

MINNESOTA
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Minncurl

A New Parsley Variety

A. E. HUTCHINS

A NEW PARSLEY that several seedsmen and seed growers say has outstanding merit is now being introduced with the name Minncurl.

Most commercial varieties of parsley seem to be variable in their commercial characteristics. With this in mind, selections were made a number of years ago for good market type in the variety Moss Curled and inbred. The Minncurl resulted from six generations of selection and inbreeding.

In comparison, Minncurl is not quite as vigorous as some varieties but is more vigorous than others. It is very uniform in plant size, compact growth habit, and curling. It has a deep green color, a crisp tight curl, a finely cut leaf, a good flavor, and is tender.

The quality, color, curl, and general attractiveness and yield make it suitable for home and commercial production.



Minncurl parsley

A. E. Hutchins is a professor in the Department of Horticulture.

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New Research Publications

Following is 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.

Misc. Rpt. 24 (Revised). *Varietal Trials of Farm Crops*.

Misc. Rpt. 42. *New Chrysanthemum for 1961—Wayzata*.

Misc. Rpt. 43. *Minncurl—A New Parsley*.

Misc. Rpt. 44. *New Fruit Varieties for 1961—The 'Moongold' and 'Sungold' Apricots*.

The following publications will be available within the next month.

Misc. Sta. *A Half Century of Seed Testing*.

Misc. Rpt. 20 (Revised). *Maturity Ratings for Corn Hybrids—1961-62*.

Misc. Rpt. 28 (Revised). *1960 Hybrid Corn Performance Trials*.

Sta. Bul. 452. *Beef from Grasslands*.

You can get these publications from your county agent or from the Bulletin Room, 3 Coffey Hall, Institute of Agriculture, University of Minnesota, St. Paul 1, Minnesota.

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Pre-Emergence Weed Control in Corn and Soybeans

H. J. OTTO and R. BEHRENS

MODERN CHEMICALS OFFER THE FARMER NEW WEAPONS to use in the never-ending battle with weeds. The search for more efficient herbicides is a continuous process in the laboratory and field.

The specifications for weed control chemicals are exacting. They should: Control weeds without damaging the crop or succeeding crops in the rotation, be safe to apply, not accumulate in the crop plant in quantities that might harm humans or animals, and be economical to use. Thousands of chemicals must be screened to find one that approaches these specifications.

Promising herbicides developed by chemical companies are evaluated by the Minnesota Agricultural Experiment Station. Those that appear to be satisfactory in research plots are further evaluated in county demonstration trials. These trials show the performance of the chemicals under many different soil and climatic con-

ditions and allow farmers to observe them in their locality.

Information from the numerous county demonstration trials located throughout the corn and soybean growing areas of the state is invaluable in determining the relative effectiveness of the promising herbicides.

Pre-emergence Herbicides

Practically all of the recently introduced herbicides are applied to the soil after the crop has been planted but before it emerges. Applications made at this time are called pre-emergence applications. All of the compounds used in the county demonstration trials were used as pre-emergence applications.

The effectiveness of chemicals taken into the plant from the soil is more dependent upon soil type and rainfall than where the chemical enters the plant through the foliage. Hence, results are often more erratic with pre-emergence chemicals than with those applied to the foliage. At least 1/2 inch of rainfall is needed within 2 weeks

after application if the chemicals are to be effective.

Pre-emergence applications have the following advantages:

1. The chemical can be applied at planting, thus saving a trip over the field.
2. The first cultivation often can be delayed. This may allow more time for putting up high-quality hay.
3. Early season competition between crops and weeds is reduced.
4. The number of cultivations may be reduced.
5. Weeds in the row can be controlled better than where cultivation is the only means of weed control.

Granular vs. Spray Form of Herbicides

Most of the pre-emergence herbicides are available for application with either a granule applicator or sprayer. Granules are more convenient to apply, but cost somewhat more than liquid or wettable powder forms.

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H. J. Otto is an extension agronomist and R. Behrens is an associate professor in the Department of Agronomy and Plant Genetics.



This corn field was treated with a pre-emergence herbicide in bands over the row. Note the absence of weeds in the row as compared to the untreated, uncultivated areas between the rows. The rows in the upper right-hand corner received no chemical.



House Mouse Control

JAMES R. BEER

Control of house mice depends upon the elimination of nesting and hiding places and on a continuous poisoning program. Anticoagulant poisons should be kept in permanent poison stations at all times. The poison material should be checked at frequent intervals to make sure that the supply is adequate and to remove any material that has become moldy.

EVERY YEAR, HOUSE MICE cause considerable losses due to chewed sacks and contamination of grain. A recent study showed that about 17 percent of the stored grain in this region contains one or more mouse droppings per pint of grain. Grain containing two or more droppings per pint is usually considered unfit for human consumption—so must be sold at a lower price.

The house mouse has come to live with, depend upon, and travel with man. In traveling with man it has come to and established itself in nearly every country in the world and in nearly every permanent community in Minnesota.

We can divide the house mouse populations into two types: the first, and most important, is the mice living in and about buildings and the second is the animals found in the fields. In contrast to the more southerly states, Minnesota with its long, cold winters has few if any permanent, self-perpetuating field populations.

A house mouse population will develop with an available food supply and nesting and escape cover. The maximum number of mice in an area is controlled by these factors up to the point where the mice become so abundant that their fighting prevents the females from giving proper care to the young, and the maturing mice are driven out.

James R. Beer is an associate professor in the Department of Entomology and Economic Zoology.

The home range, or area that an animal travels in during feeding and other daily activities, partly determines the amount of contact between mice and thus the amount of fighting that takes place. The normal home range of the house mouse is usually smaller than that of most other mice.

In one of our studies we trapped and marked a large number of live mice. Of these, 329 were handled five or more times. The average greatest distance traveled between points of capture was about 40 feet. A few mice were observed to travel greater distances than this but it appeared that these greater distances were due to human disturbances in the buildings. Other workers have estimated home ranges for house mice to average from 12 to 20 feet across. The differences in home range sizes reported appear to be controlled by the amount of and distribution of escape cover and food.

The usual population pattern for house mice is for a pregnant female or a male and female to arrive at a set of buildings. If there is suitable cover and food they will settle down; if not, they will probably continue to move until they find a place they like.

They will produce a litter and as the young mature, they are forced to leave the vicinity of the nest. They usually establish themselves in other parts of the building. This continues until all suitable areas are occupied by mice. This often means that there are several hundred mice in a single barn or elevator. After this point is

reached the sub-adult mice are forced to leave the building to find an area in which they can establish themselves. During the warmer parts of the year they often will make their homes in the fields, in hay or straw stacks, rubbish areas, and even in fence rows.

In these wanderings they often move considerable distances. One mouse was retaken a mile and another three quarters of a mile from the building in which they were born. It is probable that house mice, when hunting for a new home, often travel distances a lot greater than this.

The house mice, unlike most native rodents, breed throughout the year. The females start to breed when not much over half-grown and proceed to produce litters at the rate of several a year until death. The number of young born in each litter averages between 5 and 6. From this it is easy to see that house mouse populations build up very rapidly when the conditions are favorable. Although the house mouse breeds throughout the year the rate of survival of the young during the winter in unheated buildings and in unprotected areas is quite low.

The house mice are found most commonly in and around buildings where there is an adequate food supply. The types of foods they will eat are quite varied. They may depend on stored food in houses, stored grains in elevators and bins, or stored livestock feed or feed left in the troughs and mangers. They may also eat weed seeds and grain in hay. House mice living in fields usually depend upon grain in the field but also do fairly well on weed and grass seeds in fence rows and waste areas.

Often during the early fall there are many house mice in the fields as well as around buildings. With the coming of cold weather many of these

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MINNESOTA FARM AND HOME SCIENCE

Tree Planting Under the Soil Bank Act

RICHARD A. SKOK and ROBERT BENSON

TREE PLANTING has been one of the options available to farm owners retiring land under the Soil Bank Act of 1956. Among the alternatives offered, this practice is one of the most permanent forms of land retirement.

Farmers contracting land for tree planting received a 10-year contract with annual rental payments of generally \$10 per acre. For at least 10 years, this land is removed from crop production. After that period, land clearing would be difficult and expensive, reducing the tendency to return these lands to annual farm crops.

In the fall of 1959 the School of Forestry conducted a study of the people, the institutions, and the land affected by the tree practice option of this Act. Who elected to plant their lands to trees rather than legumes? Were adequate provisions made to provide the technical advice and planting stock this program required? What will be the future of plantations established through the Soil Bank? These were some of the questions we attempted to answer for a 20-county area in central Minnesota (figure 1).

Tree Practice Participation

About 27,000 acres of cropland in Minnesota were entered under tree practice contracts from 1956-1960. The average contract was for 32 acres or for about 25 percent of the acreage of the farm concerned.

Tree practice contracts were provided to 405 farm owners in the area studied. About three-fourths of this group reported they had to delay planting of contract acreage for at least 1 year. The lack of planting stock was the cause of such delays by 9 out of 10 contract holders.

The federal government provided funds for the expansion of state nursery production to meet increased

Richard A. Skok is an assistant professor and Robert Benson was a research assistant in the School of Forestry.

