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UNIVERSITY OF MINNESOTA (1)
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The Institute of Agriculture issues many printed reports and bulletins reporting the results of its research and providing information on new farming and homemaking developments. These appear as Extension Service bulletins, folders, or fact sheets; as Experiment Station bulletins; as articles in Minnesota Farm and Home Science, Minnesota Feed Service, and Farm Business Notes; and in several other forms.

In addition, the Institute also sends news releases to newspapers, radio stations, trade and farm papers, and other outlets. These releases contain valuable information, often not published in any other form, that could be used in the educational programs carried on by county extension agents, high school teachers, and others.

This publication has brought together some of the more important of these releases. Through this publication the Institute hopes to improve its informational service and to extend the reporting of the results of its research.

Agricultural Biochemistry...

BIOCHEMISTS EMPHASIZE BASIC RESEARCH

Corn starch molecules are getting a close look in the agricultural biochemistry department at the University of Minnesota.

These molecules can't actually be seen even with a microscope. But scientists do have ways of studying them, in starch as well as in a host of other agricultural products.

W. F. Geddes, head of the department, emphasizes that such basic investigations make up the major portion of the department's research.

Right now, for example, University biochemists are studying chemical reactions which may lead to development of plastic-type products made from corn starch. To experiment with these reactions, however, biochemists must first know the structure of many different types of carbohydrates.

Carbohydrate research is only one example of basic studies underway in the department of biochemistry. Other research subjects there include:

* Fats and oils. Biochemists are studying characteristics of fat and how they affect food shortening. They are also attempting to learn what happens to the oil molecule when oil, such as in paint, dries and hardens. This information could be of extreme value to paint manufacturers.

* Nutrition. Studies are underway to see if there are any as yet "unknown" growth factors in food. Vitamins were once unknown, but basic research led to their discovery. Biochemists are feeding experimental "purified" diets of known chemical composition, to study processes by which animals and man utilize food. In one phase of the nutrition work, biochemists, in cooperation with the College of Veterinary Medicine, are looking for the reason why soybean meal extracted by the "trichloroethylene" process is toxic to certain animals. The fact that soybeans processed this way do have a poisonous effect was proven several years ago, but the actual substance that causes this toxic effect has not been isolated.

* Thyroid gland functioning. Scientists are searching for more information on how the thyroid gland produces the hormone thyroxine, which is necessary for life in all animals. A recent finding on thyroid gland activity led to a new and improved diagnostic test for thyroid gland functioning.

* Legume proteins. Biochemists are studying the "phytoagglutinins" in soybeans. These are plant proteins which cause red blood cells to group or clump together. Minnesota research in recent years has shown that heat treatment improves the nutritive value of these proteins. Studies now are aimed at finding whether there is any relationship between the "clumping characteristic" of these proteins and their nutritive value.

* Milk chemistry. In this project, biochemists are studying the characteristics of proteins and fat in milk. They hope to learn, for example, the effects of heat on coagulation of milk by rennet, an enzyme used in cheese making. They are also studying effects of heat on milk salts in coagulation of casein in concentrated milk products. This information may be particularly valuable for the milk industry in developing better manufactured dairy products.

* Grain storage. Much of this work has been on an "applied" or practical level, but some fundamental aspects are extremely important. Several years ago, Geddes and his co-workers, in cooperation with plant pathologists, found that mold in stored wheat caused wheat to "respire" faster and cause heating in the grain. This finding emphasized the importance of controlling mold in stored wheat and gave background information to scientists studying storage procedures.

MILK PROTEINS RESPONSIBLE FOR BREAD PROBLEM

Two milk proteins are at least partly responsible for a soft dough problem that sometimes occurs in bread baking, University of Minnesota scientists have learned.

According to Robert Jenness, agricultural biochemist, bread doughs made with inadequately heated nonfat dry milk (dry skimmilk) are soft and difficult to machine in commercial bakery operation; in addition they yield small loaves of inferior crumb grain. Bakers have known for years that heating the skimmilk before drying markedly improves its breadmaking properties, but the cause of the improvement has never been completely determined.

Recent basic research shows that casein, the principal protein in milk, and another protein present only in milk in very small amounts, are at least partial causes of the trouble. Jenness and his group are presently trying to learn more about this so-called "minor protein" and to discover why it and casein have such pronounced effects in dough and bread.

Studies in the past at Minnesota have shown that dry skimmilk must be heated to 165 degrees for 30 minutes, or at an equivalent combination of temperature and time, to prevent the soft dough. But this alone was not a complete solution; bakers had no way of telling whether the powdered skimmilk they bought had received proper heat treatment.

The Minnesota scientists, including Jenness and S. T. Coulter, dairy industry researcher, standardized a test for determining whether lots of nonfat dry milk have been heated enough. The test was developed to the point where different laboratories now using it can get uniform results.

BIOCHEMISTS SEEKING WAYS TO USE CORN STARCH IN INDUSTRY

If scientists have their way, the corn plant will some day serve as raw material for an expanded chemical industry.

Agricultural biochemists at the University of Minnesota are making a determined search for practical ways to produce commercially-important "plant gums" from corn and other cereal grains.

If they succeed, there will be two important results:

First, an additional market for corn--now a surplus crop.

Second, a better and cheaper supply for American industry of gums, which now must be imported and are getting more expensive all the time.

According to Biochemist Fred Smith, plant gums (not related to chewing gum) are extremely important in manufacturing certain products. There are many different kinds of plant gum.

"Gum tragacanth," for example, is necessary for many pharmaceutical products. "Gum arabic" is used in adhesives, such as transparent tape and mucilage on envelopes. "Locustbean" and "Guar" gum are used in several food products, in paper manufacture and in mineral ore separation; these gums have made it much simpler to obtain potash for fertilizer from mineral ore.

All these gums are from trees and shrubs, which grow, largely, in foreign lands. Gum-producing trees are found only in semi-arid parts of the world; if the tree isn't under some sort of stress, it doesn't exude them.

Because of this peculiar nature of the gums, they are collected mostly by native laborers in areas where the trees are found. And as economic conditions in these areas improve, the gums will become more expensive.

The ideal solution would be to find a "home-grown" source of the gums. Biochemists call the gums "carbohydrate polymers," a term which refers to the molecular structure of the material. University scientists already know that grains like oats, barley, wheat and corn contain polymers which have structural features similar to those of the plant gums.

At present, however, the material in grains cannot be used in industry. But if research is continued persistently on this material, the biochemists say there is no reason why ways to transform it into products replacing natural gums can't be developed.

The amount of gum-like material in many grains is very small. In oats, the content is so low that separation of the material would not be economically feasible. The most readily available source of a carbohydrate polymer is corn starch, which scientists believe may well prove to be a good starting material for making synthetic gum-like substances.

In experimental work, the University biochemists have already changed corn starch into materials which are structurally similar to natural gums. However, the processes for making the transformations have not yet been tested on a large scale.

An important part of this work is the basic research on molecular structure of the gums. Scientists at the University of Minnesota are learning the physical characteristics and the structure of the natural polymers, so structural "specifications" can be established for what is required in transforming corn starch into synthetic gums.

POTENTIAL OUTLET FOR SOYBEANS ALMOST UNTOUCHED

More use of soybean proteins could furnish one of the best answers to food problems in heavily-populated nations, according to David R. Briggs, agricultural biochemist at the University of Minnesota.

Soybeans, figuring average yields, produce about 480 pounds of protein per acre, compared to 340 pounds from corn and 180 from wheat. Where there is a food shortage, using soybean protein for human food would save labor and be more efficient than first feeding it to animals and then having people eat the meat.

Why isn't this being done at present? Well, in this country, soybeans are a near-surplus crop and Americans can afford the "inefficiency" of putting the plant protein through meat animals.

But even for food-shortage countries, there are some barriers. Soy proteins often give foods a "beany" flavor, a brown color and a harsh texture. The answer, Briggs says, is for food processors and research workers to develop processing methods which eliminate these characteristics.

From a nutritional standpoint, Briggs points out, soybeans alone can efficiently supply all the protein requirements for both animals and humans. This isn't true of other common vegetable proteins.

Proteins are built of chemical units called amino acids. Some of them can be synthesized by animals in their own bodies and some, the "essential" amino acids, must be supplied in the diet. If animals or humans don't get enough of any one of these essential amino acids, they may become sick or fail to grow.

Wheat and corn, for example, contain only small amounts of certain essential amino acids.

Soy protein does have certain components which need to be changed before its high quality can be effective in food. One such component makes it difficult for an animal or human to digest the protein. Fortunately, heating destroys this characteristic.

Agricultural Economics ...

OTHER ADJUSTMENTS MUST ACCOMPANY DAIRY PROGRAMS

Dairy adjustment programs that ignore the rest of the farm problem aren't likely to be successful, a University of Minnesota economist says.

"Dairymen must recognize the overall agricultural problem," E. Fred Koller told county agents at the annual Minnesota Agricultural Extension Service conference in early December.

"Otherwise," he continued, "if an adjustment in dairying were effective, dairy prices would move up, but feed, labor and capital from other lines of agriculture would move in to nullify the market improvement which has been made."

Comparing different types of dairy programs, Koller said, "Dairy purchase programs are a satisfactory way of dealing with market imbalance when surpluses are relatively small." He said that current success of the dairy program has been helped by favorable prices for beef cattle and hogs. "This has encouraged shifting farm production resources out of dairying and has restricted milk production."

Koller pointed out that production and consumption of milk in 1958 and '59 will be closer to balance than at any time in the past 6 years. As a consequence, he added, government purchases are apt to be small in the coming year. "It is even possible there will be shortages of some types of dairy products in some areas next summer and fall," he said.

"When there is a wide gap between production and market sales, more drastic remedies, such as milk production controls, may be needed," he added. "Production control is one of the severest ways to deal with dairy surpluses. It should be limited to high-surplus situation."

Koller said that because of inelastic demand for most dairy foods, "increased consumption" programs have rather limited possibilities.

However, he pointed out that distribution programs, like school lunch, school milk, welfare donations and food stamp plans, have received more attention lately as a result of unemployment in many areas.

"Where state milk control laws have been used, they have helped to stabilize producer prices," Koller said, but he added that such laws haven't made any important price increases. "These laws have been more effective in milk deficit states than in states having large milk surpluses. A major weakness of state milk control is that interstate supplies cannot be controlled."

The economist said federal milk market orders have stabilized producer prices in fluid market areas covered. But in some areas, he added, "it appears that Class 1 prices (for bottled use) have been set at unduly high levels and large supplies have resulted. The surplus supplies move into manufactured products in competition with midwest producer."

Milk market orders require all milk handlers to pay producers specified minimum prices for milk in each use classification and to observe certain sale terms. There are 72 federal milk market orders in the U. S., three of them in Minnesota.

RECORDS SHOW CHANGE IN MINNESOTA FARMING

The story of a technological "revolution in agriculture" is told by the record books of 150 farmers in the 31-year old Southeast Minnesota Farm Management association.

These records portray a pattern of change no less striking than the industrial revolution, according to George Pond, retired agricultural economist who helped form the association in 1928.

Since the first year, the records show, farms in the association have grown 42 percent in size. Their fields yield 55 percent more corn per acre and the farms have 50 percent more land in cultivated crops--mostly corn and soybeans. Sod crops have increased from 28 to 34 percent of crop acreage and small grains have dropped from 42 to 21 percent.

There have been changes in livestock, too. All members of the association kept dairy herds in 1928, and most had hogs and chickens. Last year, only 81 percent had dairy herds, 76 percent had hogs and 69 percent poultry.

At the same time, the dairy herds increased by 73 percent in size, pig litters per farm doubled and poultry flocks also became twice as big. Each cow produces more than a third more butterfat, pigs per litter jumped 13 percent and egg production per hen has more than doubled since 1928.

In numbers alone, the biggest changes have been in machinery. Only two-thirds of the members used tractors 30 years ago, while now the average is more than two tractors per farm.

Investment per acre in mechanical power--tractors, trucks, electric motors and the like--went up 382 percent on 41 identical farms from 1928 to 1952.

Average sales per farm went up tremendously in the 30-year period, but so did proportion of income needed to cover expenses. In 1928, the average farm in the association sold $4,456 worth of products and spent 51 percent of it--$2,258--for cash expenses. In 1956, average sales per farm were $18,844, but 70 cents of each dollar went for operating costs. That means expenses totalled $13,233 per farm, on the average.

LARGE VOLUME BUTTER-POWDER PLANTS ARE MORE EFFICIENT

In general, large local butter-powder plants in Minnesota can process milk more cheaply than can small plants.

Linley E. Juers and E. Fred Koller, agricultural economists at the University of Minnesota, base that conclusion on a recent study of three "model" butter-powder plants.

"Plant 1" averaged 129,000 pounds whole milk processed daily and costs averaged 47.6 cents per hundred pounds. "Plant 2" averaged 174,000 pounds at a cost of 42.6 cents, while "Plant 3" processed 265,000 pounds per day and had costs averaging only 38.4 cents per hundred pounds.

These are plants that receive whole milk direct from farmers and produce both butter and dry milk. There are now about 40 of them in the state.

The three model plants were ones that were operating under "ideal" condition. All of them received milk in 10 gallon cans, direct from producers. They used similar processing techniques and equipment, except for size, had similar building construction and had uniform wage rates.

Labor was a major cost item. It was 12 cents in Plant 1, 9.6 cents in Plant 2 and 6.6 cents per hundred pounds of milk in Plant 3. It was cheaper in bigger plants because of the fuller utilization of some fixed labor time. For example, the small plant required almost the same amount of cleanup time as the largest one.

Fuel costs, on the other hand, varied little with size of plant, because heat required for processing is nearly directly proportional to quantity of milk produced.

While these costs are for model butter-powder plants operating under ideal conditions, the economists say they still represent results which well-managed plants can approach.

CHANGE TO LIVESTOCK BOOSTS FARM INCOME

ALDEN, MINN. -- The farm business sometimes needs a complete overhaul to really put it in high gear.

Wesley Pierson found eight years ago that the best way to improve his operation was to get rid of the milk cows and keep other live stock instead.

Wesley and his father have been farming in partnership since 1945. They originally had 13 dairy cows - all their small barn would hold. They also kept 600 laying hens, marketed about 100 hogs every year, and fed some lambs. Considering their size, all enterprises were doing reasonably well; yet, the total business didn't have enough volume for a really good income.

A bigger dairy barn and a new milk house would have meant a big expense. With hogs, sheep and a bigger-than-average poultry operation, more dairy cows would have caused a labor problem.

So to expand at least cost and do a bigger business with a minimum of labor, Pierson in 1950 sold the cows and expanded the hog business and planned to also raise feeder lambs or feeder cattle. He kept fewer hens each year and in 1954 quit raising them altogether.

With the chickens gone, the well-insulated poultry house was easily converted into an ideal farrowing house. The barn was made into a hog house and the barnyard became a drylot for cattle or lamb feeding.

For the next two years, the Piersons kept about 40 feeder cattle annually, and no lambs. They had both feeder lambs and feeder cattle for two years after that, but since 1955 have had lambs and no cattle. This is a matter of fitting livestock to the farm and to fit his own likes and dislikes, Wesley says.

"We're raising lambs instead of beef because we have a good deal of hay in the crop rotation. Raising both hogs and drylot-fed cattle would call for more corn. Sheep can be fed to market on a ration that's half hay."

Wesley and his father usually buy about a thousand feeder lambs in three groups every year.

Last September they bought 521 lambs, sheared them and turned them into the corn fields. "The lambs eat up a lot of the weeds and lower leaves of standing corn, without hurting the corn itself," Wesley says.

In early December, the lambs went into drylot and Wesley "topped out" the heaviest lambs and marketed them. He did this four times until all were marketed by mid-January. He then bought another 360 lambs, fed them in drylot and marketed them in spring.

This system fits the Pierson farm "and my own preferences" much better than a ewe flock would, Wesley says. "There's less of a parasite problem with no ewes around. Also, we would need more buildings for lambing if we kept our own ewes."

Wesley Pierson's record books show he is in the top half of the Southeast Minnesota Farm Management association as far as gross income is concerned. Before the change, he was always in the lower half.

VERTICAL INTEGRATION IMPACT SEEN

How will vertical integration--often called "contract farming"--affect Minnesota agriculture?

It could help some farmers and hurt others says Darrell Fienup, agricultural economist at the University of Minnesota.

A farmer under an integrated system may be giving up a higher average income over a longer time for a somewhat lower but less variable income, Fienup points out. But for a farmer who doesn't have enough capital or credit to operate on a very high scale by himself, integrating may give him both a higher and more stable income.

Vertical integration isn't new; many non-agricultural industries have been integrated for a long time. Large oil companies, for example, have complete control over supplies of their raw materials. Neither, for that matter, is integration new in farming. A farmer selling milk through a cooperative has "integrated" production and processing.

