terrace length and spacing. Since the V-shaped channel used for parallel terracing has a narrower bottom width, ridge height must be from 0.1 to 0.2 foot greater than a standard terrace of the same length. However, parallel terraces are usually shorter so the ridge height is seldom much over 1 foot. Thus the channel sides and ridge have a gradual slope.

With the terraces spaced some even multiple of four rows, and with the proper channel dimensions, parallel terraces are custom made for four-row equipment.

LAYING THEM OUT

To lay out a system of parallel terraces, most existing waterways are used as terrace outlets. Thus you may have long terraces (and rows) made up of several sections 200 to 600 feet long. Grass should be established in each waterway used as a terrace outlet well before beginning terrace construction.

The first or key terrace is staked out with a uniform grade as with standard terraces. Average slope of the field is determined and terraces are spaced accordingly to give adequate erosion control. Table 1 gives recommended spacings as well as adjusted spacings for 40-inch rows. With a tape or rope, adjacent terraces are laid out parallel to the key terrace and at the desired spacing. Adjacent terraces are then checked with surveyor's level to determine whether they have a suitable grade toward an outlet waterway.

Grades on parallel terraces can vary considerably to help obtain parallel lines. However, if the grade along the line is excessive or if the terrace

(Continued on page 4)

C. L. Larson is an associate professor and R. E. Machmeier an instructor in the Department of Agricultural Engineering.

These standard terraces in southeastern Minnesota have a constant grade throughout their length, but spacing between adjacent terraces varies. This results in point rows which are difficult to farm and have become more of an inconvenience as the size of farm equipment has increased.

(Continued from page 3)

line dips, cutting and filling is necessary to obtain a suitable grade at all points. Maximum depth of cut depends on depth of topsoil and character of subsoil.

In a small area where parallel lines cannot be obtained without excessive cutting or filling, the terrace line must be shifted, leaving a few point rows. Fields with long slopes and irregular topography may need a second key terrace. In this case, a few point rows are necessary.

BUILDING PARALLEL TERRACES

A track-tractor and scraper are generally needed to do the cutting and filling. The remainder of the work can be done with a motor grader, as with standard terraces. If there is considerable cutting and filling, use a tractor and scraper for all construction.

An experienced motor grader operator can construct about 300 feet of standard terrace per hour. Cost of hiring a motor grader varies with locality but might be about $8 to $10 per hour. Using the last column in the table and these figures, you can estimate the cost of building standard terraces on a particular field. Parallel terraces generally cost from 20 to 50 percent more, depending on the amount of cutting and filling.

Spacing of standard and parallel terraces on various slopes

Average land slope	Standard spacing	Adjusted spacing	Number of 40-inch rows	Terrace length
percent	feet	feet		feet per acre
2	160	160	48	270
3	127	120	36	360
4	110	107	32	400
5	100	107	32	400
6	93	93	28	470
7	90	93	28	470
8	85	80	24	540
9	83	80	24	540
10	80	80	24	540

COST CAN BE AMORTIZED

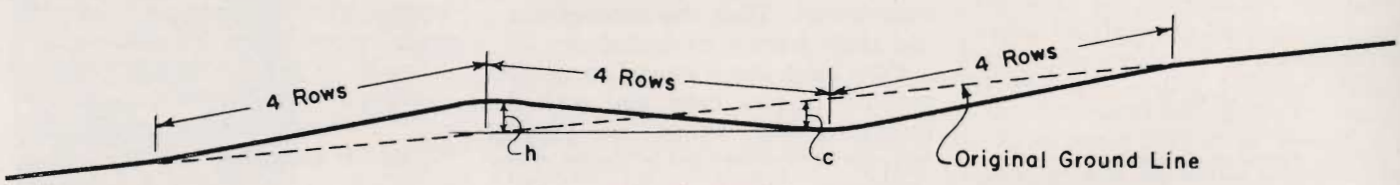
Since a terrace system is a permanent improvement, cost can be amortized over a period of years. This makes the annual cost only a few dollars per acre. Engineering and design is provided by the Soil Conservation Service through the local Soil Conservation District. Terracing also qualifies for cost sharing under the Agricultural Conservation Program.

FARMING PARALLEL TERRACES

Till and plant parallel to terraces, lifting all equipment at grass waterways. Plow to maintain the terrace shape, normally placing the backfurrow on the terrace ridge and the deadfurrow between terraces. Be careful, however, to avoid building up the terrace ridge too high.

You can plant row crops both ways from the key terrace. If terraces are spaced properly and if the proper row spacing is maintained in planting, rows will be even between terraces.

Farming operations are not difficult with parallel terraces because they virtually eliminate point rows and permit the use of four-row equipment. For these reasons parallel terraces are becoming an increasingly popular soil conservation practice.



Cross section of a parallel terrace.

Temperature trials at the Northwest School and Agricultural Experiment Station show how to

Keep Udder Wash Solution Warm

Edward C. Frederick and Conrad H. Kvamme

A WARM UDDER WASH SOLUTION is important. It helps remove foreign material and stimulates the cow's udder for proper letdown of milk. But dairymen face the problem of how to keep the solution warm most easily and conveniently.

In cooporation with herdsman Martin von Ruden, we recently conducted a temperature-controlled study with udder washcloths at the Northwest School and Experiment Station, Crookston. We wanted to determine a method of keeping individual udder washcloths between 110° and 120° F. during milking.

Four different types of pails were tested:

1. 12-quart metal pail.
2. 12-quart plastic pail.
3. 8-quart insulated pail after 6 months' use.
4. 12-quart new insulated pail.

Insulated pails had a polystyrene inner liner protected by a metal outer covering. They were purchased at a local hardware store where they were sold as minnow buckets.

Pails were tested with and without covers for temperature-holding ability at barn temperatures of 45°, 65°, and 85° F. We tested all pails at the same time under each temperature condition. Two gallons of an iodophor-sanitizing solution and 20 12 x 14-inch terry cloth udder washcloths were placed in each pail. Starting temperature of the solution in each pail was adjusted to 120° F. and temperature was recorded at 3-minute intervals for 1 hour. We removed one udder washcloth after each temperature reading.

Each trial was conducted twice in order to verify results.

TEMPERATURE VARIATION

Temperature varied most between pails when the barn temperature was 45° F. This is the recommended temperature for dairy barns during winter months. After 1 hour at 45° F., solution in the plastic pail without a cover cooled down to 93° F. Solution in the new insulated pail with cover cooled only to 116° F.

Covered insulated pails, whether new or in use 6 months, didn't cool below 112° F. in any temperature trial.

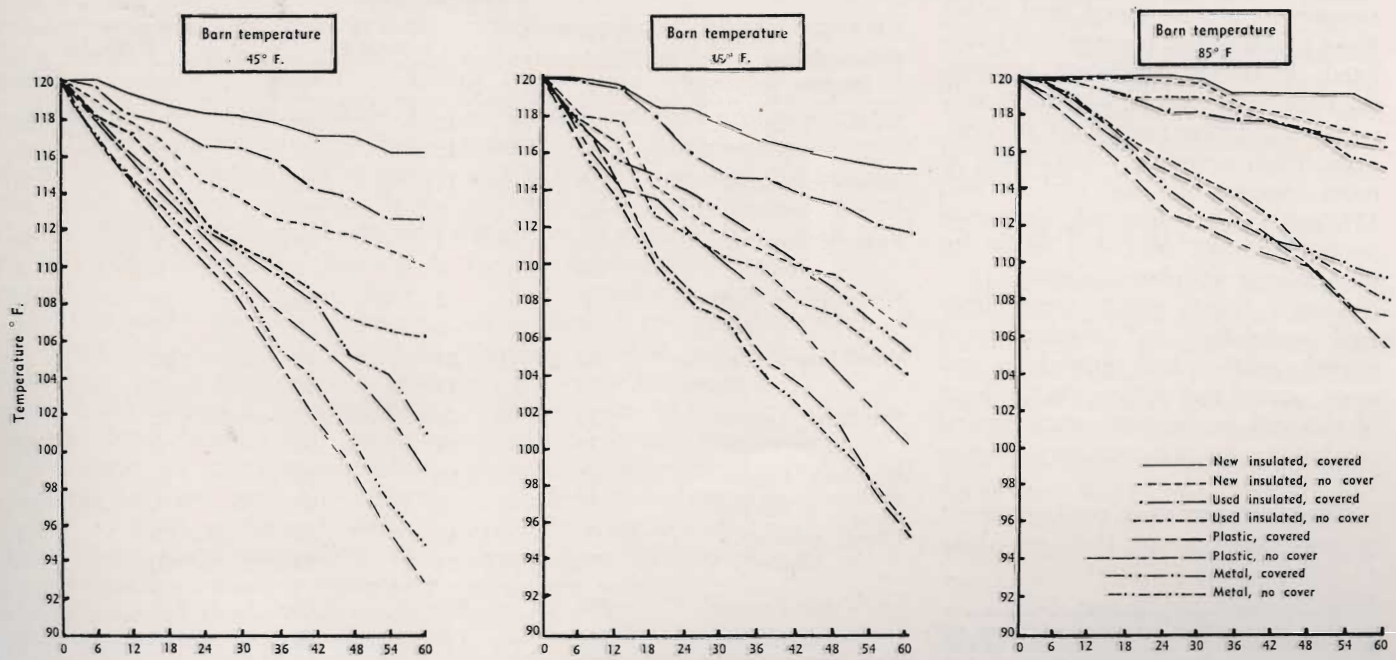
With barn temperature at 85° F., solution in the new covered insulated pail cooled only 2° in 1 hour. The used, covered insulated pail compared favorably. Its solution cooled only 4° in an hour, indicating that the insulated pail could maintain temperature a long time under heavy use.