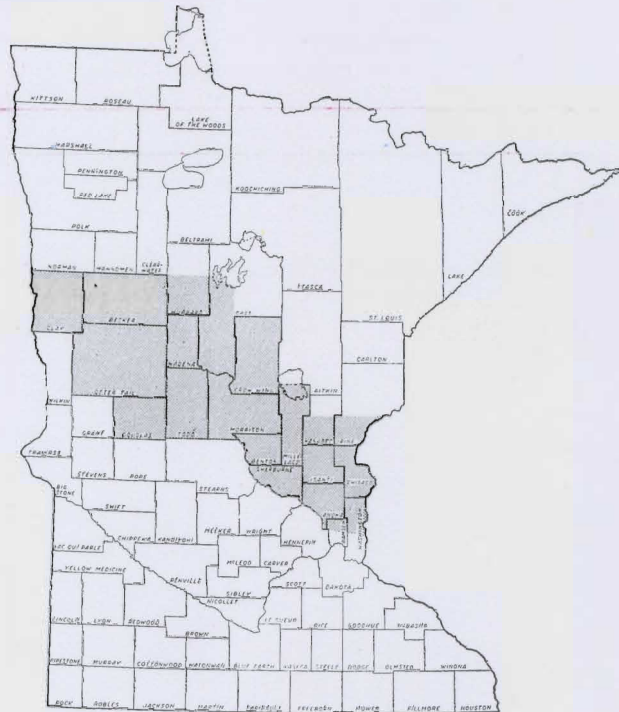


Fig. 1. The shaded section is the area that was studied for the tree contract participation.

needs resulting from the Soil Bank program. Because seedlings for planting require at least 2 years to grow, a time lag between fund availability and more seedlings resulted. However, indications are that this shortage of seedlings will be overcome by the spring of 1961 and all 27,000 acres under contract will have then been planted.

The forced spreading of plantings over a period of years on Soil Bank lands had an advantage. By doing this, the risk of large planting losses due to drought was materially reduced.

It is probable that early experience with planting stock shortages reduced the use of the tree practice option. In the first 1 million acres of cropland entered under the Soil Bank in Minnesota, about 20,000 acres were tree practice lands. In the second million acres, this option dropped to 5,000 acres. This was unfortunate because of the effectiveness of this land-use choice in retiring farm acres for long periods.

Participants and Their Farms

Participants were generally farm owners who had other woodlands (58 percent) and recognized the benefits they obtained from such land-use. The average non-Soil Bank woodland holdings of these owners was 72 acres.

The typical tree contract farm had been owned by the participant for 10 years. From 1956 to 1958, farms were frequently purchased for entry under the tree practice option. By 1959 such activity almost stopped and is no longer authorized.

No major change in residence for tree practice participants was found. The table compares the pre- and post-Soil Bank entry status of these owners. Thus the choice of the tree planting option did not lead to net increases in the nonresident ownership in the area studied.

Most farm owners choosing tree practices relied on a nonfarming occupation as their primary income

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Biology of BARLEY LOOSE SMUT

Determines Its Control Measures

D. L. MUMFORD and K. D. FEZER

THE LOOSE SMUT DISEASE causes severe losses of barley every year in Minnesota. It was unusually severe in 1959, with 6-7 percent of the barley crop destroyed (30 percent in some fields). This is an estimated loss to Minnesota growers of over \$1,500,000. The loss in 1960 was about \$500,000 or about half of what would have been lost if control measures had not been introduced.

The disease is caused by a small parasitic fungus that lives most of its life inside barley plants. Control of this disease depends to a great extent on knowledge of (1) the life history of the fungus, (2) the environmental conditions that influence development of the disease, and (3) the occurrence of different parasitic types (races) of the fungus, and the ability of some barley varieties to resist the fungus.

Life History of the Fungus

Tiny spores (fungus seeds) are produced in smutted heads (see the figure) and are carried by wind or rain into the flowers of healthy barley plants at the time of heading. The spores germinate and the smut fungus grows into the embryo (germ) of the developing grain where it remains.

When infected barley seed is planted and begins to grow the smut fungus grows with the plant. Instead of producing grain, the heads of infected plants become a black mass of spores. If conditions are favorable, the spores are then spread to the flowers of nearby healthy plants and the cycle is repeated.

The disease can be controlled either by killing the fungus in the seed or by planting seed that is free of the fungus. Since the fungus is inside the seed it cannot be controlled by ordinary chemical seed treatment. Semi-loose smut of barley (distinguishable from loose smut only by a laboratory test) and covered smut (figure)—can



Left to right: The first two heads are infected with loose smut, the second one with the spores blown away. The next head is infected with covered smut and the last one is a healthy head.

A smutted head may produce over 1 billion spores, more than 300 times the number of people in Minnesota.

be controlled by chemical seed treatment. True loose smut, however, can be killed in the seed only by either of two methods.

The first is to immerse pre-soaked seed in water just hot enough to kill the smut fungus but not the seed.

The second is to place the pre-soaked seed in an anaerobic (low-oxygen) atmosphere long enough to kill the smut fungus without injuring the seed. This has been accomplished by putting seed in airtight containers or immersing it in a salt solution.

These methods require careful attention, are bothersome to use, and sometimes reduce germination and yield. They are, therefore, not recommended for routine use by the grower. Such treatments are, however, often used in seed increase and certification programs.

Until recently barley seed with loose smut infection could be identified only by growing the plants to heading. Now methods have been developed for detecting the percentage

of infection by removing and examining barley embryos for presence of the fungus.

The percentage loss in yield that will result from planting infected seed will usually be about the same as the percentage of infection in the seeds planted. A small sample from a seedlot is embryo tested and if a very low percentage of the embryos are infected the seedlot is considered safe for planting. More than 700 seedlots intended for planting in 1960 were tested at the University of Minnesota during the winter of 1959-60.

Factors Influencing Disease Development

The percentage of plants infected with loose smut in barley fields is influenced by environmental conditions at two different times—at the time when the young embryos become infected and during the growth of plants derived from infected seeds. The loose smut fungus can only infect the young embryos of the seeds at the time when the flowers are pollinated. Cool, moist weather during this period favors infection and hot, dry weather limits it. Therefore, the percentage of loose smut in a seed lot of barley may be much higher or much lower than the percentage of smutted heads in the field in which the seed was produced.

Generally the percentage of smutted plants in the field is about the same as the percentage of infected embryos in the seed used for planting that field. Recent studies at St. Paul, however, indicate that environmental conditions that reduce seedling emergence also sometimes reduce the percentage of infected plants by as much as 50 percent.

Resistance to the Loose Smut Fungus

Some barley varieties are more resistant to loose smut than others. Unfortunately these resistant varieties

(Continued on page 13)

D. L. Mumford is a research fellow and K. D. Fezer is an assistant professor in the Department of Plant Pathology and Botany.

Transportation Changes Affect Grain Marketing

REYNOLD P. DAHL and JOHN D. HYSLOP

THE RAILROADS HAVE BEEN THE MOST IMPORTANT CARRIERS of grain for many years. In recent years, however, there has been increased competition from trucks and water carriers. Changes in transportation technology and rates have an important impact on the location and type of grain marketing facilities.

The table shows the gains made by trucks and water carriers from 1954 to 1959. Rail receipts of grain at Minneapolis-St. Paul and Duluth-Superior remained almost constant during this period.

Truck receipts of grain at Duluth-Superior increased from less than 1 million bushels in 1954 to 23 million bushels in 1959. At Minneapolis-St. Paul the increase was over eight-fold, from less than 6 million bushels in 1954 to over 49 million in 1958.

Water transportation which applies to outbound shipments has become more important. Lake shipments from Duluth-Superior increased from 100 million bushels in 1954 to 140 million bushels in 1959. Barge shipments of grain increased from 9 million bushels in 1954 to 29 million bushels in 1958.

These changes have resulted largely from lower rates charged by trucks and water carriers. Rail rates on grain doubled from 1946 to 1958. Rates charged by other carriers also increased but by lesser amounts. Hence, truck and water transportation became more economical to grain firms. The increases by the railroads were applied to a rate structure on grain which was established when the railroads had little competition from other carriers.

The Railroad Grain Rate Structure

This rate structure is extremely complex. It is based more on the value of the commodity rather than on the costs of providing the service. It is also designed to make transportation

Reynold P. Dahl is an associate professor and John D. Hyslop is a research assistant in the Department of Agricultural Economics.

Grain movements to and from major Minnesota markets

	1954	1955	1956	1957	1958	1959
millions of bushels						
Duluth-Superior						
<i>Inbound</i>						
Rail	122	114	130	117	118	134
Truck	1	*	*	1	5	23
<i>Outbound</i>						
Rail	27	26	25	34	28	25
Lake	100	101	112	89	91	140
Minneapolis-St. Paul						
<i>Inbound</i>						
Rail	277	291	291	306	298	†
Truck	6	19	18	37	49	†
<i>Outbound</i>						
Rail	165	173	152	177	155	†
Barge	9	17	15	23	29	†

* Less than 500,000 bushels.

† Data not available.

costs among competing markets and firms uniform.

A main feature of the rate structure is the so-called transit privilege. This allows grain to be halted for storage or milling at an intermediate point between the origin and the final destination. This service is provided without additional charges to the shipper. The total freight rate paid is the same as the through rate from origin to final destination.

As long as railroads had little competition in grain traffic, this system worked well. Since grains have a relatively high value they could stand high overall rates which covered the cost of providing the transit service.

The loss of grain shipments to trucks in recent years has forced selective rail-rate reductions. In 1958 and 1959 rates on coarse grains were lowered. Perhaps a more significant development was the lower rates established on wheat, rye, and flaxseed in April 1960 from country points to Duluth and Minneapolis. Grain moving under the reduced rate cannot be stopped for milling in transit and cannot move by rail beyond these markets except at high rates.