There are two main types of integration involving farmers. One is the farm cooperative, in which the farmer hires a business man to do certain jobs for him. The other is when private business contracts with the farmer to do certain things.

The processor or distributor stands to gain through vertical integration, because it helps him cut production and selling costs. It can help him

even out his supplies and reduce storage costs. It gives him a greater control over his supply than he formerly had.

An example of vertical integration would be a feed company financing the cost of the farmer's hogs and feed, with the farmer in turn agreeing to use the company's feed. The farmer might also agree to sell his hogs to a particular packing company.

In some cases, the farmer doesn't own the hogs at all; he supplies only land, buildings, equipment and labor and is told how and what to feed and where and when to sell.

The biggest reason why contract farming is gaining ground, Fienup says, is the need for credit at a reasonable rate. Farmers need more and more equipment, fertilizer and land--all costing more than ever. So many of them turn to vertical integration. It gives them the needed capital, takes away the risk involved in borrowing money, and may result in a more efficient, higher-volume farm unit. Also, the farmer gets expert management help through integrating, resulting in more efficient production.

For agriculture in general, Fienup says it will undoubtedly lead to greater specialization on the farm, and each farm will need more capital. It will lead to higher total production. Take the broiler industry for example: 143 million birds were produced in 1940, 631 million in 1950 and one-third billion in 1956. Integration played a key role in this increase.

While vertical integration can bring about some drastic changes in agriculture, the only way to stop it would be through government control, Fienup points out. Another alternative would be to accept it, but organize integrated farmers into a type of labor union to bargain collectively with the integrators.

A third way to handle integration is through farmer cooperatives. In this case, farmers would be the integrators; they would control the processing and distribution. Some cooperatives already are attempting to "out-integrate" the integrators by extending credit and expanding their operations toward the consumer level.

TRIPLING DAIRY HERD ONLY DOUBLES LABOR NEEDS

Tripling the size of the dairy herd doesn't mean tripling the chore load.

A University of Minnesota study on 100 farms in southern Minnesota shows that a 30-cow dairy herd calls for only twice as much labor as do 10 cows.

H. J. Aune and L. M. Day, U. S. Department of Agriculture economists at the University found it takes almost 129 hours during the year to care for each cow in a 10-cow herd. In a 30-cow herd, it takes only 80 hours per animal yearly.

For one particular 15-cow herd, it took 23.7 labor hours per week in summer and 35.2 hours during winter. For this herd, each cow added to the herd would require .83 hours extra labor per week during summer, and that more than half of this labor would be for milking.

So during summer, the logical way to save chore labor would be to, somehow, shorten the milking time. Yet, this raises other problems. A loose housing system with a milking parlor will shorten milking chores, but not every farmer with a stanchion barn would find it profitable to make the change.

In winter, less than a third of the total dairy chore time was used in milking, mostly because of the hay and silage feeding and manure disposal work that a farmer doesn't have in summer. This means that a farmer with a stanchion barn and short on help in winter can make a substantial reduction in chore time by installing a silo unloader or a gutter cleaner or both.

In summer, Aune and Day say, a dairy farmer with a stanchion barn is often better off by looking for ways to shorten his field work, rather than trying to make big work savings in the dairy barn.

This study was based on feeding grain and hay twice daily, two single milker units, can coolers for selling manufacturing milk, stored hay and bedding overhead, upright silos and litter carriers or drive-through systems for manure disposal.

LAND CONTRACT GAINS POPULARITY

More and more farmers in Minnesota are buying property by the "land contract" method, a pair of University of Minnesota agricultural economists report.

R. V. Elefson and Philip M. Raup found that 38 percent of all Minnesota farm sales in 1957 were financed by land contracts. This is an increase from 20 percent in 1946.

Under a land contract, title to the land remains with the seller until the buyer has completed all payments on the contract. With a mortgage, the buyer gets the title at the time of the sale.

The economists found that as a group, land contract buyers bought a higher percentage of farms with "good" land than did mortgage or cash buyers. Also, contract buyers were more likely to buy farms with buildings on them, and the buildings in general were in better shape. Contract buyers were more interested in getting a complete unit, instead of a parcel or tract to be added to an existing farm. More farmers buying on land contract intended to operate the farm themselves.

The land contract--also called "contract for deed"--is a method of low equity financing. Down payments for Minnesota farm property bought this way average about 20 percent of the purchase price, in comparison to 40-50 percent for mortgage down payments. This, the economists say, means the seller should have a good deal of confidence in the buyer and you might therefore, expect to find many land contract sales between relatives. But such was not the case.

The proportion of land contract sales involving transfers between fathers and sons or other relatives was not much different from cash or mortgage sales.

In a survey of 350 farmers who had financed farm purchases with land contracts, the economists found that, in general, the farmers had good experiences with this system.

Most farmers in this survey had bought farms recently, although some had bought in the 1920's and several bought during the 1930's. Eighty-four

percent of these farmers had never missed a payment on their contracts, while about 14 percent--33 farmers--had missed payments. Of those who had missed payments, only 9 percent had missed four or more.

Under a land contract, Minnesota law permits the seller to repossess his land by a simple eviction procedure, which can be set in motion 30 days after a buyer has defaulted. Yet, of the 33 farmers in this study who had missed payments, only one had received notification of contract cancellation, even though some of the buyers were in default for as long as three or four years.

Elefson and Raup say this indicates a lenient attitude on the part of those who sell farms on contracts.

The economists explain that the disadvantages of the 30-day cancellation period is offset to some extent by a practice, often used, in which the contract permits the buyer to make advance payments or to exchange the contract for a mortgage.

This allows a buyer to pay out on his contract whenever he has built up enough equity to shift his financing to a more conventional mortgage.

Twenty-seven percent of the farmers questioned had an explicit provision written into their contracts for exchanging the contract for a mortgage. Seventy-four percent had the privilege of making payments of any size they desired, in advance.

NOTES IMPORTANCE OF FOREIGN TRADE TO AGRICULTURE

Soybeans from a third of the acreage planted to this crop in the U. S. last year were sold in foreign countries.

This is one example of how important foreign trade is to Minnesota agriculture, says Luther Pickrel, extension agricultural economist at the University of Minnesota.

Pickrel says, exports of wheat--another important crop in Minnesota--made up almost 54 percent of the nation's total wheat crop last year.

Importance of foreign trade to agriculture goes beyond what farmers sell abroad. The U. S. economy in part depends on large foreign markets for industrial goods as well as for farm products, Pickrel explains. Therefore, keeping foreign markets helps insure buying power of industrial workers--"number one" consumers of agricultural goods.

But to sell to countries, we must buy from them, too. Many nations depend on exports for their very existence. Chile send the U.S. two-thirds of her total copper production. Cuba sells us half her sugar and Bolivia, half her tin.

Some nations buy more from the U. S. than this country buys from them. In 1955, the U. S. sold Canada $282 million worth of farm goods and bought only $157 million worth. Yet, agricultural exports are as important to Canada as they are to the U. S. Pickrel points out that despite frequent comments about imports of Canadian grain, this country exported to Canada about half as much as we bought.

These points must be kept in mind in deciding whether tariffs should be imposed on agricultural imports.

Pickrel says it's sometimes argued that tariff protection increases the amount of work available for American labor. But this argument overlooks the fact that stopping imports reduces the work available in export industries. In this way, tariffs can actually be harmful to the American public.

REAL ESTATE MARKET UNDERGOES "INSIDE" CHANGES

Despite their importance, higher land prices are only one part of a big overall change in the farm real estate market in Minnesota.

This conclusion comes from an analysis of real estate transfers in the state during 1957. The study was conducted by Philip M. Raup and Jerome E. Johnson, agricultural economists at the University of Minnesota.

They report that the upward trend in land prices has continued since the middle thirties. Land values rose 9.5 percent from 1956 to 1957 in the state, for an average of $12 per acre. Highest values were in southwest Minnesota, where they averaged $230 per acre. Current trends show these values are likely to rise even more.

The steady increase in land values can't be explained by farmers' income earning potential, the economists state. While land values have risen by almost a third since 1953, net farm income in the state has declined. A large part--and perhaps the greatest--of land value increases in the last 10 years is due to sustained capital investments in land, both from public and private sources.

Another major reason for the increase in land values is that "investor" buyers--nonfarmers--bought more land than ever in 1957. They accounted for 19 percent of the total farm sales during the year, compared to 16 percent the year before, 14 percent in 1955 and 16 percent in 1954.

A third important reason for the land value upswing is the "farm expansion" buyer. For the state as a whole, persons expanding their present farms accounted for about 30 percent of 1957 farm sales. This was the same as a year earlier. Within certain areas, however, there were some changes. For example, "farm expansion" sales in the Red River Valley increased from 59 percent of all sales in 1956 to 64 percent last year.

"Investor" and "farm expansion" buyers together accounted for more than 50 percent of all sales in the western half of the state during the year. For the entire state, these buyers increased from 36 percent of all purchases in 1955 to 44 percent in 1957.

While the total rate of sales by "voluntary" (other than inheritance) transfer was not abnormally low, almost half of the voluntary sales were made either to "investor" or "farm expansion" buyers. This meant that the beginning farmer or renter in 1957 had only slightly better than a 50-50 chance of coming out as the successful bidder for a farm being sold by voluntary sale. In the northwestern counties, his chances were only 3 out of 10.

This, Raup and Johnson say, shows that the big advantage in today's land market--particularly in western Minnesota--is held by buyers who either can draw on capital from outside agriculture or can pay for the land with earnings from an existing farm.

The Soil Bank had little to do with raising farm land values. The current level is heavily weighted by high values in the southern part of the state, where there has been only minimum Soil Bank participation.

In their analysis, Raup and Johnson found that of all farm transfers in 1957, 30 percent were in some way connected with inheritance. This is the highest proportion of inheritance transfers in the state since 1926.

The study showed that "farm expansion" buyers are buying complete farms, not simply adjacent tracts or pieces of farms. Evidence to support this conclusion is that the average size unit bought by these buyers is about as large as the average size farm in each district concerned.

Finally, the economists found that both farm expansion and investor buyers weren't interested in buildings. More than half of all sales to these buyers involved land with either poor buildings or no buildings at all.

TENANT FARMERS WANT MORE LIVESTOCK

If Nicollet county is any indication, many tenant farmers in Minnesota would like to have more livestock.

R. V. Elefson, agricultural economist at the University of Minnesota, draws that conclusion from a recent survey of 77 tenant farmers in that county.

Two-thirds said they would increase their total number of livestock, if they owned their farms. None wanted to reduce one or more livestock enterprises without wishing to increase another one at the same time. Only 13 percent were satisfied with their present livestock arrangements.

As a group, these farmers wanted to expand their dairy herds more than any other single enterprise. Forty-nine percent wanted more dairy cows; only 5 percent wanted fewer head.

Forty-two percent wanted to keep more brood sows, compared to 4 percent who wished to have a smaller number. About 30 percent said they'd like to handle more feeder cattle while none wanted to feed fewer cattle. As a whole, these farmers wanted to feed 695 more cattle, which would be an increase of 135 percent over their 1957 operations.

SALES TAX LIKELY TO INCREASE FARM TAX IN MINNESOTA

A sales tax in Minnesota would likely put a heavier portion of the total tax burden on farmers, according to Philip M. Raup, agricultural economist at the University of Minnesota.

His conclusion is based on a study he made while a member of Governor Freeman's tax study commission.

The sales tax has recently been considered as a possible method of increasing state tax revenue in Minnesota. It also has been proposed as a way of relieving the burden on the property tax.

Raup explains that the income tax falls relatively lightly on the farmer. A sales tax, however, is based on volume of purchases. Since farmers are heavy buyers of household goods and farm supplies, both for the farm business and for the home, a sales tax hits them harder than non-farmers.

Both Illinois and Iowa have $2\frac{1}{2}$ percent sales taxes, although the two states handle them somewhat differently. A recent report from the University of Illinois shows that sales taxes on farm household items and farm machinery in that state averaged about 50 cents per acre, or roughly $24 per farm person annually. This was higher than the sales tax burden on the non-farm population.

Besides, the Illinois report did not include all farm purchases; it omitted building equipment, fencing, well supplies and other items. Therefore, the actual sales tax burden per farm person in Illinois is even higher than these figures show.

In Iowa, 1954, sales tax collections averaged $28 per person for farm families and $18 per person for non-farm families.

Suppose an additional $10 million were to be raised by taxes in Minnesota. If it had been raised by the income tax in 1955, Raup figures that farmers would have paid about $350,000 or $3\frac{1}{2}$ percent of the total increase.

But if a sales tax were used and if the burden per person were similar to that reported for Illinois, Minnesota farmers would have paid about 19 percent of the increase, or about $1.9 million of the $10 million total.

Basing the calculation on Iowa per-person figures, Raup says Minnesota farmers would have paid about 25 percent of the total, or about $2.47 million.

While exact measurement isn't possible, Raup figures that using a $2\frac{1}{2}$ percent sales tax in Minnesota would put from three to five times as large a percent of the new tax burden on farmers as would be the case if the same amount of revenue were to be raised by the existing income tax.

There is also evidence that farmers would be no better off if the sales tax were used to replace the personal property tax. In fact, they could be worse off in this case, according to Raup. To replace the personal property tax would probably require at least a 2 percent sales tax, and perhaps even a $2\frac{1}{2}$ percent tax.

In 1954, about half of the personal property tax levies in Minnesota were in Hennepin, Ramsey and St. Louis counties--counties that also contain about half of the state's population. This means the personal property tax at present is distributed throughout Minnesota in about the same proportion as the state population.

But Raup says it's reasonable to assume that a $2\frac{1}{2}$ percent sales tax in Minnesota would have results similar to Iowa, where the tax per person is 50 percent higher on farmers than on non-farmers. If that were the case here, adopting a sales tax to replace the personal property tax would shift a sizeable portion of the tax burden from non-farm to farm people.

FERTILIZER HELPS "BOOST FARM SIZE"

Fertilizer is one of the best answers Minnesota farmers have for the "small farm size" problem.

It's also an ideal way to lower per unit production costs.

Ermond Hartmans, extension farm management specialist at the University of Minnesota, says this: According to long-time Minnesota farm production figures, a good fertility program coupled with good crop production methods can make a smaller high-yielding farm more profitable than a larger farm with only average yields.

He gives this example: If a 120-acre farm produces 70 bushels corn, 60 bushels of oats and three tons hay per acre, total "crop labor return" will be only $100 less than from a 180-acre farm averaging 50 bushels corn, 40 bushels oats and two tons hay from each acre. "Crop labor return" is what's left after fertilizer, land charges, machinery and all other costs except labor are paid for.

The 120-acre farm, with the better yields, would require 350 hours less labor for the year. This saved labor could be used on livestock--hogs or feeding cattle--and would be enough for an extra $500 net income. So although the small farm had a somewhat smaller crop return, total income "potential" would still be $400 higher than for the 180-acre unit where yields were only average.

These figures are really conservative, Hartmans adds. In many Minnesota areas, the average yields, with enough fertilizer and good crop management, could be increased to 100 bushels corn, 60 bushels oats and four tons alfalfa per acre. In this case, total crop labor return would be $4,000 or $1200 more than a 180-acre farm still getting average yields.

Hartmans draws this conclusion: Before increasing the acreage on your farm, make sure your present land is producing above average yields.

Here's another argument for the high-fertilizer, high yield approach: If corn dropped to 80 cents per bushel, the average-yielding farm would make no profit no matter how large it is. But the "good-yielding" farm, at that price, would still make $6 profit per acre.

BIGGER HERD OF FEEDER CATTLE MORE EFFICIENT

If you have around 30 feeder calves, you can increase to 40 or 50 head without having to spend much more time caring for the herd. And the added efficiency can make a big difference in profits.

A recent University of Minnesota study of 59 cattle farms in southern Minnesota showed this: Thirty long-fed calves required about 7 hours labor per week, or an hour a day for regular chores while on limited feed of grain in dry lot. This was for hand feeding hay, silage and grain twice daily. It also included bedding the animals two or three times weekly, watering and observation, care of sick animals, and grinding feed on the farm. Hauling manure and other tasks took about 90 hours for the feeding season. Agricultural economists R. G. Johnson and T. R. Nodland made the study.

Adding more cattle took only 50 additional minutes per week for regular chores for each extra ten head and about $7\frac{1}{2}$ hours more for the entire feeding period for handling manure and other jobs. This rule held up to about 120 head. All these calculations are for hand labor.

Compared another way, 40 head of calves took 400 hours of labor over a 49-week period which includes 6 weeks on corn stalks. Herds of 80 required only 50 percent more, or 600 hours. From the study, Johnson and Nodland learned you can estimate total labor hours for a typical long fed calf program this way: Multiply the number of head by 5 and add this figure to 200.