Metal and plastic pails never achieved a temperature-holding ability of 110° F. after 1 hour. This is the minimum recommended temperature of an udder wash solution.

Our study clearly shows that the covered, insulated pail is an effective, simple, and economical means of keeping individual udder cloths between 110° and 120° F. while milking.

This insulated pail has a polystyrene liner and a metal outer jacket.

Edward C. Frederick is an associate professor and Conrad Kvamme is an instructor at the Northwest School and Experiment Station, Crookston.

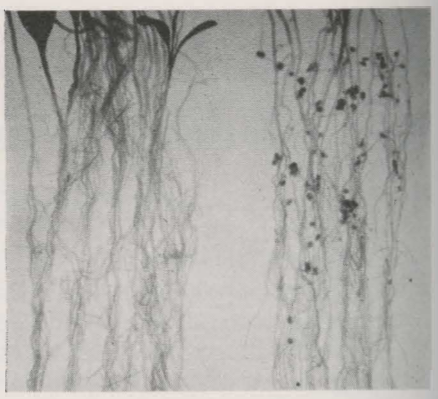


Number of minutes that pails kept udder wash solution warm at different barn temperatures.

EVALUATION OF PREINOCULATION PROCESSES

This is a report of University of Minnesota studies of preinoculated alfalfa and clover seeds

Roy D. Wilcoxson and K. L. Blanchard



Nodulation was satisfactory when plants appeared as those on the right, but unsatisfactory if plants were without nodules as those on the left.

TO GET MAXIMUM YIELDS of alfalfa, red clover, and sweet clover, soil must be properly limed and fertilized with phosphate and potash. In addition, nodules must develop on plant roots. To insure nodule formation, most farmers inoculate seed at planting time with proper strains of nodule-causing bacteria.

No one can apply fertilizer to seed before it is sold, but seedsmen can preinoculate or apply nodule-forming bacteria to seed before sale. The advantages of buying preinoculated seed are obvious. During 1962, about 90 percent of the alfalfa and clover seed purchased by Minnesota farmers was preinoculated.

1961 TESTS

In February 1961, the University of Minnesota began studies of market samples of preinoculated seed to see if the plants would become well nodulated. Producing seedsmen supplied the University with 11 samples of seed representing three preinoculation processes. Each sample lot was stored at room temperature and also at 20°, 15°, and 5° C. At intervals, during an 8-month period, seed was tested for formation of nodulated plants.

After 1 month plants were either well nodulated and making good growth, or they had no nodules and were stunted and yellow. On the basis of this difference, tests were scored satisfactory or unsatisfactory (figure 1).

Vicoat samples gave positive results in each test except that an alsike clover lot performed satisfactorily only when stored at 15° and 5° C. Samples of *Dormal* were unsatisfactory in all trials. *Noculized* samples gave satisfactory results in initial tests but generally failed to yield nodulated plants in subsequent trials.

1962 TESTS

In 1962, inspection was undertaken on a larger scale. The Minnesota Department of Agriculture collected samples of preinoculated seed from January through April from retail outlets out of the same dealer seed lots that farmers would buy. These samples were inspected immediately for development of nodulated plants and again after storage. Final tests were planted in May and early June. During the 1- or 2-month storage period, samples were stored in an unheated building, subject to prevailing conditions of temperature and humidity.

On the whole, about three-fourths of the samples yielded plants with satisfactory nodulation in both initial and second trials (table 1). *Vicoat*, *Nitrocharge*, and *Noculized* samples yielded comparable results. These processes account for the majority of

Table 1. Number and percentage of preinoculated legume seed samples* and preinoculated alfalfa seed samples that produced satisfactorily nodulated plants, greenhouse, 1962

Preinoculation process	Number of samples	Trial 1		Trial 2	
		Number	Percent	Number	Percent
Dormal: Legume	40	12	30	10	25
Alfalfa	31	12	39	10	32
Hanson's: Legume	18	11	61	9	50
Alfalfa	15	9	60	7	47
Kiester's: Legume	5	1	20	1	20
Alfalfa	1	0	0	0	0
Micro Guard: Legume	6	3	50	2	33
Alfalfa	3	0	0	0	0
NitroCharged: Legume	29	23	78	26	89
Alfalfa	20	18	90	19	95
Noculized: Legume	89	73	82	72	81
Alfalfa	74	65	88	63	85
Peterson's: Legume	17	10	59	10	59
Alfalfa	15	9	60	9	60
Vicoat: Legume	98	83	85	89	91
Alfalfa	75	63	84	70	93
Totals Legume:	392	216	72	219	73
Totals Alfalfa:	234	176	75	178	76

* 234 samples of alfalfa, 40 of red clover, 19 of sweet clover, and 9 of alsike clover.

Roy D. Wilcoxson is an associate professor in the Department of Plant Pathology and Botany and K. L. Blanchard is an agronomist for the Division of Plant Industry, Minnesota Department of Agriculture.

the seed sold in Minnesota. *Hanson*, *Micro-Guard*, and *Peterson* samples appeared comparable, but their performance was inferior. *Dormal* and *Kiester* samples fell into a third class.

Alfalfa—Table 1 also lists results obtained in examinations of alfalfa seed samples. The three divisions of samples are again evident. Since the majority of all samples were alfalfa seed, results for alfalfa and all legume seed are nearly identical.

Red clover—Forty samples of preinoculated red clover seed, representing eight preinoculation processes, were examined. Although the number of samples was too small to permit a meaningful comparison of processes, *Vicoat*-treated red clover appeared superior.

Sweet clover, alsike—Smaller numbers of sweet clover and alsike clover samples were examined. All 19 sweet clover samples gave satisfactory results in laboratory inspections. Differences among processes were not evident. In general, alsike samples did not perform as well as alfalfa samples, but the processes cannot be compared from the nine samples inspected.

We should emphasize several points.

First, seed samples were collected from retail outlets where they were stored under various conditions. Seed history is unknown up to the time of sample collection. Some difficulties exist in comparison of processes because of potential differences in handling of the various seed lots by dealers.

Second, the test is not infallible. In a number of tests, negative results in the initial trial were followed by positive results in the second trial. It is possible that the test method may not always detect rhizobia that are present.

It seems safe to conclude, however, that most preinoculated seed sold in Minnesota during the past year was probably inoculated at planting time and that living bacteria were present. While none of the preinoculation processes behaved perfectly, several appear to have performed well in these trials. These tests show that progress has been made in perfecting preinoculation methods. We hope that additional progress will be made in coming seasons.

Research in horticulture will bring you

Shorter Poinsettias for Christmas

R. E. Widmer

DON'T LOOK FOR A PLANT PSYCHIATRIST if your florist advertises tranquilized poinsettias for Christmas. The demand for lower cars, homes, and plants also extends to our most popular Christmas pot plant, the poinsettia. Some are treated to grow shorter, and are commonly referred to as "tranquilized" plants.

The demand for short poinsettias has presented a serious problem because well grown specimens tend to become too tall. Here's the whole story:

POINSETTIA CULTURE

Dormant stock plants from California usually arrive in Minnesota in early April. They are potted in sterile soil and then grown in greenhouses. When plants attain adequate size, 4- to 6-inch sections of the growing tips are removed and rooted. These cuttings are taken from June through September.

After rooting, the cuttings are planted in 2¼-inch pots. In September or October three or more similar plants are placed in larger pots.

Development of the flowers and the showy red bracts surrounding them depends on photoperiod—total length of the light period—and temperature. Short days are essential, and a night temperature between 60 and 70° F. gives best results.

R. E. Widmer is associate professor in the Department of Horticulture.

Under natural day length flower buds usually begin to form about October 1. Recently, commercial growers have delayed bud set by using electric lights at night. This keeps plants from becoming overmature by Christmas.

Use of lights combined with cultural methods favoring maximum growth can produce plants 3 to 6 feet tall. Desired height is 10 to 18 inches. Normally, cuttings taken late in the season produce the shortest plants.

Unfortunately, not enough cuttings may be economically produced in September to supply demand. Also, late propagated plants produce smaller bract clusters. So commercial growers are forced to take cuttings earlier and control height by limiting the water and nutrient supply. This usually compromises quality and results in some plant loss.

GROWTH REGULATORS

Plant scientists have long known the need for regulators that increase or decrease plant size without producing undesirable side effects. They have been aware of growth regulators for more than 50 years. Recently many new experimental growth regulators have been developed.