These adjustments indicate that the basic railroad rate structure is being

challenged. Cost considerations may become more important as a basis for rate making.

Technological advances in transportation and changes in the rail-rate structure affect the location of firms in the grain industry. Firms which have located with respect to the traditional rail-rate structure may be under increasing pressure to seek lower cost transportation locations.

If cost considerations result in lower rates on grain than on grain products, processing facilities may be located closer to consuming centers than to grain producing areas.

Buffalo, New York replaced Minneapolis as the major flour milling city largely because of its advantageous location with respect to water transportation.

More recently, the growth of the broiler industry in southeastern United States has been aided by the availability of low-cost barge transportation for shipping feed grains into that area.

The transit privilege is important to flour millers in Minneapolis. If this rate privilege is abandoned by the railroads, it could mean that mills in this area would be limited largely to production for local markets.

Watersheds —

A Coordinated Approach to Water Problems

CURTIS L. LARSON

WATER PROBLEMS IN MINNESOTA, until recently, have been attacked mainly with a single-purpose approach. Farmers have installed tile systems and ditches to relieve drainage problems. They have built waterways, terraces, ponds, and used other soil and water conservation practices mainly to conserve soil and water. Cities and towns have drilled more wells or diverted more water from streams to keep pace with their growing water needs. The state has built dams to control lake levels and has purchased wetland areas for duck breeding and hunting.

All of these activities are essential to the groups concerned and beneficial to the state as a whole. However, solving one water problem often leaves other water problems of the area uncared for, perhaps permanently. Conflicts sometimes develop, in some cases due to lack of consideration for other problems.

The watershed approach to water problems, however, shows great promise because a coordinated or multi-purpose solution of our water problems becomes possible. By proper planning and cooperation, the above activities can complement each other rather than interfere. An overall program is not only more effective but more economical, and certainly a happier solution for everyone.

Curtis L. Larson is an associate professor in the Department of Agricultural Engineering.

Another water problem is flooding. Floods are not frequent, but even occasional flooding can be serious. Along with a flood we often have severe erosion on the farm lands of the watershed and sediment damage to areas downstream. In flood control, especially for small watersheds, the coordinated or watershed approach is almost essential. Hence the need for flood control serves as a unifying force through which other water problems are being solved.

Flood Control Methods

In recent years, flood control principles and methods have been adapted to small watersheds. As with large watersheds, there are several methods of reducing flooding and flood damage.

One common method of reducing the area flooded is **channel improvement**. This includes deepening, widening, and straightening of the main channel. These changes increase the capacity of the channel, thereby reducing the amount of land flooded. Natural channels are often very small especially in flat portions of the state. Channel improvement is therefore an effective and often economical way of reducing flooding in such areas.

Another important method is building **detention reservoirs** to store floodwater and release it gradually. If possible, the spillway or outlet of a de-

tection reservoir is designed for a release rate or outflow that will stay within the banks of the channel below the reservoir. The greater the volume of storage capacity in the reservoir, the more one can reduce the flow downstream.

Suitable reservoir sites are not always available where needed. In some parts of the state the land is so flat that there are no reservoir sites. In the rolling areas there are plenty of dam sites, but we sometimes find that a relatively high and expensive dam is needed to obtain a small amount of storage. Gently rolling land, where a low dam will create a large reservoir, is best for this purpose.

To provide protection from flooding by using detention reservoirs alone, usually 25 to 40 percent of the watershed area must be tributary to the reservoirs. This is most effective and economical if done with a few good-sized reservoirs located just above the damage areas. Dozens of smaller reservoirs or farm ponds in the headwaters will not do the job.

Detention should be used where possible since it reduces flood flows, while channel improvement does not. In many cases the best solution for small watersheds is a combination of detention and channel improvement. With detention reservoirs delaying the flow from the upper portions of the watershed, the amount of channel improvement in the lower portion can be reduced considerably.

Some additional methods of reducing flood damage are **levees** and **flood plain zoning**. Levees are best suited to protecting small, high value areas such as urban areas or farmsteads. Flood plain zoning is simply zoning to prohibit building and other high value uses within flood plains. It does not prevent flooding, but is a simple way of preventing large flood damages.

Whether flood control is by detention or channel improvement, the erosion and sediment problem must be controlled. Sediment deposits in channels reduce their capacity to carry away floodwater. Sediment deposits also destroy the storage capacity of both natural lakes and reservoirs. Thus, controlling soil erosion, the source of most sediment, is an essential part of a sound flood control program.

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This is an air view of the detention dam and conservation practices in the East Willow Watershed Project in Fillmore County. The reservoir will store 202 acre-feet of floodwater, or 1.2 inches of runoff from the 1,980-acre watershed. The dam is 32 feet high and reduces the flood flow 71 percent.

How Productive Are Minnesota Soils?

R. H. RUST and J. E. FOSS

HOW PRODUCTIVE ARE THE VARIED SOILS of Minnesota? How do they respond to various practices in soil and crop management used by the farm operator? Can they be made equally productive? These, and other questions related to soil productivity, are asked by farm operators, prospective land buyers, lending agencies, fertilizer dealers, and the various technical people serving the farmer.

To answer these questions the results of experimental work at the several experiment stations are related to as many soils as seems appropriate. These results, however, do not provide information for many of the soils and cropping practices occurring on many Minnesota farms. In 1956 the Department of Soil Science in cooperation with the Soil Conservation Service and the Agricultural Extension Service began collecting crop yield and soil management information from fields located on the more extensive soil series. About 75 soils were initially selected.

At present about 300 farmers have provided detailed information on

Table 1. Averaged results of pH, O.M., P, and K tests by the Soil Testing Laboratory for soils where 10 or more fields are under study, tests are of plow layer

Soil*	pH	Organic	P	K
		matter percent		
Aastad	6.9	5.1	18	270
Barnes	7.0	4.5	14	255
Clarion	6.3	4.1	21	200
Estherville	5.8	3.9	58	155
Fargo	7.2	5.3	18	280
Fayette	†	2.2	40	185
Hayden	6.2	2.5	34	180
Hubbard	5.7	2.4	50	155
Lester	6.3	3.8	32	230
Nicollet	6.4	5.0	38	245
Waukegan	6.0	4.0	32	170
Waukon	7.2	5.1	22	225
Webster	7.0	6.0	23	205

* For location of soil series, see Ext. Bul. 278, *Soils of Minnesota*.

† Insufficient unlimed fields to establish value.

R. H. Rust is an assistant professor and J. E. Foss was a research assistant in the Department of Soil Science.

Table 2. Soils, crops, and per acre yields where six or more records have been received in the productivity study, 1956-59

Soil	Crop	Yield per acre
		bushels or tons
Barnes	Corn	57
	Soybeans	22
	Oats	63
Clarion	Corn	73
	Oats	61
	Alfalfa-Brome	3.4 tons
Hayden	Corn	95
	Oats	52
	Alfalfa	2.7 tons
Hubbard*	Corn	78
	Soybeans	20
Nicollet	Corn	81
Waukegan	Corn	85
Webster	Corn	84
	Soybeans	20
	Oats	59
	Alfalfa-Brome	2.9 tons

* In areas of about 100 to 105 days' corn maturity.

about 500 fields. This includes data on crop variety and planting date, stand, soil amendments used, chemical controls for weeds and insects, date of harvest, total yield, losses from various factors, rainfall records, and certain tillage practices. A soil test is made of each field at a rate of one sample for about 10 acres.

The data in table 1 indicate the results of the soil tests for pH, organic matter, and available P and K made at the beginning of the record. The tests are repeated every 4 years to establish fertility level changes.

A major objective of the study is to collect enough data on each soil series (to make a correlation analysis, that is) to establish the relationship between yield and the various soil and crop management factors which

can be quantitatively expressed. In addition, to evaluate the effect of weather on crop yields it is necessary to include a number of years (probably 5 to 10) so that a range of weather conditions can be studied. Though this objective has not been fully realized, we can give some preliminary observations.

The data in table 2 are the average yields of selected crops on soils where we have received six or more records.

Since it has not been possible to express these yields on the basis of comparable soil management practices, the figures should not be used to indicate the relative productivity of the listed soils. However, the yields partially indicate the level of yields attained by some farmers. The average of all corn yields currently reported in the study is 76 bushels per acre, compared to the state average of 54 bushels for the years 1956-59.

Examples of the extent of soil amendments used are shown in table 3. The figures for N include, in some records, an estimate of N contributed from a preceding legume crop.

A 3-year history of crops preceding the one under study is also recorded. The following "average" cropping sequences on similar soils are apparent:

- on level, dark-colored, medium to fine textured soils R-R-R-G-M (R = row crop; G = small grain; M = hay or pasture)
- on gently rolling, dark-colored, medium textured soils R-R-R-G-M and R-R-G-M
- on rolling, dark-colored, medium textured soils R-R-G-M
- on rolling, light-colored, medium textured soils R-R-G-M-M-M and R-G-M-M
- on level, dark-colored, medium to coarse-textured soils R-R-G-M

(Continued on page 19)

Table 3. Selected crops and the reported amounts of N, P, and K used. The two-thirds range indicates that about two of three cooperators will use these amounts

Crop	Average	Two-thirds	Average	Two-thirds	Average	Two-thirds
	N used	range	P ₂ O ₅ used	range	K ₂ O used	range
	pounds per acre					
Corn	68	15-120	43	10-75	51	10-95
Oats	18	0-45	17	0-45	23	0-50
Soybeans			7	0-25	13	0-50
Alfalfa			24	0-60	23	0-60



from Can Handling Milk to

Will A Dairyman Make the Change?