Biggest increases in efficiency come from enlarging small herds. For example, increasing from 20-30 head reduces labor per animal by 22 percent. But going from 50 to 60 head cuts labor by around $7\frac{1}{2}$ percent per head.

EFFECT OF HIGHWAYS ON PROPERTY VALUES STUDIED BY ECONOMISTS

What effect will the new Interstate highway system have on Minnesota property values?

Nobody yet has all the answers, but University of Minnesota researchers are developing some measures to help find out.

Staff members from the geography and agricultural economics departments recently studied changes in property values and land use in three areas near the Twin Cities: highway 12 from St. Paul to Hudson, Wis.; highway 100 between Richfield and Bloomington; and 12 from Minneapolis to Wayzata.

The study showed a wide range in estimated property values within areas and between areas. In rural Washington county, the highest estimates of average per acre total value was 10 times the lowest. In the Richfield-Bloomington area, the highest was about 16 times the lowest.

Compared another way, the highest average value per acre in the Richfield-Bloomington area was 540 times higher than the lowest average per-acre value in rural Washington county.

While these findings need further testing, the researchers say the study also showed that:

1. Urban growth alone accounts for some land-use changes, independently of highway development.

2. Where land is changing from farming to industrial, commercial and residential uses, there tend to be expanding belts of idle land--probably signifying a value increase.

3. Regardless of how the area is zoned, there is a strong tendency for development of commercial-industrial strips along highways in suburban areas.

4. Pressure for commercial development soon slows or stops residential development on land near the highway.

5. The commercial strip tends to develop at first in "beads" at major intersections. Open areas of land tend to remain idle between the intersections for several years. But just how long this idleness continues has not been determined for all cases.

6. When there is a change in major use underway, values don't change uniformly over the affected area. But it's in these areas where the greatest value changes occur.

The study was conducted by Donald D. Carroll and John R. Borchert, department of geography, and James Schwinden and Philip M. Raup, agri-

cultural economists.

It was sponsored by the U. S. Bureau of Public roads and was done in cooperation with several state departments and county and local government officials.

DRY MILK INDUSTRY CHANGES IN MINNESOTA

Minnesota's dry milk industry has undergone some major changes in recent years, according to a pair of agricultural economists at the University of Minnesota.

E. Fred Koller and Richard J. Goodman say, total dry milk production in Minnesota has mushroomed from about 30 million pounds in 1936 to about 480 million in 1957. Much of this growth is due to, first, World War II demands and special prices and, more recently, the relatively favorable government support prices for nonfat dry milk.

Before 1945, most of the nonfat dry milk was produced by the roller process. Since then, the industry has shifted more and more to spray process powder production. Of the 383 million pounds of nonfat dry milk solids produced in Minnesota in 1956, all but 22.8 million were produced by spray process.

Another big change is that more manufacturers are producing more milk powders for specific customer uses. In the past, nearly all dry milk was of a rather standard "high heat" type. This was fine for bakery products and some other uses, but not for all. Recently, various "low heat" powders have been developed, for products like cottage cheese, instant milk and food mixes.

Larger volume is making dry milk plants more efficient. While wage rates, fuel prices and other costs have risen, the plants have reduced their average manufacturing costs per pound of dry milk from 3.55 cents in 1947 to 3.23 cents in 1953.

Some of the most important changes in the industry have been in size and types of drying plant organization, the economists point out. Since 1940, there has been emphasis on three general types of plants at different times--specialized drying plants, local butter-powder plants and "super" butter-powder plants.

There were about 20 specialized drying plants organized in Minnesota in the 1940s and two after 1950. They were large at the start, but they've made phenomenal growth since. Sixteen of them averaged 4.7 million pounds per plant output in 1947 and increased to an average of 9.7 million pounds in 1957.

Local butter-powder plants--generally, larger local creameries which have added a milk drying department--have been increasing in number recently. These plants usually receive whole milk direct from producers, then process the cream into butter and the skimmilk into powder, all in the same plant.

There are about 40 of these local butter-powder plants drying milk in Minnesota. In 1957, they produced about 32 percent of the total dry milk in the state and averaged 3.8 million pounds for the year.

Among the local butter-powder plants, the economists say some have lowered costs and increased returns to dairy farmers through good efficiency. Others, however, still haven't reached a volume of business that allows them to operate at the lowest possible cost per unit. Some could get better results by improving their equipment and through better management.

Plants that receive whole milk and produce butter and powder on a large scale are called "super" butter-powder plants. These, too, are on the increase. There are about 14 of them in Minnesota now and they average about 11 million pounds dry milk and 3 million pounds butter per plant annually.

The super butter-powder plants have many advantages and have the greatest promise for the future, according to Koller and Goodman. Thanks to large volume, they can reduce butter manufacturing costs per pound to the lowest possible level. They can make use of bigger equipment, more efficient techniques, automation and other labor-saving methods. They also can keep better control over their products and can reduce butterfat and milk solids losses that many smaller plants have.

Agricultural Engineering ...

GRANULAR HERBICIDES SHOW PROMISE

"Granular" weed killers may be the answer to some of the chief objections farmers have to chemical herbicides.

University of Minnesota 1958 experiments showed that Simazin and Randox in granular form can give good weed control in corn -- although not quite as good as the same chemicals in sprays.

Granular herbicides are something new. Up to now, practically all anti-weed chemicals have been used as sprays, in liquid form.

Louis A. Liljedahl, USDA engineer, made the recent tests. And he says if granular materials continue to prove out well, farmers may like them better than sprays. Here's why:

Randox and Simazin--both rather new chemicals--are far better for weed control in corn than anything seen up to now. Yet many farmers don't like using them. Randox in liquid form burns the skin. It is so toxic you need to wear rubber gloves, goggles, and snug-fitting clothing when using it.

Simazin is a problem from a mechanical standpoint. It comes only in "wettable powder" form, to be mixed with water. The carrier in such a powder can ruin many sprayers in short order. Also, the powder is hard to keep in suspension and can easily plug up nozzles and hoses.

Granular weed killers get around most of these objections. They're applied dry, which eliminates the sprayer problem. Also, granular Randox is less toxic and therefore less of a worry to the operator. So the only real question is whether the granular form gives as good weed control as the spray.

Liljedahl compared spray and granular forms of the two chemicals as pre-emergence "band" applications on corn. This meant putting a band of chemical 14 inches wide over the row, just after planting but before the corn came up.

At the end of the summer, there were 92 pounds of weed per acre where Liljedahl used the spray, and 250 pounds where he applied granules. But either count meant mighty good weed control. Giant foxtail and other weeds often total up to several thousand pounds per acre where no control was used.

In his tests, Liljedahl used both forms of Randox at 4 pounds and Simazin at 2 pounds per acre. These are recommended rates for the sprays and are probably best for granules, too. Higher rates didn't control weeds any better.

FARMER BUILDS POLE-TYPE HOG HOUSE

BROWNSDALE, MINN. --What from one angle may resemble a familiar "hot-dog" stand is really a novel house for live porkers on a farm here in Mower county.

Harvey Holst's new pole-type hog house gets its unique appearance from a series of eight panels on the top half of the walls. The panels open inward for ventilation, leaving the bottom half looking somewhat like a refreshment stand counter.

Harvey Holst, left, and Don Hasbargen, Mower county agent, inspect the construction in Holst's new pole-type hog house.

But that's only one feature of the 48 x 16-foot structure, built to house up to 125 hogs being finished for market. Here are some more:

* Sides attached to the inside of the posts on the bottom three feet around the building. This keeps litter from collecting around the posts and makes the floor easier to clean. On the top half of the sides, the boards are on the outer side of the posts.

* Alternating 12-inch planks and two-by-fours on the bottom half of the wall, so that the smaller members can be removed for better cross-ventilation in hot weather.

* A 14-foot sliding door on the southside, both for ventilation and to make room for a tractor and loader to get in.

* A roof of plywood sheathing covered by corrugated metal.

* A sliding door that can be locked open at three different places.

In addition, Holst put a concrete floor in the building and paved a 32 x 48-foot area in front of it. He plans to equip the building with a water sprinkler system--to keep the hogs cool in hot weather and will put in an automatic waterer and self-feeder on the outside lot. The whole project

shouldn't cost more than $1,700, he figures.

Before building the house, Holst talked over several ideas with Donald Hasbargen, Mower county agent. "The design we finally came up with 'just grew,' you might say, as we went along," he states.

The new house will handle the growing and finishing of hogs in Holst's "multiple farrowing" plan. He has 12 sows farrow at a time, four times each year in other buildings. That will mean finishing out about 100 hogs that many times annually in the new unit.

The new hog house wasn't Holst's first pole-type structure. He built a 24 x 42-foot machine shed on the same principal a year ago, for a total cost of just $1,200.

TILT-UP BUILDING IS CHEAP AND EASY TO BUILD

A sturdy, easy-to-erect building that costs less than a dollar per square foot of floor space--that's the tilt-up concrete structure now being used on many farms.

It's ideal for machinery storage, cattle loafing pens or other use when the building doesn't need to be heated, according to D. W. Bates, extension agricultural engineer at the University of Minnesota. This structure features reinforced concrete wall panels, 4 inches thick and either 8 or 10 feet square.

To make this building, you construct the panels on a sand casting bed, cure them for 3 days, and raise them up with a tilting frame.

You set the forms at wall section junctions and cast concrete columns to hold the sections in place.

Any conventional type roof can be used on a tilt-up building. However, clear-span roofs are best because they eliminate the need for posts in the building for roof support.

One big advantage of the tilt-up building, Bates says, is that it doesn't require a foundation. The pre-cast wall panels rest on post or column-type footings where the panels join. Also, the building is as cheap to build as many other so-called low-cost structures.

HAY CONDITIONERS CAN SHORTEN HAY DRYING TIME

In sunny weather, a hay crusher or crimper can cut several hours off hay drying time in the field.

Paul Marvin, University of Minnesota agricultural engineer, reports that in 1957 field tests, hay consistently dried faster after being "conditioned" with a crusher or crimper. The tests were conducted at the Rosemount Agricultural Experiment station by Agricultural Engineers John Strait, Marvin, and Bruce Fiedler.

The weather, particularly amount of sunlight, had an important effect on how fast the hay dried after conditioning. For example, hay cut and crimped on July 10 averaged 22.3 percent moisture --about right for baling--after 26.2 hours of field drying. Unconditioned hay averaged 38.4 percent moisture after the same period. That was in clear weather.

On the other hand, second-crop hay cut and crushed August 1 in partly cloudy weather still contained 37.7 percent moisture after 30 hours of drying.

All types of hay conditioners run hay through at least one pair of rollers. Some have smooth rollers that crush the stems, some have corrugated rollers that crimp or break the stems and some have both types of rollers. Some conditioners are individual units and some are combinations mowing and conditioning machines. There was little difference between all types, on the average, in effect on drying rates.

Normally, legume hay leaves dry faster than the stems. By the time stems are dry, leaves are often so brittle that many of them fall off when hay is harvested.

Conditioning the stem allows it to dry as fast, or nearly as fast, as the high-protein leaves. Also, getting hay dry and ready to put in the barn quicker can help a farmer take advantage of shorter periods of good drying weather during the haying season.

BUILD TO FIT CLIMATE BUILDING SPECIALIST SAYS

Regardless of how well you like Minnesota's weather, you can still plan farm buildings to fit this erratic climate.

Whether it's for livestock or family, a building properly planned can be warmed by the winter sun and still refreshed by the cool breezes of summer.

Jesse Pomroy, agricultural engineer at the University of Minnesota, suggests several rules for "building to fit the climate."

Take advantage of the sun, Pomroy says. Face long, narrow buildings toward the sun, with the long axis east and west. Build some overhangs to shade sun in summer.

Shield buildings from prevailing winter winds, but don't cut off summer breezes.

If you have a choice of sites, always take south slopes over north, and pick east slopes over west. Pomroy says north slopes can be just as hot in summer as south slopes and will definitely be colder in winter. North slopes will also be slower to warm up in spring.

West slopes are very hot in summer; yet they offer no winter advantage, since the sun then is too low to be any help.

Avoid building in small valleys and low spots, Pomroy advises.

Also, avoid large windows. But if a large glass areas is absolutely necessary, make sure you have a "double glazed" arrangement--either a window with two panes or two windows. If possible, don't have such a window face prevailing winter winds.

If the ground has the right slope, there's something to be gained by building into a bank or side hill. This usually means more gradual temperature changes and walls will be warmer in winter and cooler in summer.

ADVICE GIVEN FOR SPRAYING WITH SIMAZIN

If you plan to use simazin for weed control this year, you may need to give your spraying equipment a second look.

Unlike most anti-weed chemicals, simazin is available only as wettable powder. This raises some problems with field spraying equipment, says L. A. Liljedahl, U. S. Department of Agriculture engineer at the University of Minnesota.

Whenever you use a wettable powder in solution, your spray pump will wear faster. The "carrier" material in the powder is usually abrasive to metal.

Gear pumps are most affected by this abrasive action, so try to avoid them if you use wettable powder, Liljedahl advises. Roller pumps are all right, but use one that has 2 - 2-1/2 times the rated capacity you actually need.

Here's why this is necessary: Tests show that after 40 hours of operation with wettable powder, roller pumps will be so worn that capacity is about cut in half. After this, the capacity decreases slowly and the pump will perform satisfactorily, but at the lower capacity.

A centrifugal pump is all right, but if used with power take-off, it must operate fast enough to get the desired pressure--usually 30-40 pounds. This means the pulley on the PTO shaft must be 5-6 times as large as the one on the pump.

Here are some other points to watch when using wettable powders:

1. Be certain the actual pump capacity is high enough so the by-pass liquid is enough to agitate the suspension in the tank.
2. Use either ceramic or carbide nozzles, if possible. If you use brass ones, check them frequently for wear. They may need to be replaced frequently.
3. Avoid extremely large hoses or booms between the pump and nozzle, to avoid letting the suspension settle out.

ELECTRIC POWER STUDY REPORTED

Agricultural engineers at the University of Minnesota are taking a close look at how farm families use electrical power.

Arnold M. Flikke reports a recent study of power usage for 15 days during the winter on one Hennepin county farm showing that:

* While total electrical power usage varied widely from one day to the next, the time of the "peak" load was always about the same.
* It was difficult to determine which pieces of equipment were most responsible for "peak" electricity usage.
* The highest usage that the farm meter showed for any one time was about a third of the "connected" load, or total possible usage.

In conducting this study, the engineers installed meters at different places and on certain pieces of equipment.

Total usage for the 15-day period was 1160 kilowatt hours. The total connected load for the farm was 45 kilowatts, but the highest usage during any peak period was 14 kilowatts. Peak loads occurred at about 8 a. m., 4:30 p. m. and again between 10 and 11 p. m. The time for the last peak, however, varied with the family habits.

Highest individual user of electricity for the 15 days was the water heater in the house, using 219 kilowatt hours. Next was the water heater in the milk house, with 206 kilowatt hours. Both were off-peak heaters, meaning they operated at specified times other than during times of peak electricity usage.

Equipment operating primarily during the peak periods, and kilowatt hour usage of each, included: bulk milk cooler, 105; barn lights, 18; milker, 23; pump, 30; kitchen range, 44; miscellaneous household appliances, 64.

IRRIGATION CAN BOOST CROP YIELDS

Although Minnesota growing seasons are usually quite favorable, irrigation would boost crop yields in some years.

Even during wet years, short drouths may cut crop growth, especially on light soils, according to E. R. Allred and C. L. Larson, agricultural engineers, and G. R. Blake, soils researcher at the University of Minnesota. They list the following benefits from irrigation:

* Drouth insurance.
* The right amount of moisture at exactly the right time for top yields.
* Early maturity of market fruits and vegetables, to help beat the flooded markets.
* Improved quality.
* Frost protection for low-growing crops.

Before investing in an irrigation system, make certain your water source meets three important requirements. First, water must not contain harmful salts. Second, a legal permit must be obtained to use the water. Third, plenty of water must be available at all times.

In Minnesota, you'd need about 10 gallons per minute for each acre to be irrigated, if you plan to irrigate 16 hours per day. Greater flows would be necessary if you plan shorter daily periods of operation.

UNDERGROUND CABLE DESIGNED FOR FARMS

Electricity is literally going "underground" on Minnesota farms.

There's a new electric cable available, called "underground feeder" which is just the thing for wiring that brooder house or other building without overhead wires. You can bury it in the soil; its plastic covering won't rot from moisture or animal acids.

Donald W. Bates, agricultural engineer at the University of Minnesota, says underground feeder comes in two or three-conductor cable. It comes in different gauge sizes and with or without a grounding conductor.