Our department recently tested several of these newer materials on flowering crops. One of these, CCC (2-chloroethyl trimethyammonium chloride), developed at Michigan State

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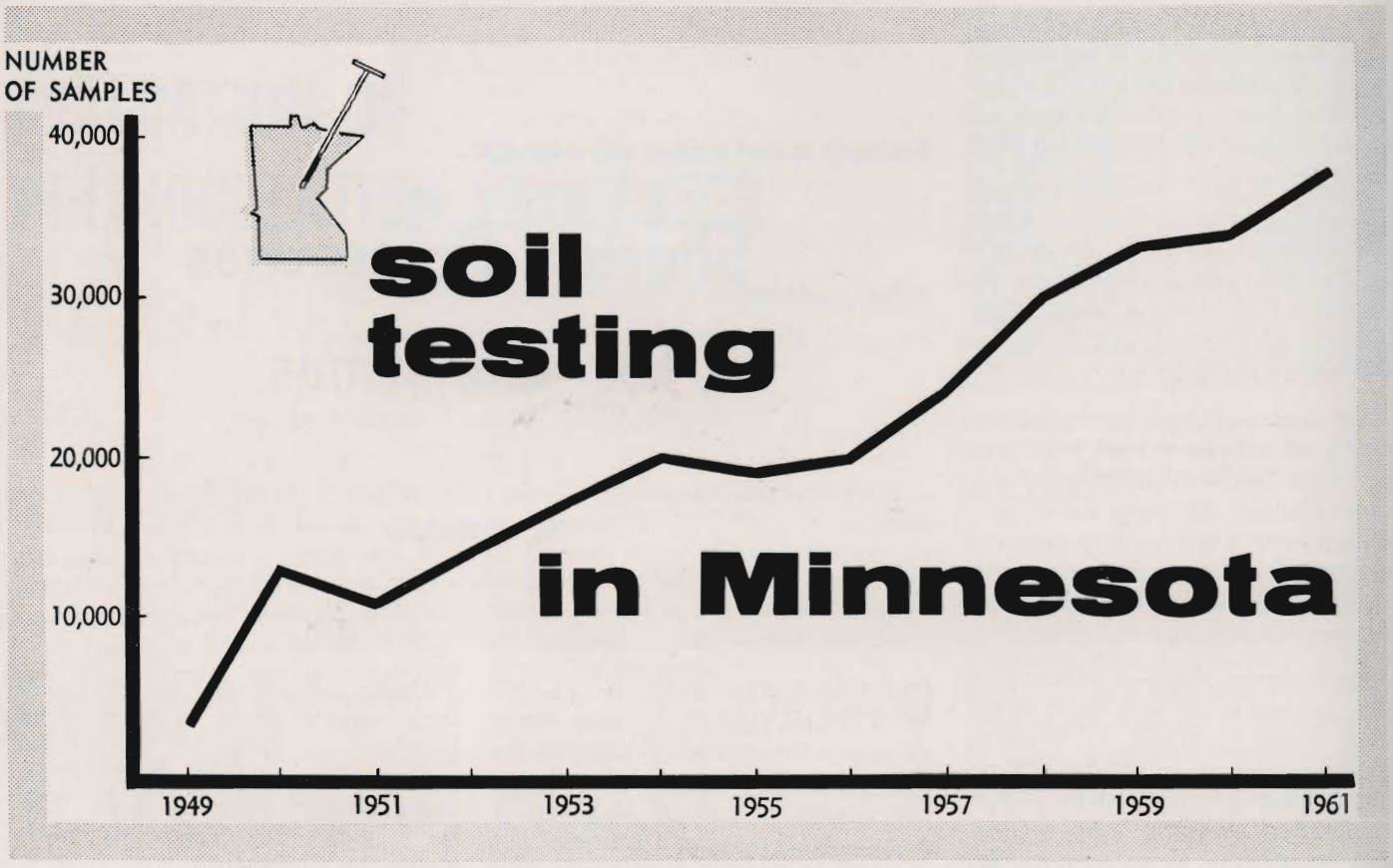


John Grava and Lowell Hanson

Soil testing is the link between a farmer's field and soil fertility research at the Minnesota Agricultural Experiment Station. This article tells why.

SOIL PROVIDES many nutrient elements taken up by farm crops, garden plants, and lawn grasses. However, native soil fertility is often inadequate so lime, manure, and commercial fertilizers must be added. Which nutrients, how much, when, and how are questions constantly asked by farmers and homeowners.

Often we observe nutrient deficiency symptoms, use leaf analyses, or conduct field experiments to diagnose a plant's nutritional ills. Chemical soil tests, however, take less time and can be used for a large number of samples. And they can tell what's needed before, not after a crop is planted.

In Minnesota, steady increases in soil testing activity have accompanied improved facilities for chemical testing of soils. The University's Soil Testing Laboratory has processed over 300,000 samples since 1949. Over 43,000 samples are now processed an-

Highlights in Soil Testing

- 1919—Soil testing started in Minnesota with soil acidity determinations for trouble shooting purposes. Simple phosphorus and potassium tests were added in 1942.
- 1949—University of Minnesota Soil Testing Laboratory established, more precise equipment introduced, and systematic method of handling samples, records, and recommendations adopted. Recommendations made at the laboratory and forwarded to farmers directly.
- 1954—Bray's No. 1 method for phosphorus and flame photometric method for potassium determination introduced.
- 1955—County extension agents trained to make recommendations.
- 1956—A chemical organic matter test introduced. First soil test summaries published.
- 1962—IBM punchcard system in data processing, bookkeeping, and printing test reports adopted.

John Grava is an assistant professor in the Department of Soil Science and supervisor of the Soil Testing Laboratory. Lowell Hanson is instructor and extension soils specialist.

nually. In 1961 this included 37,353 farm, garden, and lawn samples; 1,300 florist (greenhouse) samples; 154 limestone samples; and 3,543 departmental research samples.

Today, three full-time employees and 2 to 12 part-time student technicians operate the laboratory. With present facilities, 8,000 samples can be processed monthly. On the average, it takes 10 days for sample drying, testing, and reporting. Test reports are then mailed to county agents who make recommendations.

Soil testing in Minnesota is very seasonal (figure 1). Promotional programs, such as the "Fall Soil Sample Roundup," cut down the usual spring sample influx. More than 60 percent of the samples are now tested in the fall and winter.

Chemical methods, equipment, and skill of laboratory personnel determine reliability of soil test results.

FINDING A CHEMICAL METHOD

A suitable method must test a wide range of different soils. For many years we used a phosphorus test developed by S. F. Thornton in Indiana.

With this method dark blue extract resulted from soils well supplied with phosphorus and light blue from phosphorus deficient soils. Color intensity was compared visually with color charts. By 1954 experimental evidence showed that Thornton's extracting solution was too acid for testing Minnesota's alkaline soils. It dissolved large amounts of soil phosphorus which actually were not available to crops. In other words, it overestimated phosphorus availability.

Meanwhile, scientists at the soil science department found that Bray's No. 1 method, developed at the University of Illinois, was the most reliable. It can test acid as well as alkaline soils.

In a laboratory test of an acid Clarion clay loam, the two methods gave similar results. But on alkaline Bearden silt loam, Bray's method showed a low test of 8 pounds of extractable phosphorus per acre compared to an overestimated 200 pounds by Thornton's method.

The phosphorus test was further improved by adoption of the colorimeter. Thus, a photocell was substituted for the human eye in measuring color intensity differences of phosphorus-containing soil extract.

ESTABLISHING AVAILABILITY LEVELS

Once a suitable testing method is found, relative availability levels for a plant nutrient in soil must be established. Figure 2 illustrates results of such calibration in Minnesota. Soils ranging from low to high in phosphorus content were selected for corn trials. Some plots received all three major nutrients—nitrogen, phosphorus, and potassium (NPK treatment)—some received no phosphorus at all (NK treatment).

Corn yield increases from phosphorus fertilization were grouped according to soil test values. Soils testing very low in phosphorus averaged 19.5 additional bushels per acre in response to phosphorus treatment. But soils with high phosphorus tests yielded less than 4 additional bushels per acre.

Thus test levels, low, medium, and high, indicate chances of crop response to fertilization.

Knowing whether a soil is low or high in a nutrient, however, is not enough to make a fertilizer recommendation. The question of how much still remains unanswered. Therefore, fertilizer rate studies are conducted under field conditions keeping other growth factors at optimum and applying different nutrient rates.

Data in figure 3 illustrate a rate study, using potassium on corn, conducted at two locations in southeastern Minnesota. Application of 120 pounds of K_2O per acre was found to be most efficient on a soil testing low. On another soil with a medium test the 60-pound rate was sufficient.

When a soil sample is analyzed in the laboratory it is actually compared to similar soils on which fertilization or liming trials have been conducted. Thus, specific recommendations are based on field trials. Results of such trials are currently compiled in Extension Special Report No. 1.

Although considerable progress has been made in soil testing, all plant nutritional problems are not solved. On the contrary, each new growing season adds a few new problems. Research must continue. Soil testing is an essential link between scientific experimentation and actual use of modern soil management practices.