RONALD G. KLIETSCH, GEORGE DONOHUE, and MARVIN TAVES

Findings

At present, there is mounting evidence that the age of the operator, the size of the farming operation, the level of education, and community participation are highly associated with adoption of new farm practices.

Of course, different farm practices have different considerations influencing a decision. This study involves a practice requiring a large investment, so the farmer has to evaluate the alternatives before he can make a decision.

Family Factors

Since the farm has traditionally been a family operation, there has been a lot of speculation about the role of the family in decisions. The analyses reveal that although there were older children in the rejector's family who might serve as a labor supply rather than the capital investment of a bulk tank, rejectors did not differ from acceptors in this particular item.

However, acceptors tended to have smaller families and younger children than did rejectors. The factor of having more sons than daughters was not found to be significantly related to acceptance. In fact, more rejectors than acceptors had two sons and more acceptors than rejectors had two daughters. In this instance, then, adoption does not appear to be related to any traditional "father-son" arrangement in dairying.

Further, we found that more rejectors than acceptors had some children at home, while more acceptors than rejectors had no children living at home. On the basis of this, it appears that acceptors are in an earlier stage of family development than rejectors and have fewer and younger children, but not more resident children, than rejectors.

These findings are further related with age—acceptors were younger on the average. The average age of acceptors was slightly more than 41 year while that of the rejectors was slightly more than 47 years. A greater

number of acceptors were between the ages of 30 and 34, while more rejectors were in their 60's—possibly near retirement. Such an age difference would be very important in accepting a practice, such as bulk tank handling, since it takes some time to pay for the investment.

As the above findings show, the traditional father-son farming relationship did not appear. Older farmers, then, have little interest in making a long-range investment for one of the sons who may wish to take over the farm.

Farming Operations

The assumed relationship between size of herd and acceptance of new practices was found to valid. Acceptors have significantly larger herds than rejectors, usually over 20 cows, while a greater number of rejectors had herds of less than 20. Acceptors also operated a greater number of acres than rejectors, between 130 to 219 acres, while a greater number of rejectors operated less than 100 acres.

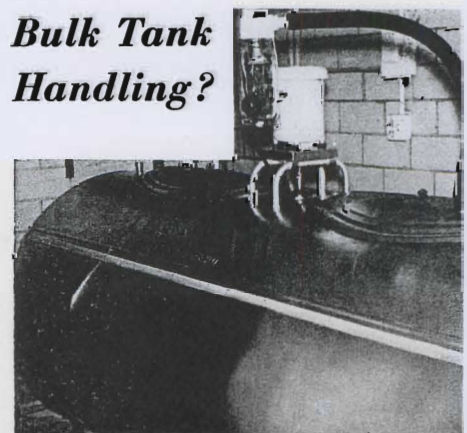
While acceptors owned more land than did rejectors, the extent of land rental was almost identical for both groups.

One would expect that those who accepted bulk tank handling might have a favorable estimate of existing dairy conditions for the future. However, acceptors did not say if their choice of adoption was related to present or future good conditions in dairying. Neither did rejectors base their rejection upon present or future bad conditions in dairying.

Acceptors closely resembled rejectors in regard to retirement plans, but

(Continued on pages 16 and 17)

Bulk Tank Handling?



What determines who adopts a new farm practice and who does not?

We recently conducted a study along this line in a north-central Minnesota county. This study involves dairy farms in the process of changing from can handling of milk to bulk tank handling. We want to answer the following questions:

1. What are acceptors and rejectors like, and how do they differ?
2. What considerations are involved in decision making and can decision making be predicted?
3. Are there different types of decision makers, and if so how do they differ from one another?

This article reports the findings of the first question—that is, are acceptors any different from rejectors in characteristics such as age, education, type of farm, size of family, nationality, or other characteristics?

Sample

Farm operators were selected from four separate creameries and grouped on a basis of the size of their dairy operations—large, medium, or small. The dairy farmers came to a central place where they were interviewed by a University of Minnesota team. Of the 195 farm operators interviewed, 66 classified themselves as acceptors and 129 as rejectors.

Ronald G. Klietsch is an assistant extension rural sociologist, George Donohue is an extension rural sociologist, and Marvin Taves is an associate professor and director in rural sociology.

BARLEY — An Excellent Ration for Growing-Finishing Swine

DIEDRICH REIMER and R. J. MEADE

BARLEY IS AN EXCELLENT FEED for growing-finishing swine. Pelleting of complete barley rations greatly improves the feeding value—as shown by more rapid and efficient gains.

Barley is higher in protein than corn, so less protein supplement is necessary. The protein supplement must be one that is relatively high in lysine, the most limiting essential amino acid in barley. Special attention must also be given to the mineral and vitamin A content of the supplement. Barley contains practically no vitamin A activity.

Pelleting of barley rations resulted in an average saving of 52 pounds of feed per 100 pounds of gain in initial studies at the Northwest Experiment Station, Crookston.

Results of a later study showed that pelleted barley rations were equal to a complete ration based on yellow corn for growing-finishing swine (table 1). In this test, pigs fed pelleted barley rations with soybean meal as the sole source of supplemental protein gained nearly as rapidly and efficiently as did pigs fed rations containing a mixture of soybean meal and fish meal as the source of supplemental protein.

The 7-percent increase in daily gains of pigs fed the ration containing fish meal may have been due to this protein being a better source of lysine than soybean meal.

The fourth group in the test was fed a pelleted barley ration in which meat and bone scraps and blood meal supplied the supplemental protein. This popular mixture has been used for several years. Pigs fed this 13-percent protein ration throughout the entire feeding period also gained as rapidly as the pigs fed the corn ration. However, they required about 10 percent more feed per unit of gain than did pigs on any other treatment.

A subsequent test was conducted to compare bloodmeal, tankage, and fish

meal as a part of the supplemental protein, along with soybean meal, in pelleted barley rations. The practice of feeding 14-percent protein rations throughout the growing-finishing period was compared with that of feeding 16-percent protein rations until the pigs weighed 100 pounds, then 13-percent protein thereafter.

Rations of either protein level sequence were not improved by replacing a part of the soybean meal with blood meal, tankage, or fish meal (table 2). The pigs fed rations based on barley and soybean meal were the most efficient in converting feed to

pork in all instances. Pigs fed the 14-percent protein rations throughout the entire feeding period gained just as rapidly and efficiently as did pigs given rations containing more protein until they weighed 100 pounds, then less thereafter.

Growing-finishing pigs make rapid and efficient gains when fed pelleted barley rations containing adequate protein, minerals, and vitamins—particularly vitamin A. Excellent results have been obtained when soybean meal supplied 60 percent or more of the supplemental protein in barley rations.

Table 1. Rate and efficiency of gain of pigs fed nonpelleted corn or pelleted barley rations

Ration comparisons*	Corn + Soybean meal	Barley + Soybean meal	Barley + Soybean meal + Fish meal	Barley + Meat and bone scraps + Blood meal
Percent protein fed				
Start to 100 lbs.	15	15	15	13
100 lbs. to market weight	11	13	13	13
Number of pigs	27	29	28	29
Average initial weight, lbs.	41	41	41	41
Average daily gain, lbs.	1.58	1.58	1.70	1.57
Feed per 100 lbs. gain, lbs.	359	366	365	400

* The corn ration was a complete mixture. All rations were supplemented with vitamins and minerals.

Table 2. Influence of source of supplemental protein and level of protein on rate and efficiency of gain of pigs fed pelleted barley rations

	Protein supplements in rations			
Soybean meal	+	+	+	+
Blood meal		+		
Tankage			+	
Fish meal				+
Protein level: 14 percent throughout feeding period				
Number of pigs	20	20	20	20
Average initial weight, lbs.	50	47	47	48
Average daily gain, lbs.	1.62	1.59	1.66	1.63
Feed per 100 lbs. gain, lbs.	355	374	377	358
Protein level: 16 percent-weaning to 100 pounds, 13 percent thereafter				
Number of pigs	20	20	20	20
Average initial weight, lbs.	48	49	49	51
Average daily gain, lbs.	1.66	1.59	1.57	1.69
Feed per 100 lbs. gain, lbs.	350	374	366	376

Diedrich Reimer is an assistant professor and animal husbandman at the Northwest Experiment Station and R. J. Meade is a professor in the Department of Animal Husbandry.

MORE PROTEIN FROM OAT ACRES

R. G. ROBINSON

Crop surpluses and the cost-price squeeze on farm income are two major problems facing agriculture. Research reported in this article suggests the partial replacement of purchased protein and nitrogen with farm-raised products.

PROTEIN FEEDS ARE EXPENSIVE — carbohydrate or energy feeds are relatively cheap. Minnesota farmers raising oats for feed should consider raising oat+pea mixture as a crop of higher protein yield per acre and a feed of higher protein content.

Oat+pea mixtures have never occupied a large acreage because of the high cost of pea seed, difficulty in harvesting the crop, and questionable advantage over oats alone. Now that field machinery is available to cut and chop standing crops for silage or soilage, the problem of badly lodged and twining vines is no longer serious. Likewise the mixed grain can be harvested for feed or seed by windrowing and combining.