Other new electrical materials also include:

* Glass fiber reinforced plastic switch boxes

which are virtually unbreakable.

* New types of "solderless" connectors which aren't affected by continued heating and cooling.

* "Remote control" switches to control lights from several places.

* "Intercommunication" systems, making it possible to find out if dinner's ready when you're still in the barn.

ELECTRIC HOUSE HEATING BEING TRIED IN STATE

One of the biggest innovations in home heating since coal-burning central furnaces replaced the pot-bellied wood stoves is getting a tryout in Minnesota.

The new system is electric heating. About 150 Minnesota homes are now being heated this way and the idea will no doubt gain popularity in years ahead.

There are four types of electrical heating units, according to Vernon Meyer, agricultural engineer at the University of Minnesota. These include: built-in wall units or panels; ceiling panels or electric cable; baseboard heaters and central units. Only the last of these--the least common--operates on the principal of a conventional furnace. The others have no blower or heat duct system.

Meyer collected power use information on 11 electrically-heated homes in Minnesota.

Electricity consumption ranged from about 8 to 19 kilowatt hours per square foot per year, depending on location, size of the house, insulation and other things. One particular house with 1,000 square feet used 18,000 kilowatt hours during the 1957 - 58 heating season, for a total heating bill of $315 for the year.

Despite the power costs, electric heating has several advantages, Meyer says. Installation costs are usually low. It makes it easy to vary the heat from room to room. The temperature can be more carefully controlled and the unit requires less space. There is no fuel storage problem, no ashes or soot and maintenance costs are low.

DRAINAGE SYSTEM PUMP IS CHEAP TO RUN

Compared to other field costs farmers have, a pump system for field drainage is pretty cheap to operate.

Depending on how it's hooked up, the pump will annually use somewhere between 60 cents and two dollars' worth of electricity per acre drained. Curtis Larson, University of Minnesota agricultural engineer, bases that conclusion on five years of studies on pumping stations in southern Minnesota.

Average power use ranged from 19.5 to 30.3 kilowatt hours per acre, for an average of 24.3. Average growing season rainfall was 1.28 inches above normal for the 5-year period.

Actual cost of electric power depends on whether the farmer connects the pump to a separate transformer. If he does, there is often a minimum charge for 40 kilowatt hours and power will cost between $1 and $2 per acre.

Where the pumping plant was near the farmstead, it was connected to the same transformer as the rest of the farm's equipment. Most farmers now use enough electricity so any added load costs only about 2-1/2 cents per hour. In this case, the average power use for the pump would be about 60 cents per acre.

The cost would be higher in unusually wet years, Larson says, but it's still low in comparison to other field expenses.

"HARD SURFACING" STRETCHES LIFE OF FARM MACHINES

Here's a cheap, easy way to get anywhere from twice to 20 times as much wear out of the "cutting edges" of your farm machinery.

It's called "hard surfacing," and means welding a coating, edge or point of metal on surfaces that get the most wear. The material used for hard surfacing is an alloy that doesn't wear as rapidly as machinery steel.

According to William L. Olson, farm shop instructor at the University of Minnesota, hard-surfacing pays on many farm machines: plow shares, discs, coulters, cultivator shovels, chisels, feed mill hammers, draw bar connections, mower shoes and even ensilage knives. Cost of hard-surfacing a plow shore, for example, may vary from 75 cents to $1.25, depending on the type of soil for which it is being prepared.

There are two main kinds of wear, Olson explains--abrasion and impact. Abrasion is a cause of wear in sandy and even in heavy soils under dry conditions such as prevail this fall. Impact is a problem in rocky soils or anytime the surface of the tool is battered and worn away. Hard-surfacing, if done properly, can help delay either condition.

Hard surfacing material comes in rods. Several types are available, but specifications clearly indicate which kind to use for certain conditions. You can do the welding yourself, if you have the equipment, or have a local welder do it. Many vocational agriculture teachers can advise farmers how to do the work.

Since this process works so well, you might wonder why machinery parts aren't made of this alloy in the first place. The reason, Olson explains, is that the alloys are more expensive than steel. It would seldom pay to make an entire plow shore, for example, from the alloy. Second, such alloys are generally brittle and wouldn't stand the strain that most machinery parts take.

Agronomy and Plant Genetics ...

BASIC STUDIES LEAD TO BETTER CROP VARIETIES

Not many years ago, plant scientists thought it would never be possible to develop an oat variety that would resist races 7 and 8 of stem rust.

In the early 1950s, that disease ruined vast acreages of oat varieties then being grown. Farmers worried over whether it could ever be stopped.

Fortunately, basic research in the department of agronomy and plant genetics at the University of Minnesota and elsewhere in the nation helped spell the answer to the dreaded stem rust.

The scientists, using basic breeding techniques, developed oat strains resistant to both races. Now, they are using these strains in breeding projects aimed at developing even better oat varieties.

This is an example of basic research in agronomy. W. M. Myers, head of the department, explains that the key to this breeding research lies in plant chromosomes--rod-shaped bodies in plant cells which carry the genetic factors that determine all inherited characteristics. They are so small they must be magnified 1,000 times to be studied.

Knowledge gained from fundamental studies on these chromosomes is enabling scientists to combine superior characteristics from different varieties, Myers says. Such research made possible varieties like Minhafer oats, Forrest barley--both University-developed varieties--Vernal alfalfa and superior corn hybrids.

Basic research on plant chromosomes has been going on for many years, but there is still much to be learned. For example, since the outbreak of race 15B of wheat stem rust, plant breeders have been trying, without success, to transfer the full resistance from Kenya Farmer wheat to improved varieties. Kenya Farmer, while resistant to 15B, has other characteristics which make it unsuitable as a commercial variety.

Fortunately, fundamental studies in recent years may open new avenues by which scientists can make use of Kenya Farmer's disease resistance. By using special genetic and microscopic techniques, scientists have found that each of several chromosomes, rather than just one, in Kenya Farmer carry an individual rust resistance "factor." That explained why it has been difficult to transfer resistance characteristics of Kenya Farmer to improved varieties by simple crossing methods.

Armed with this information, plant breeders can now proceed more intelligently to breeding Kenya Farmer resistance into improved wheat varieties, Myers says.

Some other basic studies in plant genetics are:

1. Corn breeding. Hybrid corn is based on superior inbred lines which are developed after several years of self-pollination. A new technique, called the "Oenothera" method, is being studied. Theoretically, it would allow plant breeders to produce, with only one generation of self-pollinating, inbred lines which would be even better on the average than inbreds developed now by conventional methods. Before this can be done, however, strains of corn must be produced in which all chromosomes are in a large ring instead of in pairs as is now the case. Producing such new strains will be a tedious task.

2. Irradiation. Scientists found long ago that mutations can be produced with nuclear radiation. Most of these changes have not been useful to the plant breeder, but there have been a few favorable mutations. The ultimate hope is to develop techniques which will enable scientists to produce whatever changes in hereditary characteristics they wish.

3. Cereal crop improvement. Normally, crop varieties in breeding projects are crossed only with other varieties that have the same number of chromosomes. However, some plant species related to oats have characteristics that could well be used in oats on Minnesota farms. The trouble is that the "distant cousin" plants have different chromosome numbers, meaning new basic procedures must be developed to cross them with cultivated oats.

There are also basic studies in the agronomy and plant genetics department on processes involved in silage preservation, on action of chemical herbicides and other problems in crop production and management.

LATE VARIETIES ARE BEST FOR OAT SILAGE, HAY

If you plan to harvest your oats specifically for hay or silage this year, use a late variety.

But if you plan to have a particularly large acreage of oats for silage, you might be better off planting both a late and a medium-maturing variety. This will make it possible to spread the harvest season over a longer period.

Rodney Briggs, University of Minnesota agronomist, says 1957 trials at five stations showed that late varieties consistently gave the highest forage yields. This held true both on a wet and on a dry basis.

Highest silage yielder of all oat varieties in the 1957 trials was Rodney, averaging 11.38 tons per acre. Branch and Garry, also recommended late varieties, yielded 10.2 and 10.5 tons, respectively.

When the yields were figured on a dry-matter basis, these three varieties again yielded more than medium or early-maturing varieties. Rodney averaged 3.85, Branch, 3.84 and Garry 3.66 dry tons per acre.

These tests were at University branch experiment stations near Waseca, Morris, Crookston, Grand Rapids and Duluth.

BALING SILAGE HOLDS PROMISE

A year of tests with baled grass silage show the practice is a promising way to deal with a wet hay crop.

But it also has some problems and at present is an experimental procedure, according to Rodney Briggs, University of Minnesota agronomist.

This method involves cutting and baling hay at 35-50 percent moisture--high for mow hay, low in comparison to normal grass silage. The bales are stacked on one end of a sheet of plastic. The sheet is then pulled over the stack and ends and edges are covered with enough soil to make the entire stack air-tight.

Research workers tried the idea on the St. Paul campus and at four branch experiment stations last summer.

Wherever the plastic held, the baled silage was good when the stacks were opened in winter At the Grand Rapids station, for example, total dry matter losses were below 5 percent.

However, all the baled hay silage had some white mold in it. This, Briggs says, may be due to "trapped" air, which was in the bag when sealed. The mold grew until the trapped air was used up. Curiously enough, this white mold seemed to be more help than harm. It apparently made the silage more palatable; cattle ate it well.

Silage spoiled wherever the plastic bags tore or had holes punched in them--just as anyone would expect. It's clear, according to Briggs, that plastic used this way must be least 8 or 10 "mil" in thickness.

There were also problems in opening and feeding this silage. Once you open a plastic bag, the entire surface is exposed to air. If the temperature is above 40 degrees, this makes a big spoilage problem.

BONUS EFFECT ON LEGUMES NOTED ON CORN

Agronomists at the University of Minnesota are convinced that alfalfa has an important "bonus effect" on corn planted on the field later on.

Legumes do much more than simply provide nitrogen, the scientists say. Field trials reported in past years and again in 1957 have indicated this is true.

These tests have been conducted at the Southern Experiment station, Waseca, by University agronomists, soil scientists and Waseca station staff members. In 1955, corn was planted on plots that were either in grain, grass or alfalfa the year before.

Every plot has been in corn since. Rates of 20, 40, 60 and 80 pounds of nitrogen have been compared on each set of plots during each of the three years.

For each fertilizer rate, plots that were in alfalfa in 1954 have consistently yield averages show 104 bushels of corn where the corn followed alfalfa and where 80 pounds of nitrogen was added. Where the same fertilizer application was used but where corn followed grain, yields averaged 84 bushels per acre.

While some of this increase is from nitrogen supplied by alfalfa, much of it must certainly come from other things. It's quite likely, the agronomists and soils scientists say, that the legume improves the soil structure and internal drainage. There is also a possibility that alfalfa moves plant nutrients up from lower soil layers and leaves them where corn can use them in following years.

PLASTIC COVER REDUCES LOSS IN BUNKER SILO

An inexpensive sheet of plastic over your bunker or trench silo this summer can easily save up to $100 worth of silage.

Bill Hueg, extension agronomist at the University of Minnesota, says this saving comes in preventing surface spoilage that would otherwise occur in such a silo.

Grass silage may easily suffer a 15-20 percent loss in uncovered trench or bunker silos. Research shows that much of the surface spoilage can be eliminated by covering the silo with a plastic sheet after filling.

In a silo with 200 tons capacity, even ten percent spoilage would mean losing 20 tons. If you figure the silage is worth $5 per ton, preventing this spoilage would have saved $100. And this is a conservative estimate.

Besides, preventing spoilage also gives more feed production per acre, plus lower storage costs per ton.

A plastic cover is also a good investment in an upright silo. While surface spoilage there isn't as great as in a trench or bunker silo with more exposed surface, it's still great enough to make a cover pay.

Hueg emphasizes, though, that a plastic silo cover does no good unless it seals the top tightly and keeps all air out. This means that you need at least 6 or 8 mil (thickness) plastic. The material to use is a polyvinyl plastic, either green or black.

The plastic must be held down firmly around the edges. You can put sandbags, soil, or anything that holds it tightly without leaving places where air can get under the cover.

With good care, a sheet of plastic will usually last for two years.

COMPANION CROP STUDIES REPORTED

When oats are used as a companion crop for legume-grass mixtures, it says to cut them for hay or silage.

The reason: higher forage yields the following year.

A. R. Schmid, University of Minnesota agronomist, says alfalfa-timothy mixtures in recent field tests yielded 3.55 tons per acre where the companion oats crop the year before had been cut for hay in early July.

In comparison, where oats were combined in August and the straw removed, forage yields the next year were down to 2.5 tons per acre. Combining and then clipping the stubble increased forage yields during the following year to 2.9 tons

per acre, but this was still a good half ton less than where the oats had been removed for hay or silage.

Schmid says the reason for better results from cutting the companion crop for hay is that this practice gives the legumes a better chance to develop during the first year. This means more vigorous, hardier plants.

"INTERSEEDING" LEGUMES SUCCESSFUL ON TWO FARMS

ANOKA -- Seeding alfalfa between wide corn rows could well become a popular field practice of the future.

Morris Titterud and Allen Sorteberg, two Anoka county farmers, tried this practice in 1957 and they say they have better legume stands as a result.

After talking it over with County Agent Dick Swanson last year, Titterud and Sorteberg decided to give this "interseeding" a whirl.

Titterud, a member of the Board of Supervisors for the Anoka Soil Conservation district, figures the practice might help avoid wind erosion. Ordinarily, many farmers in this area seed legumes in mid-summer with no companion crop at all. While this can give good stands, it means leaving the field without cover--and exposed to blowing winds--during several weeks of hot, dry weather.

Morris Titterud, left, Anoka county farmer and County Agent Richard Swanson examine a stand of alfalfa seeded between corn rows the year before.

Some farmers use oats as a companion crop, but oats yield poorly in this area.

When he planted his corn, Titterud used only one side of the planter, so the rows were 80 inches apart. He hitched the planter so it put the corn seed in the track of the tractor's front wheels. He planted 22 acres on undisked soil.

He rented a 72-inch packer-type seeder, specifically designed for interseeding and seeded the alfalfa in early August. "It all certainly turned out well," he says. "Although wide rows meant lower-than-normal corn yields, I still got more use of the land than I would have by leaving it idle half the summer. Also--and this is especially important--the field was constantly protected from blowing.

Like Titterud, Sorteberg says one of the big advantages of interseeding is in controlling wind erosion. On six acres, he spaced the corn rows 84 inches apart, and seeded the alfalfa July 10 with the same seeder Titterud used. At this time, Sorteberg's corn was still short enough so that he could straddle one corn row with the tractor.

Sorteberg seeded another field the old way, with no companion crop. The difference is striking. "Where I seeded between the corn rows, there's a much better stand," he says. "One reason is that interseeding was after thoroughly cultivating, which meant less quackgrass."

Results with interseeding on these two farms are in line with findings by University agronomists.

ANTI-WEED CHEMICAL GETS FARM TRYOUT

WILLMAR -- One of the newer weed-killing chemicals has already given a good account of itself on several west central Minnesota farms.

Simazin--the chemical--delivered a knockout blow to annual grass and broad-leaved weeds in a demonstration last summer on the Marvin Behm farm near Atwater. Behm set up the demonstration in cooperation with Ronald McCamus, Kandiyohi county agent, and Robert Anderson, assistant agent.

Behm compared Simazin with Randox, another chemical. He broadcast each chemical on a portion of his corn field at planting time. Present recommendations, however, call for "band spraying" over the row, simply to reduce the cost.

Both Simazin and Randox reduced the weeds enough so that Behm could eliminate the first cultivation. Randox gave the best early-season weed control, but Simazin "took hold" later on and gave the best results in the long run, Behm says.

The Kandiyohi county agents and the county weed inspector had similar results in a cooperative demonstration on the Pioneer Corn Breeding farm near Willmar. In this demonstration, Simazin gave an estimated 95-100 percent control of annual grass weeds and even eliminated many of the Canada thistles.

Randox controlled 80-95 percent of the annual grass weeds, but didn't affect Canada thistles. This is to be expected; Randox is primarily intended for controlling annual grass weeds, not perennials like Canada thistle.

Each chemical was applied at 4 pounds of active ingredient per acre in these tests. University of Minnesota research shows, however, that Simazin will give just as good results at 3 pounds per acre.

CHEMICAL STOPS WEED IN CORN

BELLE PLAINE -- Visitors to the Mahlon Schwartz farm here in Scott county have seen one of the best ways yet to stop weeds in corn fields.

In a "show window" field demonstration, Schwartz has completely licked giant foxtail with two different chemical treatments--one is a mixture of Randox and 2, 4-D "ester" and the other is Simazin.