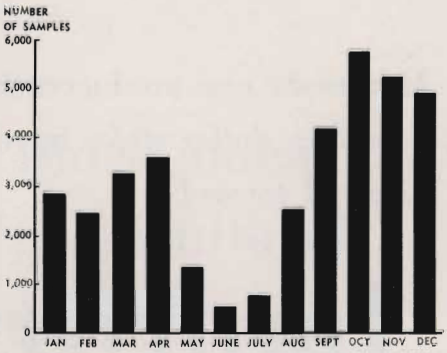


Fig. 1. Soil testing is seasonal in Minnesota. Graph shows samples tested each month, 1961.

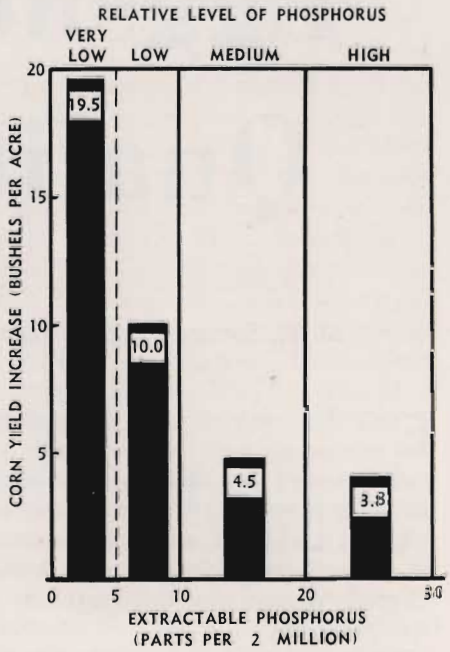


Fig. 2. Phosphorus availability determines crop response to phosphorus fertilizer.

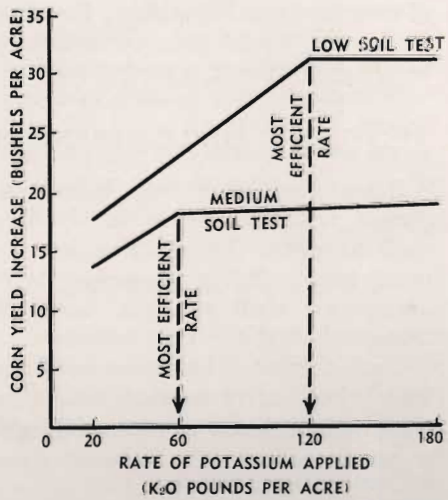
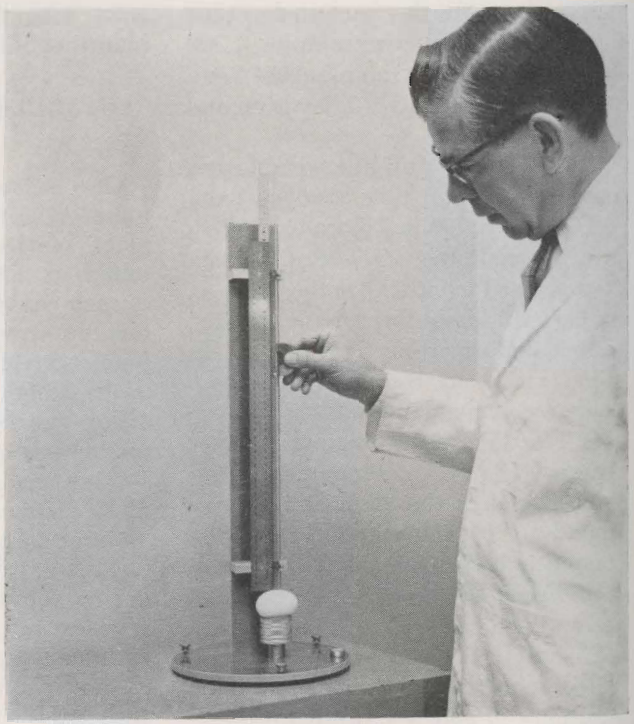


Fig. 3. Application rate study shows most effective amounts of potassium fertilizer.

Minnesota egg producers have a million dollar stake in research directed toward . . .

Improving Eggshell Quality



M. H. Swanson tests impact strength of an egg by the falling ball technique.

M. H. Swanson and D. C. Snetsinger

EGG BREAKAGE costs Minnesota producers and handlers over $1 million every year. Conservative estimates indicate that 7 to 8 percent of all eggs laid are cracked in the nest or in marketing. Checked eggs bring C-grade prices; smashed eggs are a complete loss.

Today's increased mechanization of egg handling, both in the laying house and the assembly plant, accentuates the shell quality problem. Minnesota eggs must travel long distances to out-of-state markets. Therefore, the need for strong shells able to withstand breakage in transit is magnified.

MEASURING SHELL STRENGTH

Researchers have long been concerned with the factors involved in shell strength. To do research we must have reliable measuring techniques for shell strength. Some of these techniques or tests follow:

Shell thickness has been used for some time. After breaking the egg, the shell thickness is measured with a micrometer to the nearest thousandth of an inch at several points around the egg's equator. It is assumed that the thicker the shell, the greater its resistance to breakage. Shells measuring less than .013 inch are considered poor risks in market channels.

Specific gravity is a popular method which does not require breaking the egg. A freshly laid egg sinks in pure water. If it is moved through a series of solutions with increasing salt concentration, the specific gravity of the solution in which the egg first floats about equals that of the egg. This value is highly correlated with shell thickness and thus can be used to predict shell strength. In fact, University of Minnesota research indicates that specific gravity as a single measure is more reliable than shell thickness.

Special devices, such as the one pictured here in use at the University of Minnesota, determine the force required to break the shell by impact. A steel ball is raised inside a glass tube by a magnet and dropped from increasing heights until the shell cracks. Using the weight of the ball and the distance it falls, one can calculate the force.

Another commonly used device applies a continuous, increasing pressure to the egg until it cracks. This type of breakage might occur while the egg is being transported in a basket or case. Research suggests that an egg's resistance to breakage by pressure may be quite different from its impact strength.

WHAT AFFECTS SHELL QUALITY?

Many factors are involved in the shell quality problem.

Genetic ability to lay eggs with strong shells is lacking in some hens. Commercial breeders continuously screen their stocks to make improvements through selection. However, breeding stock is selected first for the number and size of eggs, and selection for shell strength is sometimes compromised.

Physiological aging of the shell secreting gland may be responsible for normal decline of shell quality as the laying year progresses, especially during the last 4 to 6 months.

Temperatures above 70° F. in the laying house can cause hens to lay

M. H. Swanson is an associate professor and D. C. Snetsinger an assistant professor in the Department of Poultry Science.

eggs with thinner shells. Because most pullet replacements are spring hatched and begin laying in the fall, the last quarter of the laying year coincides with the hot weather of the following summer. This combination intensifies the shell quality problem during these months.

Several respiratory diseases such as infectious bronchitis and Newcastle adversely affect shell strength.

Adequate nutrition of the hen is also important for the production of sound egg shells. Some nutrients, when deficient, can decrease egg shell strength. Calcium, phosphorous, and vitamin D_3 deficiencies are most likely to occur and produce inferior shells under practical conditions. Of these, calcium is now of greatest interest (shells consist of approximately 98 percent calcium carbonate).

In the past most poultry nutritionists recommended that hens receive 2.25 percent calcium in their ration. Research at the University of Minnesota and other state universities indicates that by increasing the calcium to 3 and even 4 percent, shell thickness and specific gravity can be increased. This effect is particularly beneficial during warmer weather and at the end of laying season when shell quality decreases rapidly. Use of higher calcium level is one of the few means now available whereby poor shell quality can be partially overcome.

Nevertheless, we do not recommend that, under practical conditions, calcium levels exceed 3.5 percent. Calcium reacts with many mineral elements in the digestive tract. When fed at too high a level, it can make certain elements unavailable to the hen causing deficiencies that cut egg production.

Ultimately, research will determine more specifically the underlying basis for shell strength as well as the means of accurately measuring it. Then great improvements in shell quality will be made. Until that time the producer and egg processor must use available measures to reduce the incidence of poor shells. These include selection of a good strain of birds, proper management in housing and egg handling, and adoption of a sound vaccination program. Finally, the ration must be adequate in shell-forming nutrients, particularly calcium.

To expand use of agricultural produce scientists are studying . . .

Chemical and Biochemical Modification of Agricultural Products

S. Kirkwood, J. V. Scaletti, and F. Smith

WE CAN'T EAT all our corn and wheat surpluses. But we may be able to expand their use by livestock or develop new chemical and biochemical methods for converting them into industrial chemicals.

Here at the University of Minnesota we are investigating simple, inexpensive chemical and microbiological methods for remodelling the structure of corn and wheat starches to give new substances. We also hope to investigate new methods to make the carbohydrate components of agricultural products, especially cellulose, more susceptible to animal digestion.

THE CELLULOSE-LIGNIN COMPLEX

The energy-rich cellulose of plants is closely associated with undesirable lignin—the "cementing" substance of the plant kingdom. This cellulose-lignin complex forms the major structural framework of plants. It is resistant to digestion. Lignin itself is not a suitable energy source for animals. However, its indigestibility adversely affects utilization of materials that are good nutrients. So, its presence does affect nutrient value of feeds.