Oats+Legume Mixtures

Some oats are raised for silage and some for feed grain. What can be gained by replacing this oat acreage with oat+pea or oat+vetch mixtures? To answer this question for southern Minnesota, replicated trials were conducted for 4 years on sandy soil in Anoka County, on silt loam soil at Rosemount, and on loam to clay loam soils in southwestern Minnesota.

Rodney oats, Garry oats, Chancellor peas, and hairy vetch were the varieties used. Oat seed was treated with Ceresan M and pea seed with Spergon for control of seed-borne diseases. The seeds were mixed and at planting time the mixtures were inoculated to supply bacteria for nitrogen fixation. Oat+pea or oat+vetch mixtures pass through a grain drill satisfactorily.

R. G. Robinson is an associate professor in the Department of Agronomy and Plant Genetics.

Results applicable to silage use of the crops are shown in table 1. Both mixtures produced more forage per acre than did oats alone on sandy land in Anoka County, about the same as oats alone at Rosemount, and less than oats alone in southwestern Minnesota. At all locations, both mixtures contained more protein and yielded more protein per acre than did oats alone.

Oats+vetch forage was consistently higher in water content than the other crops because vetch is indeterminate in maturity and was still blooming

and growing vigorously when the other crops were ripe.

It should be noted that oat+pea forage contained an average of 29 percent more protein than did oat forage. This additional protein content, 2.4 percent, may enable some livestock producers to reduce their purchases of commercial protein supplements and still maintain high production.

Only half of each plot was harvested at silage stage; seed yields were obtained from the other half when both peas and oats were mature. The seed yield data reported in table 2 show that oats+peas was high in total seed yield in Anoka County but below oats alone at Rosemount and southwestern Minnesota. Oats+peas produced more protein per acre than did oats or oats+vetch. Oat

(Continued on page 19)

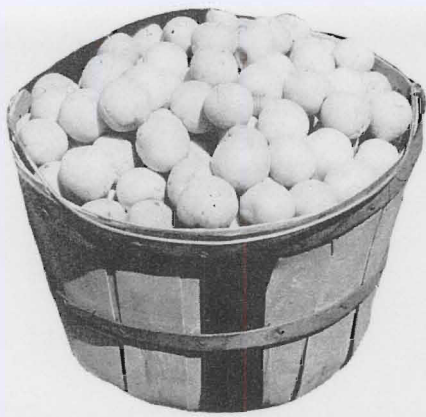
Table 1. Average moisture contents, protein contents, yields, and protein yields of forage from oats, oats+peas, and oats+vetch in southern Minnesota, 1954-57

Sowing rates per acre	Moisture content	Protein content*	Forage yield* per acre				Protein yield* per acre				
			Anoka County	Rosemount	SW Minn.	Average	Anoka County	Rosemount	SW Minn.	Average	
pounds	percent										
Oats 80	67	8.4	2,903	7,249	5,513	5,222	214	677	432	441	
Oats 48+peas 90	68	10.8	3,869	7,314	5,084	5,422	428	794	549	590	
Oats 64+vetch 20	71	10.2	3,519	7,034	5,342	5,298	394	734	466	531	

* Adjusted to a 15-percent moisture basis.

Table 2. Average yields per acre of oat seed, legume seed, total seed, and seed protein harvested from oats, oats+peas, and oats+vetch in southern Minnesota, 1954-57

Sowing rates per acre	Oats yield	Legume yield	Total seed yield				Protein yield
			Anoka County	Rosemount	SW Minn.	Average	
pounds							pounds
Oats 80	1,660	0	1,220	2,236	1,600	1,685	224
Oats 48+peas 90	926	599	1,529	1,907	1,230	1,555	286
Oats 64+vetch 20	1,438	68	1,188	1,930	1,485	1,537	223



Moongold apricot—the earlier of the two varieties.

THE 'MOONGOLD' AND 'SUNGOLD' APRICOTS are new varieties intended for the Minnesota climate. They were developed at the University of Minnesota Fruit Breeding Farm, where they have produced heavy crops of attractive, golden, free-stone fruits. They are juicy and pleasant for eating fresh, highly desirable for jam or preserves, and also suitable for canning as sauce. The fruits are only medium in size—smaller than the commercial fruits that are shipped into Minnesota markets.

The Moongold and Sungold apricots, as home-grown fruits, can be tree-ripened, an advantage that is aided by their habit of hanging well on the tree until they have matured.

The trees have been very hardy and resistant to disease. They are about as large as plum trees, a good size for the home garden. They are neat and attractive—especially in early spring when they are covered with pink blossoms, in late July and early August when the golden fruit contrasts with the green leaves, and in September and October when the foliage often takes on a brilliant autumn color.

Moongold is the earlier of the two varieties. As the name suggests, the fruit is a soft golden color. It is chubby and broader than it is long. The flavor is sweet and sprightly. The trees are rather spreading in habit.

The other variety, Sungold, has a bright, clear, golden orange color. It is slightly longer than broad and, because it is somewhat compressed laterally, it appears relatively narrower from the side. The flavor is sweet and very mild. The trees are more upright in habit.

A. N. Wilcox is a professor in the Department of Horticulture, T. S. Weir is assistant superintendent of the Fruit Breeding Farm, and Shirley Trantanello is an instructor in the Food Processing Laboratory.

New Fruit Varieties for 1961

The 'Moongold' and 'Sungold' Apricots

A. N. WILCOX, T. S. WEIR, and SHIRLEY TRANTANELLO

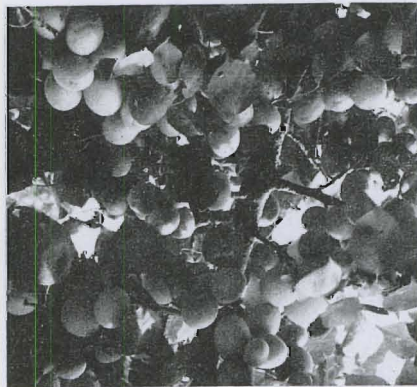
These varieties are not self-fruitful, so each one requires a pollinizer. Limited tests of cross-pollination indicate that each of these may serve as pollinizer for the other. It is recommended, therefore, that the two varieties always be planted together unless there are other apricot trees to supply the pollination needs.

Plant apricot trees in the spring. They require a well-drained soil and prefer a sunny location. The Moongold and Sungold varieties can be bought from nurseries beginning in the spring of 1961. They will not be sold by the University of Minnesota.

Moongold (Minn. No. 15)

The tree is vigorous, medium size, and rather spreading; blossoms very freely; productive; and fruit hangs well on the tree until ripe.

The fruit is oblate, up to 1½ inches long by 1¼ inches wide, and oblique; the cavity around the stem is wide and flaring; the apex is depressed; the suture is slightly depressed. The skin is medium thick and rather tough; the color is a subdued orange. The flesh is orange-yellow, thick, medium juicy, sweet with a slight acidity, and very pleasant. The quality is very good. The stone is free, medium in size, about ¾ x ¾ inch, round, and with a prominent wing.



Sungold apricot—the flavor is sweet and very mild.

Sungold (Minn. No. 36)

The tree is vigorous, medium size, and rather upright. The fruit buds are exceptionally hardy. This is a very productive variety. The fruit ripens gradually and hangs well on the tree until it is ripe.

The fruit is nearly round to slightly elongated, in proportion of 1 5/16 inches long by 1¼ inches at greatest width, and compressed on sides. The cavity is wide and of medium depth; the apex is slightly raised; the suture is a line to a slight groove. The skin is medium thin and tender; the color is bright, clean, gold with orange blush. The flesh is clear orange, tender, medium juicy; the flavor is mild and sweet. The quality is very good. The stone is free, medium in size, about 13/16 inch long by 5/8 inch wide.

BARLEY LOOSE SMUT—

(Continued from page 6)

have other characteristics that make them undesirable for commercial use. All of the varieties currently grown in Minnesota are susceptible to loose smut.

The departments of Plant Pathology and Botany, Agronomy and Plant Genetics, and Agricultural Biochemistry are cooperating in developing a variety combining resistance to loose smut with the other characteristics required in commercial varieties. As long as new parasitic types (races) of the fungus capable of attacking such a resistant variety do not appear, this would be the most effective and economical control of loose smut.

Summary

The best way to prevent losses from loose smut is to plant barley seed that is not infected. Smut-free seed can be detected by embryo-testing seedlot samples. Even this control measure will be unnecessary if a new commercially acceptable variety is produced that is resistant to prevalent races of loose smut.

Automation in Research

CHARLES E. GATES

IN AGRICULTURE, IN INDUSTRY, and, in fact, in many facets of our lives, there is a continuing trend toward letting machines do our work. This replacement of hand labor is sometimes called automation. In agricultural research, one trend toward automation has been in the mechanization of data processing.

In keeping with this trend, the St. Paul Campus has had a punched card machine installation since May 1958. The machines currently installed include a **key punch** for punching alphabetic and numeric information onto cards, a **verifier** for making sure the cards are correct as originally punched, a **sorter** which allows the cards to be arranged in a desired order, and a **tabulator** which summarizes information on cards and performs certain basic computations. In addition to these machine functions, the key punch and the tabulator can be interconnected and together can operate either to reproduce cards or to punch totals that the tabulator has obtained from the cards.

The punched card installation is administered directly by the Agricultural Experiment Station and is available to everyone in the University. At present there are two full-time employees working in the installation—a senior tabulating equipment operator and a key punch operator. During periods of peak loads, additional part-time machine operators are employed.