"Foxtail is one of the worst weeds ever to get in our corn." Schwartz explains. "I've sprayed with 2, 4-D in the past for other weeds, but that chemical alone won't stop foxtail." This is because foxtail is a grass with narrow leaves; 2, 4-D kills only broad-leaved weeds.

Mahlon Schwartz, right, shows Scott county agent Arnold Sandager the effect of a mixture of Randox and 2, 4-D ester spray. The row in front of Schwartz was not sprayed and is full of foxtail. The row to the left, by Sandager, was sprayed and is weed-free.

With help from Arnold Sandager, Scott county agent, Schwartz in spring 1958 set up a weed control demonstration in a 10-acre corn field. He compared five different chemical treatments--all applied as "pre-emergence" sprays in a band over the corn row at planting time.

"Where I sprayed with the Randox-2, 4-D mixture, you could hardly find a weed in the row," Schwartz says. "But the untreated rows nearby were 'full' of foxtail." He applied this mixture at 5 pounds Randox and 1 pound 2, 4-D ester per acre.

FARMERS URGED TO WATCH FOR SILO GAS

While silo gas is definitely a danger at filling time, it shouldn't stop anyone from making silage.

Rodney Briggs, University of Minnesota agronomist, says a few simple rules will eliminate danger from silo gas poisoning:

1. Watch for irritating yellow or brown fumes in or near the silo during filling operations. If you notice such fumes, stay away.
2. Don't enter the silo without first operating the blower for 10 or 15 minutes. This will ventilate the silo, chute and silo room. Follow this procedure whenever entering the silo for the first 7 or 10 days after filling.
3. Leave the top chute door of the silo open to prevent accumulation of gases on the surface of the silage.
4. Make sure there's a way to ventilate the silo room or area near the base of the silo. The gas is heavier than air and settles downward.
5. Keep children and animals away from the silo for the 7-10 day period after filling.

RANDOX KILLS FOXTAIL IN GRAIN SORGHUM

Randox--a proven chemical for killing weeds in corn and soybeans--does a good job in grain sorghum, too.

In 1958 spring trials at the University of Minnesota's Rosemount Agricultural Experiment station, Randox eliminated giant foxtail in sorghum plots. Foxtail is one of the most bothersome weeds in Minnesota.

According to R. G. Robinson, University agronomist, the best time to apply Randox on sorghum fields was when the sorghum came up but not later than the "two-leaf" stage. This gave good foxtail control, but didn't hurt the sorghum. Application rate was 4-6 pounds of Randox per acre.

Applying the chemical at planting time, as a "pre-emergence" spray also killed the weeds, but that treatment resulted in slight sorghum injury.

SUMMER SEEDING OK FOR ALFALFA

Alfalfa can be successfully seeded in midsummer, if done no later than August 15.

This tip comes from William Hueg, extension agronomist at the University of Minnesota.

Mid-summer alfalfa seeding makes it possible to take advantage of late summer and early fall rain, Hueg explains. Also, there should be good growth before frost and fewer weeds.

Hueg suggests these rules for success if you're planning to seed this summer:

1. Use a winter-hardy and wilt-resistant variety--either Vernal or Ranger. Certified seed should be first choice.
2. Test the soil and fertilize accordingly.
3. Inoculate the seed, before planting, with alfalfa inoculum.
4. Seed shallow. Set the seeder to place seed 1/2 to 1/4 inch deep in a firm seedbed. Cultipack the field to make good contact between seed and soil particles.
5. Don't graze the seeding this fall; wait until next year.

LISTS CHOICES FOR IMMATURE CORN

Even if corn freezes before it gets ripe, farmers can still salvage a good deal of the feed value in the crop.

William Hueg and Harley Otto, extension agronomists at the University of Minnesota list several ways to handle frozen, but immature corn.

First, they say, you can put the corn up as ear corn or shelled corn silage. Seventy-eight Minnesota farmers recently surveyed tried this practice in 1957 with good results. Ear corn silage must have 40-50 percent moisture and shelled corn needs 30-35 percent moisture to store well.

Also, a hammer or burr mill should be used for making such silage, the agronomists say. This grinds the corn more finely and prevents the cobs and kernel in ear corn silage from separating. If the separation occurs, there may be more mold and beef cattle don't like the bunches of cobs. Also, the silo needs to be air-tight and the silage should be covered with a plastic cap.

Second, frozen but immature corn can be put up as regular corn silage--stalks, ears and all-if it's done as quickly as possible after the frost. It may be necessary to add water to make up for moisture loss in frozen leaves.

Third, corn can be put in permanent cribs, if the crib is no more than 4 feet wide. If it's wider, there should be ventilators or air ducts built through the center.

Fourth, long, narrow temporary cribs can be built for storing the immature corn. They should be not more than 4 feet wide and need a slatted floor 10-12 inches off the ground.

Finally, you can let the corn dry more on the stalks, if it's possible to hold off picking until colder weather sets in. This will avoid much spoilage that might occur in cribs.

ORCHARDGRASS IS PROMISING FOR BLOAT CONTROL

Orchardgrass might be an effective weapon for preventing bloat in cattle.

The reason: this grass is a good competitor with legumes. In recent field trials at the University of Minnesota's Rosemount Experiment station, pastures seeded with a mixture containing orchardgrass ranged from 54 to 72 percent grass the year after seeding.

It's generally agreed that bloat is much less of a problem when the pasture is less than half legumes. But controlling the grass-legume proportion is often quite a problem. When legumes and grasses are seeded together, the legumes tend to be most dominant the first year, then gradually give way to the grasses in later years.

According to A. R. Schmid, University agronomist, the seed mixture used in the Rosemount tests contained 5 pounds alfalfa, 1 pound alsike clover, 6 pounds bromegrass and 2 pounds orchardgrass. But despite the small amount of orchardgrass seeded, that species made up most of the grass in the pasture this summer.

The pasture was renovated and seeded in the spring of 1957.

"EMERGENCY" SILAGE PROCESS BECOMES STANDARD PROCEDURE

WINDOM -- A new idea in silage-making did such a good job of solving a "wet corn" problem here a year ago that many farmers made standard practice of the innovation in 1958.

The new procedure is making ear corn silage of a crop too wet to put in cribs, but too low in moisture for ordinary corn-and-stalk silage.

One man who picked up the idea was Alfred Nielsen, beef and hog farmer, "A moisture test in fall, 1957, showed that my corn contained nearly 40 percent moisture," he recalls. Corn should be down to 22 percent for safe storage in most cribs, while 65 percent is the minimum for ordinary silage.

After discussing the problem with Herman Vossen, Cottonwood county agent, Nielsen decided on ear corn silage.

Here's how he did it: He picked the corn and hired a portable hammer mill to grind up the ears and blow it into his 14 x 40-foot concrete stave silo. To keep the silo air-tight as possible, he calked the doors and put a sheet of plastic over the top of the silage.

"If I had put that corn in a crib, it all would spoiled," Nielsen says, "But there was no spoilage in my silo to amount to anything. What's more, I fed about two inches of silage per day, and still there was practically no spoilage during this time." He liked the procedure so well that he followed it again in 1958.

Last year, Nielsen used no screen in the hammer mill, but put in a two-inch screen this year. The cob in the ear was ground very well and mixed nicely with the corn. "This is important," Nielsen says, "because the cob shouldn't get separated from the corn when blowing into the silo."

Beef steers and heifers ate the silage and gained well, according to Nielsen, and he states that "I really think corn stored this way is more digestible than it would be as dry ear corn."

This year, his corn tested out to 33-38 percent moisture so, following Vossen's recommendations, Nielsen put in about 1,000 gallons of water to raise the moisture content.

GRASS AND LEGUME HARD TO BEAT FOR DAIRY PASTURES

When you seed down a field of your best soil for dairy pasture, the "old standard" alfalfa-grass mixture is still probably the best one to pick.

First-year results of a new University of Minnesota experiment show the alfalfa-grass pasture yielded more total dry matter per acre than a "straight grass" pasture of brome and orchardgrass fertilized with 140 pounds of nitrogen per acre.

Also, cows produced more milk per acre from the alfalfa and grass than they did from the other one. And the old standard mix also did just as well in these respects as a "shotgun" mixture of 9 different legumes and grasses.

Walter F. Wedin, U. S. Department of Agriculture agronomist and John D. Donker, University dairy scientist, made the study. They seeded

the three different mixtures in fall, 1957, at the Rosemount station.

The alfalfa-grass mixture last summer produced 1.95 tons total dry matter per acre, compared to 1.74 tons for the straight grass and 2.16 tons from the third mixture. Cows ate about 56 percent of the standard, 46.5 percent of the straight grass and around 54 percent of the 9-variety pasture.

Biggest trouble with that shotgun mixture was its cost--$12.75 per acre just for seed. The legume-grass cost $5.59 per acre for seed and the straight grass was $3.16. Real purpose of the 9-variety mixture is to see if such a high seeding rate--32 pounds total seed per acre--will produce more plants per acre and prevent the forage from maturing too rapidly.

This fall, there were an average of 30 plants per square foot in the standard pasture, 20 in the all-grass plots and 44 in the 9-variety area. How well these counts hold up in future years remains to be seen.

The researchers emphasize these are only first-year results. And the studies are on first-rate land. Where it's necessary to pasture land which can't be worked or reseeded, just fertilizing and managing the pasture better might still be the best answer.

NEW SCHEME ON OLD GRASS PASTURE CUTS ACRES, FEED BILL

LEWISTON -- A new chapter for the books on pasture management is being written in the rolling hills of southeastern Minnesota.

The new story: how to get more milk from fewer acres of old "permanent grass" pastures -- the kind generally thought useless in recent years.

One of several farmers demonstrating this idea is Clifford Pierce in Winona county, who pastured 21 milking Guernseys for 77 days in 1958 on just 7 acres of grass. That's only a third of an acre per cow and less than a third as much acreage as usually required with this type of pasture.

He turned the trick with careful pasture management and about $200 worth of fertilizer. Expensive? Maybe, but note this: The pasture produced such high-quality feed that in comparison with last year, Pierce saved about $200 in extra grain and hay that the cows didn't need this summer. So the feed saving alone was enough to pay for the fertilizer, and the left-over land was clear profit. Besides, this system involved no "renovating" at all; the pasture was used just as it was.

Pierce has detailed records to back up these statements. He worked out this pasture plan as a special demonstration, in cooperation with Robert Ascheman, Winona county agent, Jerry Richardson, assistant agent and University of Minnesota extension specialists. Also cooperating was the National Plant Food Institute.

"In past years, we usually needed most or all of a 35-acre area for summer pasture," Pierce says. "This is rather steep and rolling land, some of which hasn't been touched since last seeded in the early '50s. The seven acres we selected for this demonstration contain a mixture of timothy, bluegrass, quackgrass and some white clover."

Clifford Pierce, left, shows assistant county agent Jerry Richardson a sample of the forage in his dairy pasture.

The soil is a shallow "Dubuque" silt loam, which is difficult to "renovate." This was one more reason why Pierce was eager to try the new plan.

He wound up with what amounts to a complete experiment. With Ascheman and Richardson's help, he divided the pasture into seven one-acre strips. One strip was left as an unfertilized check. The one received only phosphate and potash and the other five all received nitrogen treatments varying, on the different strips, from 50 to 250 pounds per acre. The nitrogen was applied in 50-pound doses at different times during the summer. Phosphate and potash were applied to all except the check strip, according to soil test.

"We started letting the cows graze these strips May 22 and finally took them off the first week of August," according to Pierce. "I divided each strip in two lots and let the cows graze for either a day or a day and a half on each, depending on the growth."

"The cows received about a pound of dry hay per head daily and I fed only a pound of grain for each 2½ pounds of milk above 30 pounds per day. Cows producing less than 30 pounds didn't get any grain. All in all, this amounted to only a fourth as much hay and corn as last year."

Pierce's records show that the extra feed he did give the cows cost about $65, or roughly $200 less than for the same period in 1957.

The herd's production stayed as high as ever. Records up to Aug. 4 show that on the strip receiving 50 pounds nitrogen and also where 100 pounds were applied, the cows had produced more than 4,900 pounds per acre, compared to barely 4,000 pounds on the unfertilized strip. On the 150-pound nitrogen strip and where 250 pounds were applied, milk production per acre went over 6,000 pounds.

The herd grazed the strips with 50 and 100 pounds nitrogen about 11 days each, and it varied from 11 1/2 to 14 days on the high rates. On the no-fertilizer check, there were only nine days of grazing.

Animal Husbandry . . .

BASIC ANIMAL HUSBANDRY RESEARCH AIMED AT BREEDING, NUTRITION

What procedures will bring the most rapid improvement in hogs raised on Minnesota farms?

To answer this question, livestock breeders need much more fundamental information in swine genetics. And getting this information is the aim of basic swine breeding studies being conducted at the University of Minnesota.

Most farmers raising market hogs follow some system of crossbreeding. This is because they can get larger litters, faster growth, and, as a result, more pork per unit of feed and labor by using crossbreds.

However, the proven worth of crossbreds--which has made them popular in market hog production--has also brought new questions. Until recently, the main concern was on breeding procedures for improving performance within the breeds themselves.

Now, the center of interest has shifted to methods that will be most effective for improving performance in crossbreds.

L. E. Hanson, head of the University's animal husbandry department, says these fundamental breeding studies involve some 3,000 or more pigs every year. The animals are raised and studied at branch experiment stations at Rosemount, Morris, Crookston, Grand Rapids, Duluth and Waseca.

Fundamental information from these studies, Hanson says, will provide the basis for developing better breeding methods; methods which will produce more rapid improvement in litter size, feed efficiency, carcass quality and other characteristics that affect profitability of hogs.

Other basic studies in animal husbandry include:

1. Genetics and environment in swine. This involves studies on whether swine from different breeds, lines or strains react differently to feed, housing and other differences in management. Is one set of feeding and management conditions best for all breeds? Will animals developed under one environment do as well under others? These have been important questions in animal breeding for years.

2. Sheep breeding. Basic studies on "combining ability" in crossing sheep breeds are being conducted in flocks at the Waseca, Crookston, Grand Rapids, Morris and Rosemount experiment stations. Combining ability refers to how well two or more breeds complement each other when used in breed crosses. It is measured in terms of performance of the crossbred animals produced.

3. Swine nutrition. In one phase of this work, scientists are studying vitamin E and selenium in preventing liver necrosis in pigs. Past research has shown that severe liver necrosis develops when pigs eat certain rations. What causes the condition isn't exactly known, but University scientists have been able to prevent it by adding either vitamin E or selenium to the diet. Vitamin E does not contain selenium; yet, either can prevent the necrosis. In basic studies, livestock nutritionists hope to learn why.

Other basic experiments in swine nutrition include studies of calcium needs of pigs 308 weeks old, and nitrogen "metabolism" studies--a measure of the adequacy of protein in the diet.

4. Beef nutrition. As part of the Beef-Grassland project at the Rosemount station, livestock scientists are making basic studies on forage utilization in beef cattle, and on things that affect silage utilization by steers.

5. Carcass studies. Research around the country has shown that certain feed additives can increase gains and feed efficiency in cattle. Studies at the University now are aimed at learning the effect of these additives on the chemical and physical composition of the carcasses.

6. Physiology of fetus development. In a cooperative project with the Medical School, the animal husbandry department is studying physiology of unborn lambs at different stages of development. These studies are concerned with oxygen transfer across the placenta--the physical connection between the mother and her unborn young--and the movement of antibodies between the mother and the young.

TWO TREATMENTS HELP PREVENT ANEMIA IN PIGS

Supplemental injections of iron-dextran compounds at 3 weeks of age can help prevent iron-deficiency in pigs during the latter part of the nursing period.

Swabbing the sow's udder with a "copperas" solution (crude ferrous sulfate) can also prevent anemia, University of Minnesota research shows.

Earlier experiments showed that one injection of an iron-dextran compound would prevent anemia in baby pigs up to 3 weeks of age. But in 1957 tests, pigs injected with iron-dextran at 3-4 days of age were anemic when 35-40 days old.

In 1958 research, additional injections were tried at 21 days of age. Doing the studies were R. J. Meade and Myron Dammann, livestock nutritionists and H. C. H. Kernkamp and Victor Perman, veterinary pathologists. Twenty-one litters of pigs were used.

All pigs, except two litters getting a copperas solution swabbed daily on the sow's udders, were injected with 2cc. of iron-dextram compound at 3 or 4 days of age. The compound contained 50 milligrams of iron per cc. Then when the pigs were 21 days old, the researchers again injected one group of pigs with 1 cc. and another with 2 cc. of iron-dextram. A third group received no iron-dextran compound at this age.

The scientists checked for anemia by determining the "hemoglobin" content of the blood. A low hemoglobin level indicates iron-deficiency anemia. Pigs that received no iron-dextran com-

pound at three weeks showed a 21 percent decline in hemoglobin level during the next 14 days.