Cellulose is quite different since it is composed of the simple carbohydrate glucose—nature's best energy source. What is needed, therefore, is a method or methods (chemical or biochemical) for splitting this cellulose-lignin complex. For nonherbivorous animals such as pigs a method of predigesting liberated cellulose would be needed also.

S. Kirkwood and F. Smith are professors in the Department of Agricultural Biochemistry; J. V. Scaletti is an assistant professor in the Department of Animal Husbandry.

ENZYMES REQUIRED FOR DIGESTION

The purpose of digestion is to dismantle complex food chemicals into their simplest building units. These are then absorbed by the digesting organism and built into its own complex structure. This dismantling is done by enzymes that are produced only by living cells. In general we can accomplish the same type of change occurring in digestion by ordinary chemical means. But the process is then more expensive and difficult.

It is an odd quirk of nature that although a significant percentage of the energy utilized by animals originates in cellulose, no animal can produce the enzyme cellulase that attacks this material. Nevertheless, ruminants can digest at least 50 percent of the cellulose in their feed. Omnivora, such as pigs and chickens, on the other hand, cannot utilize cellulose.

Herbivora, such as cattle, sheep, and horses, and particularly ruminants, can use cellulose due to the microorganisms in their digestive tracts which produce considerable cellulase. These organisms, through completing their life cycle in the rumen, make a considerable proportion of the energy present in cellulose available to the ruminant animal.

ARTIFICIAL DIGESTION

Digestion in the rumen suggests artificial ways to stimulate cellulose digestion in ruminants. One is to add preparations of the enzyme cellulase to animal feeds.

The two features needed for this enzymatic approach to animal food

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Breeding Soybeans for the World Market

J. W. Lambert and R. L. Cooper

R. L. Cooper makes a soybean cross.

MINNESOTA'S SOYBEANS are going abroad. They travel to many lands in the form of soy oil, soy meal, and as whole beans. And this export stream will probably grow larger.

Soybeans rose to second place among Minnesota's cash crops in less than 3 decades. In 1938 there were fewer than 30,000 acres in the state, mostly for emergency forage. In 1962 there are nearly 2½ million acres, virtually all producing seed for processing, or for planting next year.

In 1961 Minnesota's 56-million-bushel crop ranked fifth in the nation. This is only a little more than the United States shipped last year to Japan, the largest single importer of the nation's crop. All told, the United States disposes of more than a third of its soybean crop abroad.

REEXAMINING BREEDING PROJECTS

Because of the expanding importance of soybeans in Minnesota we are reexamining the Agricultural Experiment Station's breeding project. What kinds of varieties should we develop for Minnesota farms? Have our needs changed?

Obviously, the need for high yields of harvestable seed continues much the same as in the past. And this, of course, calls for close attention to proper maturity, plant height, standing ability, and shattering resistance.

HIGH PROTEIN CONTENT NEEDED

New requirements, however, are also developing due to changes in both our domestic market and our rapidly growing export market. A few years ago the greatest emphasis was on varieties having a high oil content.

Soybean oilmeal was considered a byproduct. Recently, however, the world supply of oils and fats has been in surplus, and soybean oil prices have fallen. At the same time use of soybean meal in feed industries at home and abroad has grown enormously. Soybean protein for livestock and poultry nutrition is in high demand. Moreover, the far-eastern whole-bean export market is primarily for soy protein. Many of the whole beans go directly into traditional food items to help balance the diets of these rice-eating peoples. The need for increased emphasis on protein in the new varietal improvement program thus seems clear.

SIZE, COLOR IMPORTANT

Along with high protein, however, are other requirements. Far-eastern users of whole beans prefer large, solid yellow seeds. Domestic processors also prefer completely yellow seeds since many special products manufactured from such beans are more attractive than those produced from beans having dark-colored hila (seed scars).

WITHSTANDING ROUGH TREATMENT

The additional loading, unloading, and handling in exporting soybeans increases the mechanical damage to the seed. This means more cracked and split beans, both undesirable to the importer, especially if he supplies the whole bean market. Our new breeding program will emphasize selection for seeds that withstand at least moderately rough treatment.

DISEASE REMAINS A PROBLEM

Minnesota soybean producers have had few problems with soybean diseases that wipe out the crop. Every year, however, varying amounts of less dramatic losses occur from root rots, bacterial blight, and other foliar diseases. Iron chlorosis on the high lime soils of western Minnesota also cause appreciable losses. Our new breeding program gives major attention to these problems.

Minnesota is well situated geographically to play a major role in supplying the world's vast needs for the soybean.

First, we have 10 million acres of cropland on which soybeans can be grown. Much of this land is highly productive.

Second, our farm practices and marketing and merchandising facilities are well geared to cash grain production.

Third, the state can take advantage of low cost, long distance water transportation either down the Mississippi to the Gulf of Mexico or through Duluth-Superior to the St. Lawrence Seaway.

The new breeding program, stimulated by a substantial legislative appropriation, is well underway. Several persons, both professional and technical, have been added to our staffs. Needed equipment has been purchased for use in the field, the greenhouses, and the new Crops Research Laboratory facilities. Operations have been expanded at branch experiment stations. Arrangements have been made for establishment of an overwinter nursery in Chile, and a cooperative quality evaluation program has been initiated with the Japanese-American Soybean Institute in Japan.

All of these personnel, equipment, and facilities have been added to an already extensive and active breeding program. This program for many years has had close association with the United States Regional Soybean Laboratory at Urbana, Ilinois, and with a number of the country's leading oil seed processing companies.

J. W. Lambert is a professor and R. L. Cooper is a research associate in the Department of Agronomy and Plant Genetics.

This report shows a county's concern for . . .

Meeting Aging and Health Needs

. . . in Rural Minnesota

Gordon Bultena

IMPORTANT AND FAR-REACHING CHANGES are occurring in Minnesota—changes that relate to the physical and mental well-being of our population. What are these changes and how do they pertain to the health of Minnesota's citizens? What needs resulted from the changes and how might these be alleviated? These questions are discussed in this article.

POPULATION CHANGES

Because the prevalence of illness varies with age, changes in a population's age structure bears upon both present and future health needs. An increasing population in the older age groups, as in Minnesota, has important repercussions for medical care, public health programs, and community activities for the aged.

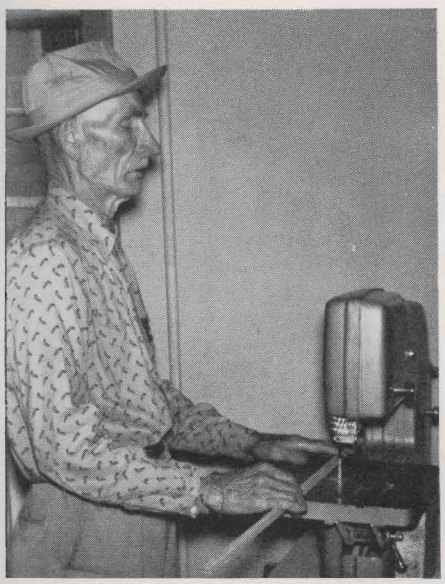
Nearly 270,000 persons age 65 and older lived in Minnesota in 1950. By 1960 this number jumped to 354,000, an increase of over 30 percent in 10 years. This growth rate is twice that of the state's population growth (14.5 percent) during the same decade.

An increasing proportion of Minnesota's population is made up of "senior citizens." In 1900, 1 of every 25 persons was 65 or older; today, 1 of 10 is in this age bracket.

The high rate of rural to urban migration among young adults restricts a rural community's ability to meet the increased aging and health needs. Leadership typically coming from young adults is lacking.

A higher proportion of persons in small villages and towns are 65 and older and a smaller proportion are in the productive ages (20 to 64) than in either the rural farm or urban population segments. Hence, communities with the greatest potential aging and health needs often are least able to cope with their problems.

Gordon Bultena is an instructor in Rural Sociology.



OTHER CHANGES

The increased longevity that brought a rapidly expanding older population also led to a longer retirement period. The average worker withdrawing from the labor force in 1900 could anticipate about 3 years in retirement. Today the average length of retirement approximates 6 years. It is expected to increase to 9 years by the year 2000.

Longer retirement leads to many problems. For some it brings a sense of worthlessness of self and alienation from others. The individual may feel that he has been "put out to pasture." His life loses the meaning that participation in the work world previously provided.

Some persons are unprepared for the free time that retirement brings. They experience guilt over the unproductiveness of their leisure activities. Part of the dilemma lies in our society's failure to provide a meaningful role or place for the retired person.

Another important change is the shift in responsibility for meeting aging and health needs from the family to governmental and private groups. The family traditionally provided care for the ill or aged family member. Relatives and neighbors could also be counted on for help.

Today the great mobility of American families and the breakdown of rural neighborhoods often mean that friends and relatives cannot furnish needed care. Also, values are changing as children feel less obligated to care for aged parents in their own home than was once the case.

Furthermore, the family is often unable to provide the needed care. Frequently the illness or mental deterioration is misunderstood by family members. Proper rehabilitation is often beyond the family's resources.