Climate Research

The punched card machines are very flexible and can be called upon to perform a variety of tasks.

One of these tasks deals with the basic research problems of relating climate and plant growth. One phase of this complex study deals with the probability of occurrence of temperatures (in 10-degree steps) for every week of the year. As a cooperative project, we are currently using data

Charles E. Gates is an associate professor and experiment station statistician.

from 10 Minnesota stations (Minneapolis-St. Paul, Waseca, Worthington, Pine River Dam, Morris, Itasca, Crookston, Cloquet, and Grand Rapids) to determine these probabilities. Some of the records used in the study go back to 1886, making the task so large that it would be impractical to do without the aid of machines. We maintain a file for all Minnesota weather station records that have been placed on punched cards.

Hybrid Corn Performance

The Agronomy and Plant Genetics Department is responsible for evaluating the performance of many commercial corn hybrids throughout the Minnesota Corn Belt.

These hybrids are numerous and and may be grown at many locations throughout the state. It is highly desirable that the data at season's end be processed in rapid-fire order so that the results may be published quickly. These factors—the large amounts of data and the urgency—are two of the factors that encourage automation. Each year the corn performance project has become more and more mechanized. Undoubtedly, in the near future the tedious calculations required will no longer be the bottleneck they once were.

Student Characteristics

An example of the use of punched card equipment very different from the above involves a student characteristics study carried on by the St. Paul Campus Office of Admissions and Records.

Here the following characteristics are studied: What factors bring students to the St. Paul Campus, how do students finance themselves in college, amount and place of part-time work, local and home residency, father's and mother's occupation, etc. The purpose of the study is to learn more about the student body so that they can be better served.

Swine Research

The Animal Husbandry Department carries on an extensive swine-breeding project to compare various systems of selection. In this study, data are collected on some 7 or 8 pig and litter characteristics such as average daily gain, backfat thickness, feed efficiency, etc.

These data are initially processed by our machines. Further computations are done on a large-scale computer on the Minneapolis Campus. This machine is capable of performing thousands of computations per second and quickly processes the swine data.

What's in the Future?

We have given you a glimpse of some of the applications of automation of data processing.

What is the future of such automation? While it is difficult to predict very far ahead, there is little doubt that the trend toward more automation will continue. Thus the researcher will be able to obtain results even more quickly and efficiently; and in some instances, he will get results that would have been too difficult to acquire a few years ago.

In general, automation in research will serve to increase the overall efficiency of the research worker. In the long run, it will benefit all citizens of the state as research results become available at an ever-increasing rate.

HOUSE MOUSE—

(Continued from page 4)

mice search for more protected areas. It is at this time that mice move back into the buildings. A few house mice do survive in the fields, especially if corn is shocked and left through the winter.

We have found that mice will travel great distances to find a new place to live. Thus, house mice may reinvade any area at almost any time. For control measures to be successful, hiding places must be eliminated and food access minimized on a community basis. In addition, active control measures such as poisoning should be used continuously to eliminate new mice as they move in.

MINNESOTA FARM AND HOME SCIENCE

Wayzata —

New Chrysanthemum for 1961

R. A. PHILLIPS and R. E. WIDMER

WAYZATA is the 40th variety of garden chrysanthemum introduced by the Agricultural Experiment Station, Department of Horticulture, University of Minnesota. The first varieties were introduced 20 years ago.

Wayzata is a vigorous, floriferous plant producing bright, bronze-tinged buds and yellow, decorative type, fully double flowers, 3 inches in diameter. It makes a good cut flower, as well as a garden specimen, because

the flowers are borne on fairly long stems providing a well-formed floral spray formation. The plants, which have clean green foliage, reach a height of 2 feet and a spread of 3 feet. Blooming usually begins in the second half of August in the Twin City area. Wayzata is the earliest blooming, most prolific of the more recent, yellow-flowered introductions of the University. This variety originated as an open-pollinated seedling of Minnesota selection 51-45-43.

Wayzata proved to be very satisfactory as a 3-inch spring-blooming pot plant when grown in the greenhouse.



Wayzata chrysanthemum — the earliest blooming of the more recent yellow-flowered introductions.

Propagation stock of Wayzata was tested by the Department of Plant Pathology and shown to be free of disease before it was released to commercial propagators. This policy will also be followed with all future chrysanthemum introductions in an effort to provide the best possible propagating stock.

R. A. Phillips is an assistant professor and R. E. Widmer is an associate professor in the Department of Horticulture.

TREE PLANTING—

(Continued from page 5)

source. By 1959 only 16 percent of these same owners reported farming as their principal income producer (see figure 2). Thus, while tree planting has not shifted people from the farm, it has certainly reduced further their reliance on farming for a livelihood. In general it seems the least reliant farmers most easily shifted to tree land-use from farm crops.

Impact on the Forest Sector

The 27,000 Soil Bank acres added to the existing 18 million acres of forest land in Minnesota seems insignificant. However, certain things about these acres make their quality potentially much more important than their area indicates. The plantations they produce should be well-stocked because the Agricultural Conservation Program cost-sharing activity they were planted under established acceptable minimum standards. In addition, because only cropland was eligible for entry, the land should be more productive for timber growing and the resulting crop more accessible than is typical for other woodlands in the area.

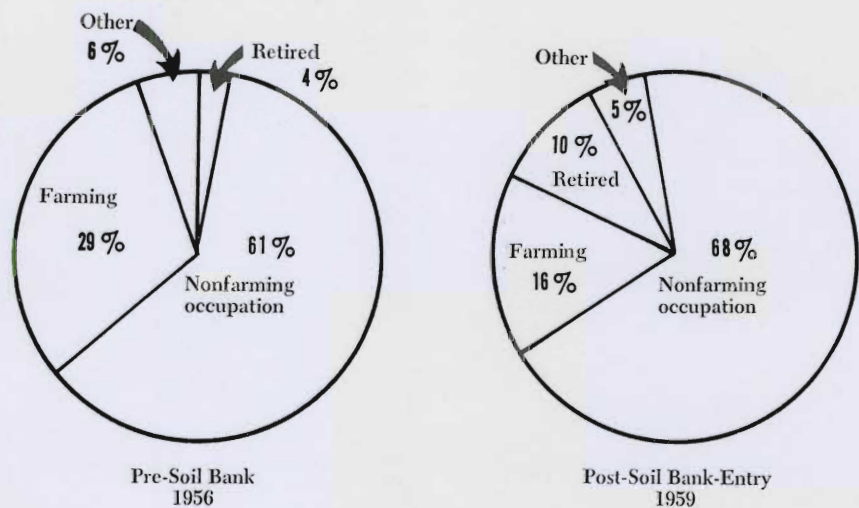


Fig. 2. The two graphs show the primary income sources for the tree-practice participants.

It is apparent that there is a need for "follow up" activity in the form of

Residence of tree practice participants		
	Pre-Soil Bank 1956	Post-Soil Bank 1959
Reside on the farm		
	percent	
None of the time	46	46
Part of the time	10	5
All of the time	45	50

technical advice. This will be most important about 10 years from now when the original contracts expire. Major decisions influencing the future of the plantings will be made at that time.

Considering the large investment society already has made in these plantation acres, the relatively small additional outlay such a consideration would require seems well justified.

WATERSHEDS—

(Continued from page 8)

Soil conservation practices such as contour strip cropping, terracing, and grass waterways will do a good job of controlling erosion and sediment damage if applied throughout the watershed. They also have a minor benefit in reducing flood flows. Experience has shown that such practices can reduce the large, most damaging floods about 10 to 15 percent. For the smaller floods, especially on small areas, a considerably greater reduction is possible. Thus soil conservation practices by themselves cannot provide adequate flood control.

Small Watershed Programs

In Minnesota, a multi-purpose, small watershed project can be carried out by use of either of two programs, or both. One is essentially a federal program, the other is sponsored by the state.

In 1954 Congress passed the Watershed Flood Prevention Act (Public Law 566). This act gave the U. S. Department of Agriculture the responsibility for flood control on watersheds under 250,000 acres. This program is intended to relieve flood damage in upstream areas, but will not eliminate floods on major streams. Larger projects will continue to be carried out by the Corps of Engineers.

As indicated by its name, the main purpose of the small watershed program is to **prevent flood and sediment damage**. A second purpose that may or may not be included is **agricultural water management**. This includes group improvements for drainage and irrigation. A third purpose is **non-agricultural water management**, which may include municipal, industrial, or recreational water supply.

Flood prevention under P.L. 566 may be accomplished by any or all of the methods mentioned earlier. The federal government pays the full cost of flood prevention features. If the channels are deepened or extended to provide drainage outlets, this is considered agricultural water management and the local people must bear a major share of this cost. If a reservoir is enlarged to provide additional storage for municipal or industrial use, the benefitted groups pay all of the additional cost. Added costs

for wildlife purposes are shared equally by the federal government and the state or a local group.

No work is carried out under this program unless the benefits exceed the costs by a safe margin. Some proposed projects that at first appear to be worthy prove to be unjustified because the cost of control is high, the benefits low, or both. It is often not possible or economical to eliminate all flooding. Thus average annual damages must be evaluated both with and without the project. Costs and benefits for several combinations of detention reservoirs and channel improvements are frequently evaluated to find the best combination.

An important phase of all P.L. 566 projects is **land treatment**, meaning on-the-farm conservation practices. The law requires that at least 50 percent of the land above any detention reservoir have soil conservation measures applied or being applied before construction can begin. Technical and financial assistance for land treatment are provided by means of existing programs.