Pigs injected with 1 cc. iron-dextran compound at 3 weeks showed only a 6 percent hemoglobin decline. Those getting 2 cc. actually had a hemoglobin increase. Also, pigs injected with either level of the compound averaged a pound heavier at 35 days of age than did non-treated pigs.

The two litters getting copperas solution on the sow's udders maintained satisfactory hemoglobin levels throughout the test.

Iron-deficiency anemia is still an important nutritional-deficiency disease in baby pigs, even though other effective treatments and preventives have been known for several years. These treatments include tablets or pills containing iron compounds, or liquids that may be given as a drench or swabbed on the sow's udder. Pigs need the extra iron because the sow's milk is low in this element and because pigs are born with very low reserves of iron. This is especially true of rapidly-growing pigs.

The reason for iron-dextran injections is to have a method for individual treatment. This is a definite advantage over the other treatments. With injections, there is more assurance that each pig will receive the required iron at the right time and in the correct amount.

HEALTHY PIGS DO WELL WITHOUT FEED ADDITIVES

If nursing pigs get proper care and the right kind of starter ration, they can make striking growth records without extra feed "additives."

University of Minnesota swine nutritionists R. J. Meade, L. E. Hanson and Glen Swartz found this true in recent tests. When pigs and sows that were nursing were fed properly and in good health, the pigs gained 0.72 pounds daily from the time they were 14 days old until 56 days of age. They received no antibiotics or other feed additives.

Feed requirements was less than 300 pounds per hundred pounds of gain, for both sows and their litters. This takes into account both the feed eaten by the sows and the weight they lost. Too often the requirement runs close to 400 pounds of feed, Meade and Hanson say, but the 300-to-100 level is still within reach of most any producer.

None of the antibiotics or other feed additives used in these tests increased pig gain from 14-35 days of age. However, aureomycin at 40 grams and a mixture of procaine penicillin and streptomycin at the same rate each increased rate of gain by 11 percent after the pigs were weaned at 35 days of age until the experiment was ended at 56 days.

None of the additives had any important effect on feed efficiency.

The secret to the good results from all pigs in this test was the management and pig starter. Each litter was on a concrete floor with an automatic waterer. Pig starter was given in a "creep," where sows couldn't get near it. The sows got a high-energy lactation ration through self-feeders.

The pig starter ration contained ground shelled corn, rolled oats, sugar, soybean oil meal, tankage, fish meal, dried skimmilk, steamed bonemeal, trace element salt and a vitamin supplement.

"THRYOID-ACTIVE" COMPOUNDS STILL IN QUESTION FOR HOGS

Whether thyroxine or other "thyroid-active" compounds are any help in hog production is still a question.

University of Minnesota livestock scientists recently tried feeding these materials both to growing pigs and to sows during farrowing and nursing periods. The results were not entirely conclusive, according to R. J. Meade and L. E. Hanson.

"Thyroid-active" materials are compounds intended to supplement or regulate the thyroxine supply within the animal body, perhaps speeding up growth or increasing milk production. They include iodinated casein, thyroxine (the thyroid hormone) and a material called triiodothyronine.

In one experiment with 17 sows and gilts, adding thyroxine to the sow's rations did make small increases in weights of pigs at 35 days of age. A second test with 48 sows and litters, however, showed no effect from feeding the material.

In neither cases did thyroxine reduce the amount of feed eaten by the sows, nor did it cause them to lose more weight while the pigs were nursing. Pigs nursing the sows fed rations containing thyroxine ate slightly less pig starter. Also, there was some increase in total feed required for every hundred pounds of net gain of sows and pigs in these groups.

Results with these materials have varied widely around the country. At Iowa State College last year, researchers increased rate of gain in nursing pigs and saved more pigs per litter by feeding iodinated casein to sows. Other stations reported less conclusive results.

In recent tests with these compounds for growing-finishing pigs, Meade and Hanson compared iodinated protein at 60 grams per ton of feed, thyroxine at 600, 1200 and 1800 grams and triiodothyronine at 200, 400 and 600 grams per ton.

The thyroid-active materials increased daily gain by 2-8 percent. However, the two higher levels of the second two compounds also made big increases in amount of feed required per hundred pounds of gain. This, the scientists say, could be the result of increased "metabolic activity" (growth processes) in the pigs fed the compounds.

GROUND EAR CORN, SHELLED CORN COMPARED FOR PIGS

While hogs usually gain faster on ground shelled corn than they will on ground ear corn, the latter choice can still get pigs to market in good time.

This point was brought out in recent experiments at the University of Minnesota's Southern Experiment station, Waseca. Kenneth Miller, researcher, and R. E. Hodgson, station superintendent, compared the two forms of corn and two different protein levels on 150 pigs.

In spite of slower gains, hogs on ground ear corn still reached marked weight before 180 days old. This is good performance anywhere. And some tests in earlier years have shown no difference between shelled and ear corn anyway. So depending upon the type of corn he has, a producer can normally plan to feed either form to hogs and get good results if he properly balances his ration for all nutrients.

For both ground shelled corn and ground ear corn, the Waseca station men fed one group of pigs 18 percent protein up to 100 pounds and 15 percent from then on and fed another group a 15-12 percent ration.

The protein level differences didn't affect rate of gain or carcass quality. Pigs on ground ear corn gained about 1.53 - 1.54 pounds daily, and required 349 pounds of corn--on a shelled corn equivalent basis--for each hundred pounds gain.

With ground shelled corn, the story was the other way around. Daily gain was 1.76-1.79 pounds per day but feed requirement was 392 pounds for the high protein level and 367 for the lower one.

HYGROMYCIN HAS NO ADVANTAGE IN PIG RESEARCH

Hygromycin, one of the newer feed additives, showed no advantage when fed to growing pigs in recent University of Minnesota research.

Two experiments involving the material were conducted on the St. Paul campus, by R.J. Meade, L.E. Hanson and R.M. Prouty, livestock scientists. Compared to rations containing antibiotics or no additives, hygromycin actually reduced daily gains in pigs fed to market weight.

Also, adding an antibiotic or a combination of antibiotics--either of which was effective when used alone--to rations containing hygromycin failed to overcome this "depressing" effect. For example: in the second of these two tests, a ration without hygromycin resulted in daily gains averaging 1.5 pounds daily while pigs on the same ration with aureomycin added gained 1.58 pounds per day.

When hygromycin alone was added to the ration, gains went down to 1.44 pounds, and averaged 1.48 pounds per day when both hygromycin and aureomycin were added. The St. Paul tests were conducted with pigs in drylot.

At the North Central Experiment station, Grand Rapids, A. B. Salmela, W. E. Rempel and R. E. Comstock tried hygromycin on growing-finishing pigs fed good brome-alfalfa pasture. They found practically no difference between pigs getting the material and those not getting it. Also, the material had no effect on feed efficiency.

Hygromycin is intended as a material for removing large roundworms, nodular worms and whipworms from swine intestines. Results from its use, as far as gain and feed efficiency are concerned, have so far been inconclusive.

The "depressing" effect that hygromycin had in St. Paul tests could be due to its unfavorable effect on feed "palatability" -- how it tastes to the animals.

SOYBEAN MEAL HARD TO BEAT AS PROTEIN FEED

Soybean oil meal is mightly hard to beat as a protein feed for growing pigs, University of Minnesota swine research shows.

R.J. Meade, University swine nutritionist, reports that 60 purebred Yorkshires and cross-bred Yorkshire-Durocs were fed from 50 pounds to market weight in one test. All pigs received 16 percent protein rations until they reached 100 pounds and 14 percent from then until marketed.

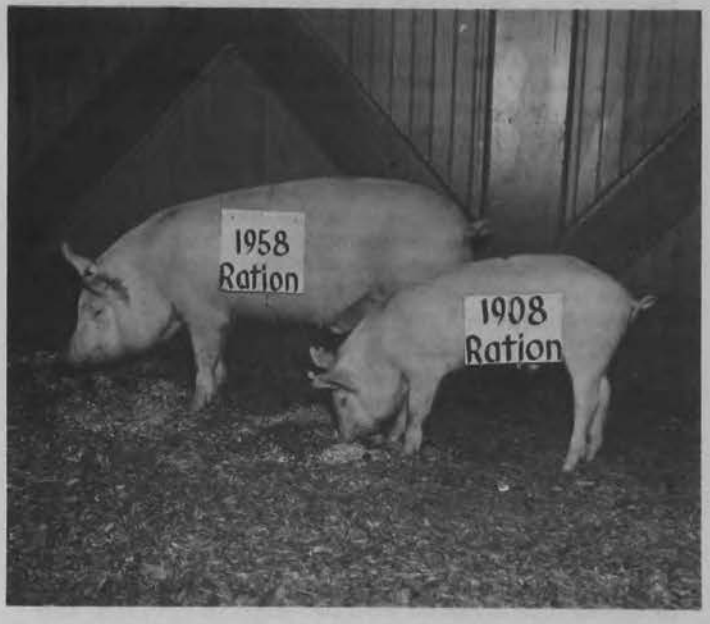
The pigs were divided into four lots. One received soybean oil meal as the only protein and tankage was substituted for part of the oilmeal in the second. Five percent dried whole whey was substituted in a third and fish meal in the fourth.

None of the substitutions brought any important increases in gain and the pigs receiving tankage actually grew slower. Daily gain averaged 1.72 pounds for pigs on soybean oil meal as the only protein supplement, 1.59 for those getting tankage, 1.76 for the part-dried-whey mixture and 1.75 for the pigs getting part fish meal in the protein feed. Since the substitutions did nothing except increase the feed cost, there was no point in using them, Meade concludes.

DEMONSTRATION SHOWS IMPROVEMENT IN HOG FEEDING

Like American families, pigs today are getting better food than ever.

This was strikingly portrayed in a recent University of Minnesota demonstration.



Four pigs on a modern menu gained 16 times as rapidly during a 2-month feeding period as did four of their brothers getting a ration of a half century ago.

Besides, pigs on the 1957-58 ration required less than a fourth as much feed for each pound of gain as did those on 1908 feeds.

R. J. Meade, swine nutritionist at the University, conducted the demonstration.

Actually, there were four rations tested in the recent demonstration. Meade used pigs from four litters, divided so there was one pig from each litter in each of four groups. One group received a 1908 ration, one a 1930 ration, a third was fed a 1953 menu and the fourth was fed by 1957-58 standards.

Pigs on all four rations averaged about 33.5 pounds when put on the test. But 62 days later, there were some big differences.

The pigs fed 1957-58 rations weighed 132.2 pounds at the end of the test. These pigs had gained 1.6 pounds daily and required only 2.82 pounds of feed for each pound of gain--most efficient of all four groups. Pigs on the 1908 ration weighed only 40.2 pounds after the test, for a daily gain of about .1 pound daily and a feed requirement of 13 pounds for each pound of gain.

In general, gains and feed efficiency for the 1930 ration were poorer than those from the 1908 ration. Pigs on the 1953 feed made about the same gains as the 1957-58 group, but required slightly more total feed for each pound of gain.

The 1908 ration contained ground yellow corn and a complex mineral mix, which was a common ration given to hogs in that day. The 1957-58 ration contained ground yellow corn, tankage, soybean oil meal, fish meal, ground limestone, steamed bone meal, high zinc trace element salt and a vitamin-antibiotic premix.

The main difference between the 1953 and 1957-58 rations is that the modern one had less fiber, more high-energy components and higher levels of some feed additives.

Also, the up-to-date ration was geared to meet the changing requirements of the pigs. From the beginning of the test to 50 pounds in weight, the mixture contained 18.5 percent protein. From 50-100 pounds, it contained 16.5 percent and after the pigs weighed 100 pounds, it was reduced to 14.5 percent protein.

This ration was the same as recommended for the Minnesota Swine Evaluation station and therefore, contained about 2.5 percent more protein than normally recommended for market pigs. The higher level is used at the Evaluation station because boars require more protein.

Why did pigs on the 1908 ration do so poorly? Meade says the old-time feed mixture was deficient in riboflavin, niacin, pantothenic acid, vitamin B_{12} and choline. Besides, it lacked quantity and quality of protein. It was deficient in several of the "essential" amino acids, or protein components which hogs need.

The 1930 ration contained ground yellow corn, meat and bone scraps and high-zinc trace element salt. This ration had 16 percent protein, which is adequate for 33 pound pigs. Yet, these pigs did as poorly as did those on 1908 rations. Meade says this is most likely because the 1930 ration used in the demonstration was too high in calcium and deficient in certain vitamins. It was also low in at least one of the essential amino acids which are needed to correct the protein deficiencies of corn.

Meade says the demonstration clearly shows why farmers didn't produce many pigs in drylot 28 and 50 years ago. They were able to produce spring pigs because these pigs were then raised on pasture, which supplied many nutrients lacking in the feed rations.

BETTER CARE WILL RAISE HOG PROFITS

Farrowing stalls, guard rails, electric heat lamps and extra care at farrowing time can make it possible to raise two more pigs from each litter to market weight.

Here are some tips for farrowing time from H. G. Zavoral, extension livestock specialist at the University of Minnesota, to make such increase possible.

First, use clean farrowing stalls. A third of the farmers on the 1957 Minnesota Swine Honor Roll used farrowing stalls and saved 9.3 pigs per sow. State average is 7.

Second, install heat lamps about 30 inches off the floor. Lamps do more than keep the little pigs warm; the light attracts them and keeps them from getting too close to the sow. That way, the little pigs are less likely to get laid on.

Third, avoid drafts and keep the bedding dry. About 48 hours after the pigs are born, use a treatment to prevent iron deficiency anemia.

Fourth, follow a good feeding plan. Give the pigs a "pre-creep" feed--one fortified with vitamins, antibiotics and minerals--as soon as they will eat it. When the pigs are about 8 to 10 days old, boost the protein content of the sow's ration to about 16-17 percent , to make sure she milks well. Keep her on this ration as long as the pigs are nursing.

Finally, pick out your strongest, most uniform litters and identify them with an ear-notching system. Then you can select the best pigs for breeding later on.

GRAIN SORGHUM MAKES GOOD FEED FOR SWINE, BEEF

Grain sorghum is a good feed for swine and beef cattle if it's handled properly and supplemented.

R. J. Meade, livestock nutritionist at the University of Minnesota, says good quality grain sorghums have a higher protein content than corn. Swine and beef cattle should be able to put on 100 pounds of gain at little, if any, more total cost than would be involved in using No. 2 yellow corn as the main "energy source" in the ration, Meade says.

In general, grain sorghums are worth 90 to 95 percent as much per pound as No. 2 yellow corn. However, sorghum grain contains about 10.9 percent protein, compared to 8.7 percent in No. 2 corn.

The two grains differ little in total digestible nutrients (TDN), fat, fiber and mineral content, but grain sorghums have practically no vitamin A. They do have more pantothenic acid--another vitamin--than corn.

There is little difference in protein quality between grain sorghum and No. 2 corn. But to take advantage of the increased protein content of grain sorghum, swine rations containing this grain would need to be supplemented with protein supplemental feed like good quality tankage or fish meal --feeds that are relatively high in lysine and methionine, two essential amino acids. Grain sorghum

protein is deficient in both, Meade points out.

Grain sorghum can be left whole if self-fed to swine. For hand-feeding, though, it needs to be ground, for pigs or beef cattle.

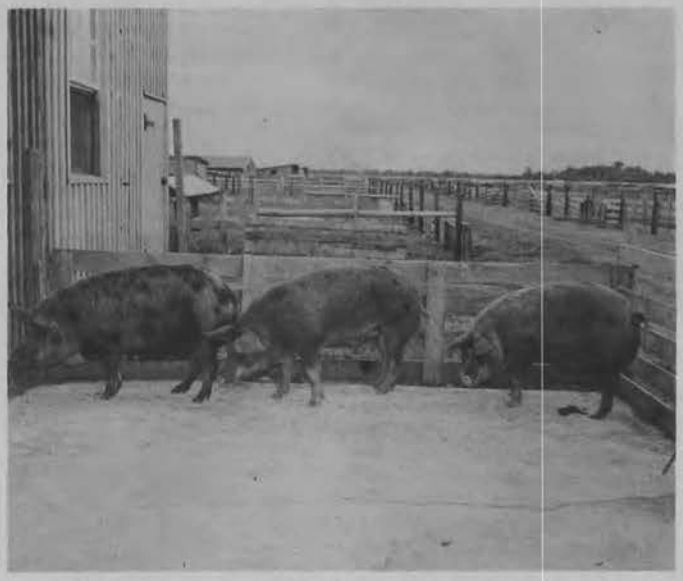
It's important to supplement grain sorghum with vitamin A, Meade says, or to make sure there is enough vitamin A in other feeds the animals receive.