MEETING THE NEEDS

Several programs were instituted throughout Minnesota to meet the needs coming out of these and other social changes. One such program is currently being developed by community leaders in Morrison County, Minnesota.

To determine both local aging and health needs and resources at hand to meet them, a comprehensive survey was recently undertaken in the county. Over 500 volunteers collected information from nearly 6,000 households. This data was analyzed in the Department of Rural Sociology at the University of Minnesota and the findings will soon be published.

WHAT THE SURVEY SHOWS

The survey uncovered 1,356 cases of chronic illness (persons ill for more than the last 30 days) out of a total county population of nearly 27,000. Also, 363 disabled persons were found. These cases are now being evaluated by local doctors and county public health nurses to determine:

- If all cases are known to both.
- What action, if any, should be taken to provide better health care.

The survey also explored problems facing retired persons in the county and asked these persons which programs they felt might be of value.

While the survey revealed several needs, it also pointed to substantial

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Cold-Soak Treating Lengthens Post Life

J. R. Neetzel
L. W. Rees
C. H. Christopherson

Fig. 1. Fenceposts are tested for durability in this plot on the University of Minnesota's St. Paul Campus.

EACH YEAR MINNESOTA FARMERS use millions of fenceposts to build and repair fences. Many of these are steel or commercially treated wood posts.

Nearly half of Minnesota's farms have woodlots and many produce all or part of their post needs. But many farm-cut posts are set without preservative treatment and last only a few years. Some farmers now treat their own posts. Others would, no doubt, do some cold-soak home treatment if they knew more of treating results.

TREATMENT AND TESTING

In 1942 the School of Forestry treated 860 fenceposts. They cold soaked them in a 5-percent pentachlorophenol solution, using kerosene as a solvent.[1] These were mostly round, 3- to 5-inch posts, 6 feet long. Seven species of wood—jack pine, black ash, white oak, red oak, cottonwood, white birch, and aspen—were used.

Butts of half the posts were soaked for 40 hours. This was followed by an 8-hour soak treatment of the tops. The other half of the posts had butts soaked for 18 hours, followed by a 6-hour top treatment.

These treated posts, together with 420 untreated posts of the same species, were set in test plots at the Cloquet Forest Research Center, the Waseca station, and on the University's St. Paul Campus (figure 1).

Since then the posts have been inspected each year and subjected to a 100-pound pull applied with a testing device (figure 2).

TEST RESULTS

Treated posts — nonpressure cold-soaking treatment cannot be expected to give the same penetration and retention as pressure treatment with the same preservative in commercial-treating plants. Nevertheless, results (see table) indicate that increased service life is obtainable with such cold-soaking treatment when all conditions are favorable. It is especially important

Service record of fenceposts treated by cold soaking with a 5-percent oil solution of pentachlorophenol*

Species	Length of treatment	Average absorption of preservative solution	Number of posts in test	Posts in service after 20 years	
	hours	pounds per cubic foot		number	percent
Jack pine	48	2.62	65	65	100
	24	2.27	67	63	94
	0 (controls)	0	69	0	0
Black ash	48	3.60	61	60	98
	24	2.99	64	51	80
	0 (controls)	0	70	0	0
White oak	48	1.39	30	28	93
	24	1.48	30	21	70
	0 (controls)	0	30	8	27
Red oak	48	1.39	60	57	95
	24	1.47	60	42	70
	0 (controls)	0	47	4	8
Cottonwood	48	4.17	60	36	60
	24	3.24	59	23	39
	0 (controls)	0	60	0	0
White (paper) birch	48	3.54	63	43	68
	24	3.02	61	18	30
	0 (controls)	0	70	0	0
Aspen	48	3.24	64	24	38
	24	3.69	64	12	19
	0 (controls)	0	70	0	0

* The average life of untreated posts showing complete failure was: aspen and cottonwood, 3.9 years; paper birch, 4.2 years; black ash, 4.5 years; and jack pine, 6.5 years.

J. R. Neetzel is research associate in the School of Forestry and USDA Forest Service technologist. L. W. Rees is a professor in the School of Forestry, and C. H. Christopherson is an associate professor in the Department of Agricultural Engineering.

Chemical supplies and support for establishment of these tests were provided by the Chapman Chemical Company, Memphis, Tennessee.

[1] F. H. Kaufert, L. W. Rees, and J. R. Neetzel. 1955. Durability of Pentachlorophenol Treated Fenceposts. Minn. For. Notes No. 44.

that posts be well seasoned before treatment.

Ninety-seven percent of the treated jack pine posts are still in service after 20 years. Actually, none of the 48-hour soak posts failed.

Black ash, white oak, and red oak treated posts have been nearly as serviceable with over 80 percent still sound.

About half the treated cottonwood and white birch are still in service after 20 years.

Poorest results were obtained with aspen posts, where most have failed.

Considering all posts of all species treated, 67 percent are still in service. Of the posts given a 48-hour cold soak, 78 percent are still in service. But only 57 percent of those given a 24-hour cold soak still withstand the 100-pound pull test.

Untreated posts—All untreated jack pine, black ash, cottonwood, white birch, and aspen posts failed within a few years (see table). Most posts of these species, which have low natural durability, failed within 2 or 3 years.

Several untreated white and red oak posts are still in service after 20 years.

APPLYING THE RESULTS

For best results when cold-soaking posts, choose easy-to-treat woods such as jack and red (Norway) pines. Carefully peel posts and permit them to thoroughly season before treatment. Posts must be dry at time of soaking. Test results indicate that you can expect a service life of at least 20 years with such treatment and species.

If these species are not available, black ash and white and red oaks are a close second choice.

Cottonwood and paper birch can be used with reasonable success.

Cold-soaked treatment of aspen with penta is not recommended when other species are available. But such treatment provides about a four-fold increase in service life even for this species.

Fig. 2. J. R. Neetzel applies 100 pounds pressure to posts in test plot.

Expansion Plans for Dairy-Hog Farmers

W. B. Sundquist

MANY MINNESOTA DAIRY-HOG FARMERS face the problem of expanding their farm business to meet rising production and living costs. New developments in crop and livestock production techniques make such expansion possible. Although no two farm situations are exactly alike, this article considers some plans applicable to many grade A dairymen.

Farmers with stanchion barns usually have four possible alternatives:

1. Expand stanchion barn space and add to the milking herd.

2. Switch to a laborsaving loose housing-milking parlor setup and increase herd size.

3. Expand cropland acreage with or without expanding in dairy and/or hogs.

4. Expand hog enterprises.

To have a benchmark for considering expansion plans, we surveyed the organization of 14 grade A dairy farms, mainly in Steele, Rice, Scott, and Waseca Counties. All are in productive soil areas and have similar production resources.

Their resources include an average of 200 acres of cropland and almost two man-equivalents of labor available the year around. Major buildings available include a 37-cow stanchion barn, silo space for storing 150 tons of corn or hay crop silage, and facilities for farrowing six sows. Consisting mainly of livestock and machinery, non-real-estate assets are valued at about $16,000. In addition, we assumed credit is available to spend on any profitable expansion. With cur-

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W. B. Sundquist is agricultural economist, Farm Economics Division, Economic Research Service, USDA.

Plant scientists may hold the key to . . .

Reducing Radioactive Content of Food

D. C. Rasmusson, L. H. Smith, and W. M. Myers

A PRINCIPAL LONG RANGE HAZARD to man from accidental or deliberate explosion of nuclear devices is contamination of food with radioactive substances. Serious damage can result from eating contaminated food with levels of radioactive material so low as to be unimportant as a source of external radiation.

Radioactive material enters the food chain when taken up by crop plants as ions from contaminated soil. Two possibilities for reducing this source of contamination have been suggested:

1. Using varieties of crop plants which take less than normal amounts of the radioactive ion from the soil.

2. Using varieties which deposit relatively less radioactive material in plant parts consumed by man or domestic animals.

For either possibility, the key to reducing food contamination is the existence within a species of genetic differences in accumulation and/or deposition of hazardous radionucleids.

This important question is being investigated in the University's Institute of Agriculture. The work is supported in part by a grant from the U. S. Atomic Energy Commission. Because of the importance of the radioactive isotopes of strontium, this ion was selected for initial study. Strontium 89 (Sr-89) was used in preference to Strontium 90 (Sr-90) because its shorter half life makes it an easier isotope to use experimentally. Half life is the time required for half of the element present to disintegrate.

The primary objective of this research is to find a way of reducing radionucleid contamination of the food chain. Important products of the investigations are basic contributions to our knowledge of the physiological processes by which plants take up and transport ions, and how genes control these processes.

DIFFERENCES AMONG VARIETIES

The first step in this research program was to determine if plant varieties differ in their capacity to take strontium from the soil. To date, 50 varieties of wheat and soybeans and 48 of barley have been evaluated. Plants were grown in the greenhouse in soil to which Sr-89 was added prior to planting. The plants were harvested at maturity, and Sr-89 content of the seed was determined by measuring the amount of radioactivity in each sample. The radioactivity is measured as disintegrations per second per gram (dis./sec./g.) of dry matter. The number of disintegrations in a sample depends on the amount of Sr-89 present.