Projects are initiated by local groups who must file an application with the State Soil Conservation Committee. If this group approves the proposed project and assigns it a high priority, the Soil Conservation Service can begin its surveys and planning. This requires a great deal of engineering work both in the field and office. Also the local people must agree to the plan, provide right-of-way for reservoirs and channel improvement, arrange for financing their share of the cost, and accelerate the application of conservation practices. Thus, it takes at least 2 years of work by both groups to complete the plan, and construction is usually scheduled over a 5-year period after funds are made available.

State action on watershed projects is being carried out through the Minnesota Watershed District Act of 1955, amended in 1959. Watershed districts can be organized along watershed lines, irrespective of political boundaries, thereby using the watershed approach. Districts can take action on any or all types of watershed problems and obtain needed funds by special assessment.

The watershed district and P.L. 566 programs have proved to be complementary, rather than competing pro-

grams. Ten watershed districts have been organized so far, and most of these have a P.L. 566 project being planned. In each case the watershed district is providing a procedure by which the people of the area may organize and raise funds for the local share of the project.

DAIRYMAN—

(Continued from page 10)

a greater number of acceptors anticipated retirement at age 65. One might expect that the higher frequency of rejectors in the older age groups might result in greater planning for retirement, and influence their adoption or rejection, but this does not appear to be the case.

The study showed that acceptors of farm practices have more careful farm management practices, such as record keeping. A significant overall difference was noted between the acceptors and rejectors in their record keeping. Indicative of a "commercial attitude," acceptors used balance sheets and other record forms to a greater extent than rejectors. Rejectors more frequently used bank receipt books, check stubs, and slips as a basis for their records.

In addition, acceptors indicated higher gross incomes than did rejectors. More rejectors claimed gross incomes of \$2,000 to \$4,000, while more acceptors claimed gross incomes of over \$8,000—indicating that adoption is associated with a high income available for possible farm investment and improvements.

When the farm operators were asked under what conditions they would quit dairying, rejectors differed from acceptors by citing a wider range of conditions of possible changes in dairy requirements that would influence their decision. Acceptors, on the other hand, were less specific and were inclined to cite the "possibility of the unexpected" in general terms as a basis for their leaving dairy farming.

Education, Nationality, Residence, and Participation

It is generally accepted that education is an important factor in whether

(Continued on page 17)

Does A Calf Like A Feed Because of FLAVOR?

K. P. MILLER, W. A. OLSON, AND J. B. WILLIAMS

WHY DO ANIMALS PREFER ONE FEED over another? How important is flavor in determining how an animal will like a feed?

At the Southern School and Experiment Station at Waseca, we have tried to find out if flavor is a factor in the acceptability of dry calf starters for dairy calves. Thirty-two new-born dairy calves were used in this experiment. All calves received colostrum and whole milk from birth through the 4th day. They also received a milk replacer fortified with vitamins A and D from the 5th through the 28th day of age. On the 29th day they were weaned.

The calves were randomly assigned to one of three groups: Control, Flavor 1, and Flavor 2. Hay, water, and calf

starter were fed to all calves beginning the 5th day of age. The formula for the calf starter was 39 parts of ground, yellow, shelled corn; 29 parts ground, white oats; 20 parts wheat bran; 10 parts soybean oil meal (44 percent protein); 1 part trace mineralized salt; and 1 part of steamed bone meal.

The calf starter was divided into three portions so that the control group received the unflavored calf starter, one group received the calf starter with Flavor 1 added, and the third group received the calf starter with Flavor 2 added. The animals were kept in individual pens and individual grain consumption was recorded daily until the animals were 42 days of age.

The average daily gain up until 28 days for the control, Flavor 1, and Flavor 2 groups was 0.81, 0.87, and 0.81 pounds per day, respectively. The gain from 28-42 days for the three

groups was 1.37, 1.31, and 1.20 pounds per day. The calves in the control group consumed 1.54 pounds of grain per day for 42 days; those in Flavor 1 group, 1.34 pounds per day; and 1.21 pounds per day for those animals being fed Flavor 2. However, all the calves gained similarly by the time they were 6 months of age.

The above experiment raised the question, could calves become accustomed to a certain flavor? To study this, we fed the same flavor to calves on the St. Paul Campus. To see if the calves were able to taste, small amounts of flavoring material were added to water. This water as well as unflavored water was offered to several calves.

Some calves preferred the flavored water while others preferred the plain water. However, after several days most of the calves developed a desire for one type of water and drank only that type of water.

These two experiments strongly suggest that these flavor compounds in dry calf starters do not increase feed consumption nor rate of gain. This is particularly true when a very acceptable and palatable calf starter is used and where the ingredients are of high quality.

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DAIRYMAN—

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or not a person accepts or rejects. However, the findings here show no differences between the educational levels of the acceptors and rejectors. Studies in other states involving other practices have found education to be an important variable in the acceptance process.

A large segment of the county's population is of Dutch ancestry. One creamery serving the area of high Dutch concentration had promoted bulk tank changeover among its patrons. A large number of ready acceptors were obtained in this area and so the Dutch nationality and the acceptance of bulk tank handling were tied together through creamery patronage.

Another generally accepted belief is that the more active one is in the community, church, and other organizations the greater the probability that

he or she will accept innovations that occur. In this study, however, there are generally no outstanding differences between acceptors and rejectors in their degree of community church participation. Rejectors appear to be as active socially as acceptors.

Conclusions

1. The variables in the following order most adequately distinguish acceptors from rejectors: Size of herd, gross farm income, birthplace of operator's mother, operator's vagueness or certainty about factors that would cause him to quit dairying, age of operator, number of acres farmed, number of acres owned, birthplace of operator's father, type of financial records kept, total number of children at home, age of youngest daughter living at home, and number of daughters living at home.

2. The variables which fail to distinguish acceptors from rejectors in any overall sense are: Residence, number of sons living at home, the age of the youngest son living at home, the operator's estimate of existing or future dairy conditions, operator's retirement plans, and the operator's community participation.

3. Acceptors are generally characterized as: Having low nonfarm incomes, larger herds, high gross farm incomes, parents of Dutch descent, younger age, a large number of acres owned and farmed, careful farm record-keeping, fewer and younger children, and more young daughters.

4. Rejectors are generally characterized as: Having high nonfarm incomes, smaller herds, low gross farm incomes, Swedish fathers, older age, fewer acres owned and operated, less careful farm record-keeping, and more and older children.

WEED CONTROL—

(Continued from page 3)

The effectiveness of the two forms is comparable on the average if both are applied uniformly. With excessive rainfall, the granules may be somewhat more effective for those chemicals which are highly water soluble.

Results of Field Tests

Evaluations of weed control obtained with these chemicals in county demonstration plots are summarized in the table.

The summary of weed control in corn is based on the evaluation of 41 trials in 1959 and 68 trials in 1960. The summary of weed control in soybeans is based on the evaluation of 28 county tests in 1959 and 30 in 1960.

The trials were organized in the following manner: The chemicals were broadcast on plots 1/100 acre in size. The plots were not cultivated. Evaluations were made by County Agricultural Agents.

Randox was much more effective in controlling annual grasses than broad-leaved weeds. Randox-T, Atrazine, and Simazine were as effective on the

Evaluation of weed control in county demonstration trials

Chemical	Years tested	Degree of weed control					
		Grasses			Broad-leaved weeds		
		Percent of trials in each class			Percent of trials in each class		
		Good	Fair	Poor	Good	Fair	Poor
CORN							
Randox	1959, 1960	27	44	29	0	29	71
Randox-T	1960	19	57	24	17	54	29
Atrazine	1959, 1960	82	13	5	84	14	2
Simazine	1959, 1960	58	34	8	68	25	7
2,4-D ester	1960	0	24	76	6	44	50
SOYBEANS							
Randox	1959, 1960	52	44	6	20	27	53
Amiben	1959, 1960	64	30	6	68	27	5
Alanap	1960	10	48	42	7	47	46

grasses as the broad-leaved weeds in the corn trials. The same is true for Amiben and Alanap in the soybean tests. The use of 2,4-D in pre-emergence applications in corn and the use of Alanap in soybeans did not give successful results.

The effect of each herbicide on the weeds was evaluated fairly late in the season. For this reason, chemicals

which control weeds for only a short period of time (such as Randox and Randox-T) may show poorer results than if they had been cultivated.

When using chemicals, follow instructions on the label closely.

For further information, see University of Minnesota Extension Folder 212, "Cultural and Chemical Weed Control in Field Crops."

SOILS—

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On soils where artificial drainage is used, farmers were asked to note size and spacing of tile as well as character of drainage (poor, fair, good). Farmers apparently considered the drainage "good" where tile spacing was about 100 feet or less with 6-inch

tile. The average yield of 16 fields rated "fair" in drainage was 76 bushels per acre; on 12 fields rated "good," the average yield was 94 bushels.

Though insufficient data are available to evaluate the relationship between yield and various factors on individual soils, a preliminary study of 168 corn yields on all soils suggests

several relationships. In table 4 we have listed the average values and ranges of some factors and an estimate, from the analysis, of the factor-value which seems to have been optimum.

The rainfall and temperature effects are, perhaps, most interesting. Previous analyses have suggested that weather variations are associated with one-third to two-thirds of yield variation. In this analysis we also noted that 6 inches less rainfall than average was associated with more yield change (-9 bushels per acre) than 6 inches above average May through August rainfall (+7 bushels per acre). Likewise, 3° F. below average May through August temperature was associated with a 16-bushel decrease and 3° F. above average, with a 14-bushel increase.