FEMALE STOCK OF MINN. NO. 3 HOG ARE RELEASED

A limited number of female Minnesota No. 3 hogs have been sold to commercial hog breeders by the University of Minnesota.

The Minnesota No. 3 is one of three hog breeds developed by the University in recent years. Herds of the first two breeds--Minnesota No. 1 and No. 2--are already on farms in Minnesota and elsewhere in the nation.

According to Ralph Comstock and William Rempel, University livestock scientists, this is the first time female stock of the breed has been released for establishing herds. A number of No. 3 boars, however, have been sold to commercial hog producers in recent years.



Three representatives of the Minnesota No. 3 breed.

Release of the animals was on a conditional basis, because of considerable variability still present in the breed and to promote performance testing of breeding stock.

The Minnesota No. 3 breed is an inbred line developed from 12 other breeds--about 60 percent of which are from English origin. Most of the pigs are black-and-red spotted but the color has not been completely fixed. The breed has gone through 7 generations since the original crosses were made.

Purpose in developing the breed was to get a fast-growing hog with a more acceptable carcass. University records on both performance and carcass composition have been very promising for the breed so far. Boars of the breed have been well accepted for crossbreeding in commercial herds.

MULTIPLE FARROWING "EVENS OUT" MARKET

Farmers in Minnesota have one of the best answers to hog market fluctuations at their disposal.

The answer? Multiple farrowing -- at least four or five times per year.

It has these advantages, according to H. G. Zavoral, extension livestock specialist at the University of Minnesota:

First, if more farmers spread their farrowing around the calendar, hog prices wouldn't fluctuate as much. The peaks would level off and the slumps wouldn't be as severe. There's already a good start in this direction; more farmers have pigs farrow in late winter. This helped keep down spring farrowings this year.

Second, more frequent farrowing makes for more efficient use of equipment. You can farrow more pigs in fewer stalls.

And third, evening out farrowing--which also evens out marketing--gives the consumer a steady flow of good quality pork.

In planning a multiple farrowing system, figure two litters per sow every 12 months. Then divide the sow herd into two or three equal groups. If you have two groups, this will mean a pig crop every 90 days. Three groups would space the farrowings just two months apart.

LIVESTOCK PROJECT EMPHASIZES PROFITS

WINDOM--Nearly 200 4-H and FFA members in southwestern Minnesota, in a different kind of beef calf project, are getting some valuable pointers on the dollars-and-cents importance of smart livestock management.

None of these animals raised, ever reach the county fair or state shows. Yet, scores of 4-H and FFA members say the project gives them some of the best practical training they ever had in feeding and marketing beef cattle.

It's called a "five-calf," or market livestock project, according to Herman Vossen, Cottonwood county agent who helped start the project in this area 10 years ago.

Here's how it works in Cottonwood county:

The 4-H or FFA member buys western calves averaging about 400 pounds around October or November. He feeds the animals during the coming year until they are ready for market.

He keeps accurate records on feed and gain to determine his profit. Then if he wishes, he enters a local show the following September, in which one first place prize is given to the project member who has the best overall record for the year.

"The entire program," Vossen explains, "is based on how business-like a job the project member can do with his calves. We figure rate of gain, cost per pound of gain and, of course, on how much genuine profit he makes."

Youths in Cottonwood county alone have averaged

about 155 calves or slightly more on this project each year since 1949.

4-H and FFA workers have made some impressive records in this project. Average daily gains for their calves were as high as 2.3 pounds per day in 1956-57 and among Cottonwood county boys and girls who brought their animals into the annual show at Windom, average feed cost was less than 17 cents per pound of gain.

The five-calf project just "grew naturally" in Cottonwood county, as Vossen tells it.

"It was often felt a youth could learn more about practical livestock management by raising calves on a straight commercial basis rather than just for the show ring."

The Cottonwood County Livestock improvement committee played a key role in getting the program under way.

Every year, members of the livestock committee go to one of the western markets and select calves for project members for the coming year in Cottonwood county.

"We weed out the poor ones, then sell the calves to the members on a straight 'gate cut,' Vossen explains. "This gives each member an equal start."

What do the club members themselves think of the project? Larry Goeman, 15, Jeffers, first entered the project last year, liked it so well that this year he has 10 calves in his project. "Farming has been more interesting to me since I have had a project of my own." Larry says.

Larry, son of Mr. and Mrs. Ed Goeman, had some profitable results from his first 4-H calf project. His steers averaged 2.27 pounds gain per day and cost 16.1 cents per pound of gain. That brought him a net profit of $292.21 for the five calves.

SILAGE LOSSES CAN REDUCE BEEF PROFITS

Although grass silage in general is about 80 percent as efficient as corn silage for steer calves, either kind of silage can be used with good results.

More important is the way the silage is stored, recent University of Minnesota research shows. As far as the amount of feed consumed was concerned, feed costs for corn silage and alfalfa-brome were about the same.

But poor storage resulted in excessively high costs for all kinds of silage in these studies.

Six lots of Hereford steer calves were fed for 112 days in the winter of 1956-57, each on a different combination of silage and preservative. They received equal amounts of corn and cob meal.

Calves fed corn silage made the biggest average daily gain--1.04 pounds per head--at lowest cost--17.2 cents per pound. Those on alfalfa-brome, untreated silage gained .9 pounds daily at a daily feed cost of 18 cents per pound of gain. Feed costs were higher with preservatives added to grass silage, with molasses added at feeding time and with oat silage. These results were similar to previous years' studies.

However, since the silage was stored in temporary facilities, heavy spoilage occurred. Based on the amount of feed stored, feed costs were 22.5 cents per pound gain with the untreated alfalfa-brome silage and 23.6 cents for the corn silage. From there, costs ranged upward to as high as 50 cents with some of the other silages. University livestock scientists, soils men and agronomists say these results show that regardless of the crop used for silage, every precaution possible should be taken to prevent losses in storage. These losses can make costs so high they will wipe out profits.

WAYS TO CUT BEEF COSTS FOUND AT ROSEMOUNT

Pasture fertilizer, feed additives and all-around careful feeding can make some big increases in profits for beef farmers.

That is what University of Minnesota researchers conclude after tests at the Agricultural Experiment station at Rosemount.

Paul Burson, University soils researcher reports in one set of 1958 trials, steers on fertilized pastures averaged $114.08 worth of "beef per acre," compared to $84.56 worth on unfertilized grazing. The steers weighed about 588 pounds each at the start of the trial, which ran from late May to Sept. 12.

These values were calculated after subtracting $15 per acre for fertilizer cost on the fertilized pasture. Steers on fertilized grazing gained faster, too--2.15 pounds per day, compared to 1.97 for the others.

The researchers also compared implanting stilbestrol with feeding grain--both on fertilized and unfertilized pasture. Livestock scientist A. L. Harvey says that after both feed and fertilizer costs were subtracted, the best returns still came from steers implanted with stilbestrol, receiving grain, and on fertilized pasture.

These animals produced about $137 in beef from each acre of pasture, compared to $85 for those on fertilized pasture without grain or stilbestrol. And steers getting no grain or stilbestrol and on unfertilized pasture averaged only $72 worth of beef per acre.

Grain fed in these tests was 5.3 pounds of ground ear corn per head daily. The stilbestrol was administered in a 24-milligram implant at the start of the trial.

Figured another way, implanting alone increased beef produced per acre by 13.5 percent, ground ear corn made a 43 percent increase. Fertilizing increased beef per acre by 47.3 percent.

O. E. Kolari, another livestock researcher, found that yearling steers gained more slowly and had lower carcass grades when "full-fed" silage than they did when fed little or no silage. Steers fed no silage gained 2.57 pounds per day. Gains from other levels of silage feeding were: "1/3 of full-fed," 2.53 pounds per day; "2/3 full-fed," 2.42 pounds and "full-fed," 2.29 pounds daily. The steers fed no silage or 1/3 of full feed had the highest margin of return over feed cost.

W. J. Aunan, University meats researcher, says trials showed that steers either fed or implanted with stilbestrol can grade as high as cattle not receiving the material, if the steers getting stilbestrol are fed as long as the others. In the

past, there has been much question on whether stilbestrol would reduce carcass grade.

Aunan adds however, that carcasses from stilbestrol-fed or implanted steer won't grade as high as animals not getting stilbestrol, if both are marketed at the same live weight.

Alfalfa-brome hay proved to be the most economical forage for wintering calves, according to J. C. Meiske, livestock researcher. Calves receiving this hay plus ground ear corn and no silage gained 1.06 pounds daily, for only 9.7 cents per pound in feed costs. In silage-fed lots of calves, costs ranged from 12.4 to 15.3 cents. However, the silage costs are still low, Meiske adds, and show that silage can be put to good use on farms where there's a lot of silage to be fed up.

NATIVE FEEDER LAMBS CAN DO AS WELL AS WESTERN STOCK

Minnesota farmers can make as much or more profit from feeding out native lambs as they can by feeding lambs from Western ranges.

That's the conclusion reached by University of Minnesota researchers after three years of experiments at the West Central Experiment station, Morris. R. M. Jordan, University livestock scientist, and H. G. Croom and Harley Hanke, Morris station staff members, report the results.

In 1954, '55, and '56, they compared lots of 30 native and 30 western lambs. Each year, both types of lambs received the same feed and management.

Selling price per hundred pounds at market time was the same for native and western lambs during the first two years, and averaged 25 cents per hundred pounds higher for the native lambs in 1956. But since the native feeders were bought at a lower price, they returned a higher profit in every year than did western lambs.

There was little or no difference in rate of gain or feed consumption between the two kinds of lambs, but native lambs graded slightly higher. Carcass yield, though, was not affected by where the lambs came from and there was no greater death loss in natives than western lambs. Native lambs, however, are often transported for shorter distances and therefore usually have less shrink.

In the past, native lambs have had a poor reputation and their purchase price has been somewhat lower than for westerns. Lamb feeders have generally considered natives less uniform and less able to take heavy feeds and make satisfactory gains. Besides, many sheep feeders expect parasite infestation and heavy death losses from Minnesota feeder lambs.

The University studies, however, show these fears are not always borne out. The research also indicates that good quality native feeder lambs could justifiably sell for at least as much as western lambs.

IMPLANTING HORMONES INCREASES LAMB GAINS

Implanting with stilbestrol or a combination of hormones increased gains of wether lambs on pasture in recent University of Minnesota research.

R. M. Jordan, University livestock scientist, reports that lambs on rape pasture implanted either with 3 milligrams of stilbestrol or with synovex grew 28-31 percent faster than did lambs not receiving the implant.

Synovex is a material which contains $2\frac{1}{2}$ milligrams of estradiol and 25 milligrams of progesterone, two hormones in each dose.

This work was conducted at the West Central School and Experiment station in cooperation with Harlie Hanke, staff member there.

Daily gains of lambs on rape pastures averaged .4 pounds for those getting no implant, .55 for lambs implanted with stilbestrol and .57 for those implanted with synovex.

Jordan says the same comparison was made with wether lambs on alfalfa pasture. In this case, lambs implanted with stilbestrol gained .35 pounds per day, those on synovex gained .34 pounds daily and those receiving no implant gained .25 pounds per day.

With ewe lambs on rape pasture, implanting with stilbestrol increased gains by 16 percent, but the same treatment of ewes on alfalfa reduced gains 8 percent, Jordan says. There were no tests with synovex on ewes.

Jordan emphasizes that implanting lambs with these materials is still an experimental procedure only; it hasn't been approved for general use by the U.S. Food and Drug Administration. Jordan also points out that past research at the University has shown there have often been unfavorable "side effects" in sheep implanted with hormones or hormone-like material.

FEEDER LAMBS NEED GOOD CARE

Feeder lambs bought in late summer or early fall need some special care to get a good start.

Lambs normally shrink up to 8 pounds per head when shipped from a central market and 6-10 pounds when they come from a western range. So get them on feed rapidly, advise R. M. Jordan, sheep researcher, and R. E. Jacobs, extension livestock specialist at the University of Minnesota.

When you first get the lambs, give them only high-quality mixed grass and legume hay and water during the first day, the bulletin advises. Feed about a fifth of a pound of 40 percent protein supplement per lamb on the second day and, by the third or fourth day, all lambs should be eating.

Add one-fifth pound of grain each day to the protein supplement until the lambs are eating about a pound of grain per head daily. From then on, increase the grain by a tenth pound per lamb daily until the lambs are on full feed.

"Full grain feed" amounts to about $1\frac{1}{2}$ to 2 pounds per lamb or what the lambs will clean up in 15-20 minutes. After lambs are on full feed, you can either cut out the protein supplement entirely or reduce it to a tenth pound per lamb daily --as long as the lambs are getting high-quality legume hay.

If you follow a self-feeding plan, put the lambs on self feeders on the second or third day after they're in the feed lot. A good starting feed is 78-80 percent chopped alfalfa, 20-25 percent barley,

cracked corn or ground ear corn and 5-10 percent protein supplement. Reduce the hay gradually and increase the grain by adding cracked corn until the lambs are getting half corn or its equivalent.

Native and Dakota feeder lambs should be wormed about the second or third week. You can drench each lamb with three-fourths to one ounce of phenothiazine or you can mix the phenothiazine with grain. If ticks are a problem, spray before the end of September.

College of Veterinary Medicine...

RESEARCH AIMED AT SOLVING KETOSIS IN DAIRY COWS

Hormones may be at the bottom of ketosis--a baffling disease in dairy cows.

One group of scientists at the University of Minnesota College of Veterinary Medicine believes there is a close tie-up between this ailment and hormones from the adrenal glands.

Ketosis is the third or fourth most troublesome disease in dairy cattle. About 40 percent of all milk cows in some herds suffer from it. The ailment hits cattle a few weeks after calving, just when they go into heavy milk production. They go off feed, may be nervous, take on a "dehydrated" appearance and go down in milk.

What causes ketosis remains a mystery, but there has been a partially successful treatment for a long time; injections of glucose (blood sugar). However, the problem itself will never be solved and preventives will not be perfected until scientists learn the initial cause of it.

Heading up some of the basic studies on ketosis is Dr. A. F. Weber, veterinary anatomist. He feels that both adrenal hormones--adrenalin, from the inner part of the adrenal gland, as well as cortisone, from the outer part--play a big part in the disease.

As Dr. Weber explains it, ketosis, in effect, results from either a lack of sugar in the cow's body, or the cow's inability to use it. The big problem is in determining how--and why--this "sugar shortage" occurs.

He points out that, normally, bacteria in the stomach break down the food a cow eats into acids that can be absorbed and made into sugar by the body cells. This sugar is needed for healthy body functioning. But when the cow undergoes a certain kind of "stress"--as after calving when heavy milk flow starts--she may not be able to get enough sugar this way.

Here's where trouble may start and where hormones may fit in: Veterinary medical research workers have found that when a cow can't get enough sugar from the normal process, the two hormones from the adrenal glands may step in to break down proteins and fats to be used as sugar sources. When a cow get ketosis, Weber believes it's because some part of this "emergency" sugar production process is not functioning properly.

Recent evidence indicates that one of the two adrenal hormones has a "permissive" effect; it allows or aids the other in doing the work in this "emergency" sugar production. Unfortunately, it isn't known yet which hormone does the "permitting" and which performs the function. Nor is it understood how this "permissive" function actually occurs.

Minnesota research so far has developed two important leads in the ketosis problem.

1. Cows with ketosis have enlarged adrenal glands. The outer part of the gland, the part that produces cortisone, seems to enlarge most.

2. The outermost part of the gland undergoes other changes in ketosis, besides swelling. This part of the gland is involved normally in salt and mineral regulation within the body.

The research findings bring up two major questions: Does the swelling of the outer part of the gland block production of adrenalin from the inner part and thereby cause ketosis? Second, does improper function of the salt regulating part of the gland have anything to do with the ailment? Only time--and more veterinary medical research--can give the answer.

In recent tests, veterinary research workers have attempted to inactivate the outer part of the gland in experimental animals, to see if lack of cortisone will produce ketosis. Results so far, however, have been inconclusive.

MASTITIS HAS MANY CAUSES

Mastitis--a major health problem in dairy herds--has no single cause.

Actually, "mastitis" means any inflammation of the udder, say Dr. K. I. Loken and Dr. H. H. Hoyt, veterinary scientists at the University of Minnesota. They point out there will never be a single "cure" for all cases of this ailment.

Mastitis is caused by a number of different microorganisms. Some microorganisms, but not all, infect the udder only when its resistance to infection is lowered. Some things that can lower this resistance include injuries, high production, poor milking procedures, chilling, poor sanitation and poor udder conformation. Also, udders seem to be more susceptible to infection shortly after the cow freshens.