The three crops differed in the amount of Sr-89 that they took from the soil and deposited in the seed. Soybean seed of the 50 varieties had an average radioactivity of 224 dis./sec./g. dry matter (table 1). Barley seed had an average radioactivity of 61, and wheat, 47.

Table 1. Sr-89 content (dis./sec./g. dry matter) in seed of soybeans, barley and wheat

Crop	Number of varieties	Average	Range Low	Range High
Soybeans	50	224	105	370
Barley	48	61	33	100
Wheat	50	47	18	82

Probably more significant was the fact that varieties within each species differed in the content of Sr-89 in the grain (table 1). For all three crops the variety with the highest content of Sr-89 in the seed contained more than three times as much as the variety with the lowest. The most variation was found among wheats. The variety Kenya 117A had 4.5 times as much Sr-89 in the seed as did the variety Great Northern. In barley, the variety Regal was the highest accumulator while Tregal was the lowest. This is of interest because Tregal is a parent of Regal. Apparently varieties can be genetically related and yet differ widely in the amount of strontium they deposit in the seed.

DIFFERENCES IN PLANT PARTS

In the second experiment, Sr-89 deposition in grain, stems, and leaves of six barley and wheat varieties was determined.

Table 2. Average Sr-89 content (dis./sec./g. dry matter) in plant parts of barley and wheat

Crop	No. of varieties	Grain	Stems	Leaves
Wheat	6	74	563	2,410
Barley	6	84	524	2,784

Maximum accumulation always occurred in the leaves (table 2). The stems were intermediate in Sr-89 content, and the grain contained the smallest amounts. Grain contained only about 3 percent as much Sr-89 as the leaves on a per gram dry matter basis. Within each crop, the varieties differed significantly not only in Sr-89 content of grain but also in Sr-89 content of stems and leaves.

Results indicate that the hazard associated with the radiostrontium in the soil can be reduced. The plant breeder could make available existing varieties that accumulate lower than normal amounts of Sr-89 and Sr-90 or breed new varieties which would contain even lower amounts of strontium. And since plant parts differ in content of Sr-89, it would be possible to specify the plant parts that are most hazardous and thereby avoid their use.

Next step in the research program will be to determine how differences in Sr-89 content are inherited. This information would be useful in planning breeding programs aimed at developing varieties which deposit limited amounts of strontium in eatable plant parts. Furthermore, this material will be useful for genetic and biochemical studies of nutrient uptake and transport by plants.

D. C. Rasmusson and L. H. Smith are assistant professors, and W. M. Myers is professor and head of the Department of Agronomy and Plant Genetics.

Modifications—

(Continued from page 11)

treatment are: (1) a cheap source of enzyme and (2) an adequate means of acting upon the food with it. At present we feel the best prospect for a cheap enzyme source would be a micro-organism that grows on inexpensive culture medium and produces large amounts of cellulase.

Many mold species secrete cellulase into the medium in which they are grown. They are not fussy in their food requirements, so they can be grown at low cost on a large scale. Although yields of enzyme so far obtained are not as large as desired these can probably be increased.

When penicillin was originally produced by British scientists for medical use, yields of 10 to 15 units per cubic centimeter were obtained in small glass bottles. Now production of several thousand units per cubic centimeter in thousand gallon batches is common. This has resulted in great price reduction of penicillin.

A similar approach could be adopted in cellulase production.

Increases in penicillin yield were obtained through careful study of effect of cultural conditions and type of organism on yields. If a sufficiently high cellulase yield could be obtained, the only concentration procedure required for the enzyme would be removal of most water present in the culture medium. If yields of this level should not prove feasible, it is still possible to get high enzyme concentrations by suitable chemical manipulations. However, if carried too far they raise cost considerably.

APPLICATION

Once a suitable concentration of cheap enzyme is available, a suitable means of application to feed must also be at hand. Many possible approaches suggest themselves. One is a variation of the ensilage process. Enzymes require a relatively high moisture content before they act and silo conditions are reasonably suitable for the action of most enzymes. Enzyme solution could be sprayed on feed material when ensiled. This would result in better cellulose utilization in present silage materials and would make many other roughage materials suitable as sources of silage. A similar treatment of feeds for pigs and chickens would allow incorporation of pretreated cheap roughage into their diet.

The possibilities of enzymatic treatment of feeds by no means begin and end with cellulase preparations. Studies on the material that survives the digestive processes of the cow show that its carbohydrate material is closely associated with lignin. Lignin "coats" the carbohydrate material so that the enzymes cannot get at it. This explains why poor quality hay is often higher in "carbohydrate" content than good quality hay. The difference resides not in the carbohydrate content but in proportion of lignin present. Thus, treating feed with lignin-attacking enzymes should considerably improve energy utilization. That is particularly true if the feed is low quality roughage.

RESEARCH NEEDED

Research in this area is almost nonexist. But many micro-organisms attack lignin. Since they must undoubtedly do so through enzyme production, research in this direction should be fruitful. Diet components other than lignin and cellulose resist digestion. Enzymes which attack them would also increase utilization efficiency when applied to feeds.

IN SUMMARY

The enzymatic approach to increasing efficiency of energy utilization in feeds shows promise. Feasibility will be determined ultimately by economic considerations. Even in our food-rich society, increased feed efficiency by all domestic animals used for food production is desirable. This would provide the possibility of increased farm income and decreased food cost for consumers.

The problem of surplus agricultural products demands a vigorous fundamental attack. Such an approach requires financial support over a long period of time and the devotion of dedicated chemists, biochemists, and microbiologists. We believe that such a policy would bring a new and thriving chemical industry based on agriculture, and more efficient feeds for animal production.

Poinsettias—

(Continued from page 7)

University, provided shorter poinsettias during the past 2 years.

REGULATOR EFFECT

Untreated plants grew up to three times as tall as plants treated with CCC. Also, foliage of treated plants was a darker green, internodes (the stem between the leaves) were shorter, and stems were sturdier. Plants propagated as early as July 15 and properly treated with CCC developed into specimens of desirable height.

BRACT RESPONSE

Bract response was another story. High application rates sometimes resulted in undesirable crinkling and even crippling of the red bracts. Lower application rates and/or early application controlled plant "stretch" without undesirable bract crinkling.

Diameter of the bract cluster was reduced, as was the open area surrounding the actual flowers in the cluster center. This resulted in a more compact, fuller appearing, attractive cluster. The more compact cluster is less apt to be bruised when wrapped for delivery.

Our studies further indicate that the concentration of CCC solution applied to the soil must vary with application time, variety grown, and degree of height retardation desired. Results may also vary with soil type and other cultural factors.

TREATED PLANTS SUPERIOR

We can now say that use of CCC should enable the grower to produce short, attractive plants with large bract clusters from mid-season cuttings. These plants are superior to late propagated plants because larger bract clusters develop on sturdier plants.

CCC is now commercially available under the trade name Cycocel. Many growers have used it this year. Because further research is necessary, commercial growers were advised to limit the use of CCC to a portion of their crop in 1962. But within a few years exceedingly tall poinsettias should be far less common.

Expansion Plans—

(Continued from page 15)

rent crop and livestock technology, these resources can service a large farm business.

Prices received for livestock and livestock products, of course, largely determine profitability of expanding livestock operations. In this case, we assessed expansion plans with blend prices for grade A milk at $3.70 per cwt. and market hog prices at $15.50 per cwt.

ORGANIZATION POSSIBILITIES

On farms studied, considering alternatives and resources available, we found two farm organizations most profitable:

1. **Stanchion dairy**—30 milk cows, 28 spring farrowed sows, 900 purchased feeder pigs, and 100 acres additional land purchased.
2. **Loose housing dairy**—80 milk cows, 6 spring farrowed sows, 40 purchased feeder pigs, and 40 acres additional land purchased.

The loose housing-milking parlor dairy operation provides about $2,000 more net income than the stanchion barn dairy. With either organization, substantial capital is needed to expand. However, the capital required would return an estimated 10 to 12 percent after covering going-rate interest charges. The stanchion barn organization requires about $42,000 short and long term credit largely to buy land, hog facilities, and hogs. The loose housing dairy needs about $60,000 additional capital largely for land, dairy facilities (including a labor effiicient double-four herringbone parlor), additional silage storage, cows, and concentrate feeds. If additional land is not available, labor would be available for slightly larger livestock enterprises. Also, a larger proportion of concentrate feed supplies would need to be purchased.

STANCHION DAIRY

This farm organization suggests several important points.

First, when good productive cropland is available, it is often more profitable to buy land than to expand the stanchion barn dairy.

Second, a dairy herd of 30 or more cows plus 300 acres of cropland require substantial labor. As a result, an additional low-labor enterprise may be profitable. In this case, fattening lots of 450 spring and 450 fall purchased feeder pigs is suggested.

This organization would require both:

1. A good supply source for feeder pigs.
2. An intensive program of hog management, particularly disease control.

An alternative would be to reduce the cropland purchased and feeder pig fattening and increase sow farrowing, preferably on a multiple farrowing basis.