In future analyses we will attempt to establish the above relationships with greater statistical significance and, particularly, to study these relationships on individual soils or on closely related soil series.

Table 4. Average, two-thirds range, and estimated optimum of selected factors in a study of 168 corn yields, 1956-59

Factor	Average	Two-thirds range	Estimated optimum	Net change* in yield bushels
Nitrogen (N) (lbs.)	68	15-120	80	+4
Phosphorus (P ₂ O ₅) (lbs.)	43	10-75	60†	+4
Potassium (K ₂ O) (lbs.)	51	10-95	60	+9
Stand (in thousands)	16.8	13-20	17†	+3
Planting date	May 15	7th to 22nd	May 7	0
Hybrid maturity (days)	107	100-110	110	+2
Rainfall (May through August), inches	17.0	11-24	18	+7
Average temperature (May through August), F°	66.2	62-70	70†	+30
Yield	76 bu.	50-100		

* Net change in yield in going from low range value to estimated optimum. For example, an increase of 4 bushels of corn per acre was associated with an increase from 15 pounds N to 80 pounds N.

† Analysis incomplete.

MORE PROTEIN—

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grain separated from the mixtures averaged 14 percent protein whereas oats alone averaged 13.5 percent protein.

Peas Alone

Comparisons at the three locations in 1956-57 show that peas alone sown at 120 pounds per acre produced over twice as many peas as did oat+pea mixture. However, when total seed yields (including oats) were compared, peas alone yielded 257 pounds more than did the mixture in Anoka County, 565 pounds less at Rosemount, and 447 pounds less in southwestern Minnesota. Forage comparisons show that peas alone were lower in forage yield but higher in protein content, protein yield per acre, and moisture content than oat+pea mixture at all locations.

Oats+Nitrogen

To determine if fertilizer nitrogen could duplicate the beneficial effects of peas in oat+pea mixture, 100 pounds of ammonium nitrate per acre were broadcast at planting time on oats alone in the 1957 trials. Response to nitrogen was high in Anoka County, moderate at Rosemount, and practically zero in the southwestern Minnesota test.

When comparing oats+nitrogen with oats+peas—oats+nitrogen produced more forage. In protein content of forage, oats+nitrogen averaged 8.5 percent whereas oats+peas averaged 11.1 percent. In forage protein yield per acre, oats+peas was higher than oats+nitrogen in Anoka County and southwestern Minnesota but less than oats+nitrogen at Rosemount. For total seed yield as an average of three locations, oats+nitrogen aver-

aged 1,744 pounds and oats+peas 1,365 pounds. However, over 600 pounds of the oat+pea yield were high-protein peas.

Mixtures and Rate of Sowing

The following sowing mixtures expressed in pounds per acre were compared at the three locations for 3 years: oats 64+peas 60, oats 64+peas 90, oats 64+peas 120, oats 48+peas 90, oats 48+peas 120, and oats 32+peas 120.

When the rate of peas per acre increased, protein content of the harvested forage and seed increased. Effects on yield cannot be generalized because of location and lodging differences, however oats 64+peas 60 was definitely inferior to the other mixtures in Anoka County even though it was better than oats alone.

Lodging is an important factor, and oats+pea mixtures lodged in proportion to the amount of peas in the mixture; more peas resulted in more lodging. Although oats 48+peas 90 is a desirable mixture, oats 64+peas 60 is more practical for areas like the Rosemount Station where lodging is severe and southwestern Minnesota where peas are not so productive. In northern Minnesota even lower rates of peas appear satisfactory on some soils.

Other Considerations

In addition to making a higher protein silage than oats alone, oat+pea mixture may retain more succulence thus prolonging the time available for harvest and may compact better in the silo.

Field observations indicate that new seedings of alfalfa, red clover, rape, or vetch can be established under oat+pea mixture if moisture is favorable and excessive lodging does not occur.

Pea aphid in southern Minnesota is quite prevalent in alfalfa and canning peas and if it becomes generally necessary to spray the mixture for control of pea insects, oat+pea mixtures would not be practical.

A major deterrent to increased use of oat+pea mixtures for forage is the high cost of commercial pea seed in the spring. By harvesting a portion of an oat+pea forage field for seed pro-

duction, future seed cost of the mixture can be reduced to that of farm-grown seed.

Summary

On sandy soil in Anoka County, oat+legume mixtures were superior to oats alone in forage yield and protein content; oats+peas was superior to oats+vetch or oats alone in total seed and protein yields per acre.

On heavier soil at Rosemount and southwestern Minnesota, oat+legume mixtures were superior to oats alone in protein content and protein yield per acre. Oats+peas yielded less seed than did oats alone but this may be offset by the higher feed quality of the oat+pea mixture.

MINNESOTA FARM AND HOME SCIENCE INDEX

We have recently prepared a new *Minnesota Farm and Home Science Index*. This index covers the period from October 1956 through May 1960. We prepare an index periodically of the articles appearing in this magazine. This index is distributed to libraries, county agents, and other interested persons.

If you would like a copy, write to the Bulletin Room, 3 Coffey Hall, University of Minnesota, St. Paul 1, Minnesota.

Research Shorts

Corn plants take up fertilizer phosphorus more rapidly when the fertilizer also contains nitrogen in ammonium form. That principle, recent studies show, holds true both when ammonium compounds and superphosphates are mixed together and when some nitrogen is chemically combined with the phosphorus, as in ammonium phosphate. However, applying the two plant nutrients at the same time but separately won't affect phosphate usage. Also, nitrogen in the nitrate form did not increase phosphorus absorption.

PROTEIN PERCENTAGE		
OATS	PEAS	VETCH
Seed 13%	Seed 26%	Seed 27%
Forage 8%	Forage 16%	Forage high

Oats is a grass; peas and vetch are legumes.

Atrazine may be the quackgrass-killing chemical which corn producers have been looking for. At the Rosemount station, broadcasting 3 or 4 pounds of atrazine per acre in the fall or early spring killed nearly all of the quack. Two limitations: First, atrazine used this way must be limited to fields where corn will be grown the next 1 or 2 years. Second, the treatment is costly—about \$15 per acre. Yet, in fields where quack is thick, that value in corn yields could be saved the first year. And once the quack is killed, a second treatment may not be needed for 5 years or more.

* * *

With proper fertilizing, it's no trick to keep good alfalfa stands on rolling hills for 8 or 9 years. In University plots, alfalfa stands established in 1951 are still producing up to 3 and 4 tons forage per acre. The best plots are those getting plenty of both potash and phosphorus. Annual topdressing is better than putting fertilizer on every other year. Starter helped, too. Where researchers put on 300 pounds of 0-20-20 the year before seeding and followed up with annual topdressing, alfalfa went 3.5 tons with topdressing alone.

* * *

Hog and corn production may some day be separate enterprises for different farms, in the opinion of a USDA economist at the University. Oswald Blach foresees specialized hog farms, with trained managers, special veterinarian services, and professional feed advisers. He believes that "vertical integration of hog production with feed manufacturing is likely to be weak and transitional until the new entrepreneurs of the hog producing industry take over." He points out that multiple farrowing is changing hog production from a part-time to a full-time job. Labor and management can no longer be drawn from off seasons in corn production.

Minnesota's Men of Science

Editor's Note—This is the thirty-fourth in a series of articles introducing scientists of the University of Minnesota Institute of Agriculture.

For strategy in Man's unceasing war against the insects, Minnesotans—rural and urban alike—have long looked to Alexander C. Hodson.

Hodson, head of the Department of Entomology and Economic Zoology at the University of Minnesota, is a noted teacher and researcher on control of insects in fruits and stored products and in forests, and he is a specialist in insect ecology—the relation of insects to their surroundings.



A. C. HODSON

He has been head of the department only since July 1, 1960, but has been serving residents of the Gopher state as a University of Minnesota faculty member during the better part of a quarter century.

Originally from Reading, Massachusetts, he earned his B.S. degree from the University of Massachusetts in 1928. He was a field assistant with the USDA Bureau of Entomology, Moorestown, New Jersey, during the summers of 1927, 1928, and 1929.

Hodson joined the University of Minnesota staff as a teaching assistant in the Department of Zoology in 1928, and in 1931 was named an instructor on the staff of the Department of Entomology where he has remained.

He earned his M.A. in 1931 and his Ph.D. in 1935—both at Minnesota. Hodson became assistant professor in 1938, associate professor in 1943, and professor in 1947.

Hodson has long been interested in predicting the abundance and seasonal increase of insects. An example of his research in this area is a calendar of the seasons' progress which he developed and which was used to time control operations for forest tent caterpillars beginning in 1952.

Hodson has served as both president and secretary of the Minnesota chapter of Sigma Xi, vice president and secretary of the Entomological Society of America, and treasurer of the Ecological Society of America.

He has been a member of the Minnesota Forestry Research Council, National Research Council subcommittee on animal reservoirs and vectors of disease, and he has served as editor of the tree insect section of *Biological Abstract* since 1952.

He is a member of a number of professional and honorary societies and is the author of numerous technical papers on insect ecology, forest entomology, and the economic problems of insects in fruits and stored products.

Typical of the dedicated teacher, Hodson has found his deepest satisfactions in contacts with students. Numerous graduate students whose interest in entomology and economic zoology was stimulated and developed under his advisorship have gone on to make names for themselves in their field.

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 at outlying Branch Stations throughout the state.

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