LOOSE HOUSING DAIRY

This farm organization utilizes labor efficiencies in dairying resulting from increased herd size and specialized housing and milking facilities. The specialized dairy enterprise competes favorably with land purchase as an expansion alternative. It does, however, require substantial dairy management ability and a large, rather specialized building investment. The small hog enterprises utilize available farrowing space and a little spare labor.

Expansion to this dairy enterprise places a high premium on quality dairy cows. Some must be purchased from other dairymen. Production levels and costs on which this organization is based require cows producing 10,000 pounds of milk when fed a 1:4 grain to milk ratio.

OTHER CONSIDERATIONS

Higher milk prices favor dairy expansion while lower milk prices do not. Similarly, better hog prices favor expansion of hog enterprises. On farms where current stanchion dairy barns are small or less adequate, the loose housing dairy setup is an even more profitable route of expanding dairy.

Labor supply, credit availability, and personal preferences often make one expansion route preferable to another. Although expanding the farm business can improve net income, such expansion takes capital and places additional pressure and premium on managerial ability.

Meeting Needs—

(Continued from page 13)

county resources to meet them. Many women with varying training and experience in nursing were discovered. And more than 500 women expressed interest in serving as homemakers for families requiring periodic help.

ACTION TO MEET THE NEEDS

Several actions were undertaken as a result of this survey. A countywide citizens' council was formed to develop and guide programs for the chronically ill and aged. A U. S. Public Health Service grant enables the county to obtain professional help in establishing these programs.

The services of the Minnesota Department of Health, the Governor's Staff on Aging, and the Department of Rural Sociology were extended to the citizens' council.

Several programs are presently being developed in the county. These include:

1. Mobilization and coordination of existing resources to develop out-of-hospital services and activities for the chronically ill and aged.
2. An extension of nursing care to the chronically ill in their own homes. This may alleviate some pressures on the local hospital and reduce the costs of providing health care.
3. Training and assignment of homemakers to assist families beset by illness or elderly couples needing help to remain in their own homes.
4. Development of a referral system between the hospital, doctors, and public health nursing service to help provide home nursing care.

These programs are planned for the near future:

- Establishment of a day center providing activities for senior citizens.
- A friendly visiting service by voluntary organizations for shut-ins.
- Periodic countywide clinics for early detection of health problems.
- Education classes for the retired.

These activities represent Morrison County's action to meet existing aging and health needs in our rapidly changing population. They might well be considered in other communities.

Ham . . . with and without added moisture

W. J. Aunan and Shirley T. Munson

"WATERED HAM," "Imitation Ham," and "Pumped Ham" are terms that were recently in the headlines. Behind the headlines was the controversy of how much added moisture should be allowed by state or federally inspected meat processing plants. Little information is available about the acceptability of hams with and without added moisture. These factors prompted us to do two studies to see if our taste panels preferred high or low moisture hams.

Ten pairs of hams were processed in the first study and 11 in the second. One of a pair of hams from one hog was pumped to 110 percent and the other to 120 percent of green weight with curing solution. Both hams were artery injected with the same curing solution, cured in the same vat, and smoked at the same temperature the same length of time. All were held in polyethylene bags in a chill cooler to prevent weight losses before cooking.

HAM PREPARATION

Hams in both studies were cooked in preheated ovens at 325° F. until internal temperatures reached 160° F., and allowed to set prior to carving. Each panel member tasted samples from the same location within the muscle from each of the paired hams. In the first study one panel scored four hams or two pairs at each setting daily; in the second the other panel scored samples of one pair of hams both in the morning and afternoon.

Persons of various occupations within the University were the panel members in both studies. Three women and three men participated in the first study and four women and one man in the second. The panels were not aware of the design or the assumptions involved in the studies. Members were instructed to taste each sample and note their preference, if any, and check the reason or reasons for their preference.

Table 1. Why taste panel members preferred high or low moisture hams (number who checked each factor), Study I, 1961

	High moisture ham	Low moisture ham	No difference
Texture	16	11	25
Tenderness	19	13	20
Flavor	24	22	6
Juciness	20	8	24
Ham preferred	28	24	.....

In the first study panel members evaluated flavor, tenderness, texture, and juiciness. In the second study they noted their preference and then checked only one of the following: texture, tenderness, flavor, and juiciness. In both studies red lights minimized the effect of color thereby reducing appearance as a factor.

There were no significant differences between high and low moisture hams for any taste factors in the first study (table 1). There was, however, a slight overall preference for higher moisture hams. The taste factor flavor was important in both high and low moisture hams. Some panel members apparently preferred moist hams with less flavor; others preferred less moist hams with more pronounced flavor.

Table 2. Panel members' preference of high and low moisture ham, Study II, 1962

Panel member	High moisture ham	Low moisture ham
A	7	4
B	3	8
C	5	4
D	4	6
E	7	4
Totals	26	26

In the second study the panel as a whole did not prefer one ham over the other—higher or lower moisture content (see table 2). Panel members, with one exception, were rather consistent in their preference. They were about equally divided in their choice of hams with and without added moisture. One panel member preferred both hams the same number of times. Two panel members preferred the higher moisture hams 7 out of 11 times and one panel member preferred the lower moisture ham 8 out of 11 times.

Juiciness was checked most often as a reason for preference of the high moisture hams. Flavor was checked most often under low moisture hams. However in the combined total, flavor was again the most important factor in preference for either the moist or less moist hams (table 3).

Table 3. Number of times taste factors checked for high and low moisture hams

Factors	High moisture	Low moisture	Totals
Texture	2	4	6
Tenderness	3	7	10
Flavor	8	13	21
Juiciness	13	2	15

Panel members varied in their individual tastes, some preferring juiciness in the higher moisture hams and others preferring more flavor. Tenderness was not an important taste factor in preference ratings of either the moist or less moist hams.

It appears from these two studies that taste factors are a matter of an individual's likes and dislikes. Hams of lower moisture content are not necessarily better in flavor. Nor are hams of higher moisture content necessarily more tender.

W. J. Aunan is an associate professor in the Department of Animal Husbandry; Shirley T. Munson is an assistant professor in the Department of Horticulture's Food Processing Laboratory.

Research Shorts

No fish story—For largemouth bass, size of a year's hatch seems to depend largely on how warm the water is and how much the wind blows. But fisheries and wildlife researchers R. H. Krammer and L. L. Smith, Jr., found that eating by other fish and chemical content of the water had no major effect on the number of fish which hatch and survive in a particular year. Size of spawning stock also made little difference.

Krammer and Smith did their study over a 3-year period at Lake George in Anoka County.

New Research Publications

Here's a list of new research publications since the last issue of Minnesota Farm and Home Science. This feature will help keep you up to date on Experiment Station publications.

Sta. Bull. 457. *Alternative Dairy Chore Systems in Loose Housing*. E. I. Fuller and H. R. Jensen.

Sta. Bull. 459. *Profitable Adjustments in Farming in East Central Minnesota*. L. M. Day, W. B. Sundquist, and H. R. Jensen.

Sta. Bull. 461. *Incorporating the Family Farm Business*. R. Beck and P. M. Raup.

Sta. Bull. 462. *Herd Size Effects on Labor for Loose Housing Chore Tasks*. E. I. Fuller and H. R. Jensen.

Misc. Rpt. 48. *University of Minnesota Landscape Arboretum—A Report of Progress*. Horticulture Department.

Misc. Rpt. 49. *Viking Queen—A New Rose*. Robert A. Phillips.

You can get these publications from your county agent or from the Bulletin Room, Coffey Hall, Intsitute of Agriculture, University of Minnesota, St. Paul 1, Minnesota.

Viking Queen, a new introduction by the University of Minnesota Agricultural Experiment Station, is a large, full double pink rose. Blooms are approximately 3 to 4 inches in diameter and are borne in clusters of five or more flowers. Flowering begins in June, with crop after crop of blooms appearing throughout the growing season. Flower color is a clear, medium to deep pink that keeps well for the normal life of the bloom. Petals also persist; they do not shatter and fall quickly after the flower has pased its prime. Foliage of the Viking Queen is a rich, glossy, deep green that appears highly resistant to black spot and mildew diseases. However, plants should be sprayed or dusted periodically with an all-purpose dust or spray recommended for roses.

Viking Queen makes vigorous semi-upright cane growth, thus requiring a supporting pillar or trellis. It is classified as an everblooming climber or pillar rose. New plants will grow 6 feet in one season and many canes develop. The plant has demonstrated unusual hardiness, but should have some protection during winter. Unprotected canes usually die back close to the ground. They make rapid growth in spring and strong floriferous plants develop rapidly. However, flowers start later on new growth than they do on old canes. Both new and old growth produce blooms; flowers are borne on both lateral and terminal growth.

Rose breeding was started at the University's Department of Horticulture in 1939 by L. E. Longley and continued by Robert A. Phillips since 1949. Principal objectives of the rose breeding program are winter hardiness and disease resistance. . . . **Robert A. Phillips**

MINNESOTA FARM AND HOME SCIENCE is published by the University of Minnesota Agricultural Experiment Station. It reports the results of research conducted by the Station, both on the St. Paul Campus and outlying branch stations throughout the state.

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