With acute mastitis, one or more quarters of the udder are hot and swollen and the milk appears abnormal. This form develops quickly and may kill the cows. Milder or chronic forms, however, may show up only as small flakes or clots in the milk. Chemical and bacteriological tests are often needed to detect chronic infection.

Important as it is, herd management alone won't control mastitis. Treatment won't stop all cases either, but there are some guides farmers can follow. For one thing, it's wise to examine the entire herd when there is evidence of mastitis. Some cows may show no signs of it, but may nevertheless be mastitis "carriers."

Farmers can usually reduce spread of mastitis within the herd by milking young cows first and older ones last. This is because more older cows carry chronic infections. The milker should be kept repaired and properly adjusted. Cows should be milked out as rapidly as possible.

It's also important to keep the barn clean, use proper bedding, have large enough stalls, and use a strip cup every day to detect mastitis.

Loken and Hoyt say future veterinary research will no doubt show better ways to help control mastitis. For the present, though, farmers can reduce loss due to the problem by applying practices already known.

"FIRST MILK" HELPS PREVENT SCOURS IN NEWLY-BORN CALVES

Colostrum--the "first milk" from a cow after calving--is mighty important in preventing diseases in newly-born calves.

According to Dr. Dale K. Sorensen, veterinary scientist at the University of Minnesota, colostrum is literally "loaded" with important vitamins, antibodies and other components which help calves fight off different infections.

One of the biggest troubles dairymen often have with calves is the pneumonia-enteritis complex. It goes by many names--calf scours, white scours, calf diarrhea, calf dysentery, 3-day scours and many others. In fact, one of the reasons so many names are used is that scientists frankly don't know all the causes, Sorenson explains. One current theory is that a virus and intestinal bacteria are responsible.

Important as colostrum is, however, it's only one step against pneumonia-enteritis complex. Others farmers need to follow include:

1. Feed the cow a well-balanced ration, so the calves are vigorous and as healthy as possible at birth.
2. Have the maternity stall well-bedded at calving time. Dry the calf off as soon as possible after being born and help it get some colostrum.
3. Leave the calf with the cow for at least 24 - 48 hours. After that, colostrum is no longer of value, because the calf can't absorb it.
4. Keep calves of the same age in the same pen. Don't crowd calves of different ages together; older calves may spread infection to younger ones.
5. Keep calves free from drafts and rapid changes in temperature. A draft may lower the calf's resistance and make it more susceptible to disease. It's better to have the calf area cold all the time than have a varying temperature.
6. Feed calves from clean pails and make sure they get plenty of milk, concentrate and milk.

CONGENITAL TREMOR IN BABY PIGS BEING STUDIED

One of the most puzzling diseases of baby pigs is getting some careful attention from veterinary scientists at the University of Minnesota.

This condition is congenital tremor, often called "the shakes," "trembles," or "jumpy pigs," according to Dr. M. W. Stromberg, assistant professor, and Dr. R. L. Kitchell, professor in the University's College of Veterinary Medicine.

The disease has been reported recently in some areas of Minnesota and has occurred in Europe, North America and Australia.

At present, the exact cause of the disease is not known. Congenital tremor was once thought to occur only in the first litters of gilts (young female swine), but recent information shows that offspring from both gilts and sows may be affected.

Newborn pigs with the disease tremble, sometimes violently. Yet, they appear normal when at rest or asleep. Since the tremor may resemble ordinary shivering, many owners try to give affected pigs a warmer area. This usually has no effect, but some pigs do improve when moved to a warm room.

While the disease doesn't kill many pigs, it still can be costly, especially to purebred breeders. Affected pigs usually recover in a few weeks, but many breeders are unwilling to risk allowing the disease to spread. Therefore, they often sell young pigs as feeder stock. This usually means a big financial loss.

Although they don't believe the disease is inherited, Stromberg and Kitchell have found that the boar plays a vital role in spread of the disease. One boar sired offspring with tremor on six different farms. Yet, not all offspring of such a boar will have "trembles;" some appear completely normal.

For the present, Dr. Stromberg and Dr. Kitchell advise breeders to avoid using any boar that has ever sired pigs with congenital tremor. Also, it's uncertain so far whether once-affected pigs should be used as breeding stock. Much more work must be done on the disease before these questions can be definitely answered.

Dairy...

BASIC DAIRY RESEARCH IS AID TO FARMERS

Basic dairy research may turn some of the peculiarities of our faithful bovines into more profits for dairy farmers in years ahead.

Such research might also lead to more and bigger markets for milk and other dairy products.

C. L. Cole, head of the University of Minnesota dairy department, points out that one such basic project involves the "complementary milk" theory. University researchers have learned in recent years that cows seldom give all their milk at milking time.

The milk which is held back is called "complementary." Dairy cattle scientists can collect it after injecting oxytocin, the milk "let-down" hormone, into cows immediately after milking.

What's the importance of this finding? Just this: The amount of complementary milk a cow has seems to be connected with the length of her lactation, or milking period. Also, this milk-holding trait seems to be inherited. If intensive studies now underway show that both things are true, dairy cattle breeders may be able to predict the future milking ability of calves according to the amount of complementary milk their mothers hold and according to whether the calves' sires have been selected for this trait.

Other basic dairy studies include:

1. Ova transplanting. Dairy cattlemen are trying to solve the basic difficulties in transplanting a fertilized "egg" from the uterus of one cow to another. If the problems can be eliminated and the process made successful, it may be possible to transplant up to a dozen eggs from one high-producing cow to other cows in one year. This way, farmers could get more calves from their topnotch cows.

2. Artificial breeding. This process itself was developed long ago, but farmers would like to have certain aspects of it improved. One basic study at the University now is aimed at processing semen in such a way that it will keep longer without being frozen. Developing such a process calls for basic research, now being conducted, which will find ways to keep sperm cells fertile for a longer period of time after a diluting material is mixed with them.

3. Dairy cattle nutrition. One current study involves learning whether the way a cow is fed during her early life has any effect on her milking ability later on. If it does, dairymen will get some important information on how growing calves and heifers should be fed. Scientists are also conducting research on growth requirements in calves.

4. Dairy cattle breeding. Dairy husbandmen are attempting to develop a basic breeding formula which might be used to improve cattle within each breed. Basic research in this case involves developing cattle families in which herdsmen can better predict the ability of their cattle to pass their characteristics on to their young.

5. Dairy industry. A current project could give valuable basic information to milk processors. Dairy industry researchers are looking for ways to put dried milk fat into suspension. This is one of the biggest "bottle-necks" preventing processors from producing a whole milk powder that when remade has the characteristics and flavor of fresh milk. When water is added to whole milk powder produced by present methods, the fat forms a scum at the top. There are other basic dairy industry projects being conducted on ice cream storage, cottage cheese and dairy bacteriology problems.

SCIENTISTS MAKE ADVANCES IN "OVA TRANSFER" STUDIES

Although they haven't yet solved the "egg transfer" problem in dairy cattle, University of Minnesota scientists studying it have uncovered some important basic information.

They have found that injecting abnormally high amounts of "gonadotrophic" hormones into cows can cause them to "superovulate." Cows so treated produce a dozen or more eggs during ovulation, instead of just one or two as is normally the case. The hormones used this way are the same as those which normally stimulate ovulation.

This finding has major implications, report P. J. Dziuk, J. D. Donker, J. R. Nichols and W. E. Petersen, former and present dairy physiologists at the University. If there were ways to keep these eggs alive and transfer them to the uterus of another cow, breeders could raise many more calves from their better animals.

So far, no one has developed a practical way to make this egg--or "ova"--transfer. In other states, the transfer has been successfully completed in a few cases, resulting in live calves. But each time, it called for major surgery and each time the "donor" animal died.

The Minnesota scientists are searching for a non-surgical method for making this transfer. Although such a technique is not in sight, they have found that:

* "Superovulation" can be repeated several times in the same cow, without hurting her.

* Putting small quantities of fluid from the uterus of one cow into the uterus of another won't kill a fetus, if one is present, in the "recipient" cow. This fluid transfer would be necessary in a non-surgical egg transplant method.

* A "biopsy" technique can be used for studying live tissue in the uterus. The scientists designed an instrument which will remove the tissue without operating and without injuring the animal. Otherwise, the only way this tissue can be studied is by slaughtering the cow and then removing it.

* Techniques for recovering live eggs from live "donor" cows are possible. However, they also found, as have researchers elsewhere, that some of the eggs will die. Ways to save all of them have not yet been perfected.

But important as these findings are, there are still many hurdles to pass before successful egg transfers can be accomplished.

One of the problems is in perfecting egg collection techniques. Another lies in the fact that a "recipient" cow at transfer time would need to be in the same stage of the estrous cycle as the donor cow is when the eggs are collected. This means scientists must either find ways to "synchronize" the estrous cycles of the two cows or they must develop methods for keeping the eggs alive during storage.

If ever perfected, the transfer technique will have two important results. First, it will mean more calves from genetically-better cows. Second, it will be an important research tool for studying causes of embryonic mortality (early abortions) in dairy cows.

Ova transplant studies at the University are now under Edward Graham, dairy cattle scientist, and his co-workers.

HERD MIX IS GOOD ENOUGH FOR CALVES

Dairy calves don't need a complete "starter" ration; a good, simple grain mixture and long hay like you give the rest of the herd is enough.

In fact, calves on a "herd" mix of 40 pounds ground shelled corn, 30 pounds ground oats, 20 pounds wheat bran and 10 pounds soybean oil meal outgained calves on a complete starter formula in University of Minnesota tests.

The starter ration contained ground corn, soybean oil meal, ground alfalfa, molasses, wheat bran, beet pulp, salt, bone meal and a feed additive. It is similar to many ready-mixed starter formulas and is "complete," while long hay was fed with the herd mix.

W. A. Olson and J. B. Williams compared the herd mix with both pelleted starter and with starter in meal form. The trial was conducted from birth to 84 days for each calf.

Average gains for the entire trial were: calves on herd mix, 1.43 pounds daily; starter meal, 1.18 pounds and pelleted starter, 0.97 pounds daily. Calves on herd mix also outgained the other two groups during both the first and second half of the trial period.

"HEAVY CULLING" IMPROVES DAIRY HERD

PLATO, MINN. -- Selling off a third of the milk cows is sometimes the best way to start improving a dairy herd.

Howard and Donald Schutte, dairy farming brothers here in McLeod county, sold 17 poor producers "over the scales" last March. The transaction raised the herd's butterfat average by close to 50 pounds per cow.

By taking advantage of a high spring market for cutter and canner cattle, the Schutte's received about 17 cents per pound for the cows. The cows averaged 1,350 pounds and brought around $230 each--good price for cull cows.

Last winter, the Schuttes had 47 milk cows--22 on the main farm and 25 on a rented place. Their plan was to consolidate the two herds into

Donald (left) and Howard Schutte feed silage to their dairy herd.

one bigger one for the main farm, but there were only 34 stalls in the barn. They picked 17 to sell from both herds by checking the Dairy Herd Improvement association butterfat records. They first considered holding an auction, but, after discussing the matter with Vernon Hoysler, McLeod county agent, they decided on the slaughter market.

"Last year," Donald says, "the home herd averaged 352 pounds butterfat and the one on the other farm was about 377. The cows we sold had averaged about 300 pounds each. By getting them out, this year's average should be well over 400 or 420 pound per cow.

Donald and Howard were back up to around 50 head of milking cows by December 1, 1958. "The added cows were first-calf heifers we raised ourselves," they say. "We figure that a farmer won't sell his good cows, so the only way to be sure of getting good ones is to raise your own."

Last winter, the home farm only had stalls for 34 cows. Now, the same barn has another row of 17 stalls and the improvement only cost $300, about the cost of one cow.

They got rid of the 400-hen laying flock--which hadn't been too profitable, anyway--and remodeled the 20 x 40-foot laying house into a calf barn. There are now 10 individual calf pens in the building--each full of dry bedding.

The Schutte cows get top quality forage and grain and protein according to production. Last summer, the brothers started "green feeding"--hauling fresh, chopped hay to the cows daily, instead of putting the cows on pasture. This makes for efficient use of the pasture; the cows don't tramp the forage down and there are no fences to keep up.

THREE-WAY APPROACH AIDS DAIRY INCOME

AITKIN--A three-way "intensification" plan has increased returns from a dairy herd by almost 20 percent in the past three years on an Aitkin county farm.

For the 1955-56 record-keeping year, Norman Wright's 29-cow herd of Guernseys averaged 395 pounds butterfat each--already 150 pounds above state average. Twelve months later the average was 420 and for 1957-58, the herd averaged a whopping 470 pounds per cow.

What made the change? "Mainly, three things," says Wright.

"First was getting more feed value from forages, through heavier use of fertilizer, more intensive pasture management and silage."

"Second, I've recently done stricter culling in the herd. When an individual cow slips in production, out she goes."

"Third," Wright says, "thanks to artificial breeding and better calf selection, the heifers do better from the beginning now. Not long ago, they averaged around 300 pounds butterfat for the first year. Now, they all start between 350 and 400 and some even higher."

The Wright family moved to its present farm 6 years ago. Although there were 160 acres of tillable soil on the place, neither pasture, grain nor cultivated crops were doing as well as Norman thought they should. So he talked it over with Fritz Gebrels, Aitkin county agent, with whom the Wrights were cooperating in a "Farm and Home Development" project.

With Gehrels' help, Wright worked out a fertilizer and pasture management plan that went into operation three years ago. The fertilizer: about 200 pounds ammonium nitrate in the fall, followed by another treatment midway through the pasture season. Phosphate and potash went on according to soil test recommendations. The management: either a ration-a-day system, or at least a rotational set-up, so the cows in summer get small areas of fresh grazing frequently.

Last year, this combination allowed the cows to get most of their summer feeding from a 12-acre pasture. Dry spring and early summer weather, however, resulted in poorer growth in the pasture in 1958 and the cows needed a larger area.

But the pastures supply so much high quality feed for the cows that Wright feeds only ground grain during the summer, without any protein supplement.

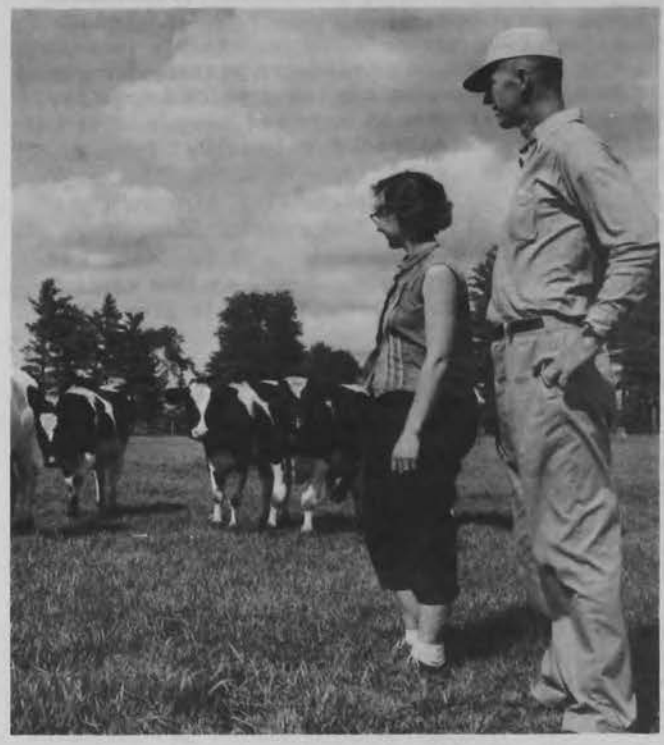
Important as feed is for the herd, Wright puts just as much emphasis on his dairy records strict culling and breeding and calf selection program. "If you don't keep records, you never really know what your cows are doing," he states. "Without knowing how much butterfat each cow is producing, you may get the wrong idea about the herd. A lot of milk from a cow doesn't mean much if the test is low, because fat is what brings the pay."

Wright recently completed a new milk house, built into one end of his barn. He hopes to remodel the barn in the future and convert it into a parlor milking setup.

NITROGEN FERTILIZER CUTS PASTURE NEEDS BY TWO-THIRDS

BAGLEY--As recent as April, 1958, dairy farmer Axel Hogberg found it hard to believe that fertilizing his pasture would pay.

But one sack of nitrogen fertilizer spread in a strip on the field changed his mind. It made such a striking difference ten days later that he decided to fertilize the whole pasture.



Axel and Mrs. Hogberg watch their Holstein herd on the well-fertilized pasture.

The payoff: Along with better pasture management, fertilizing meant that Hogberg needed only a third as much dairy pasture as before. He also had no more trouble with bloat, because the cows ate grass instead of legumes.

This "new look" in pastures on the Hogberg farm grew out of an early spring conversation Axel and Mrs. Hogberg had with Arnold Heikkila, Clearwater county agent, and Ed Becker, Grand Rapids, area rural development agent.

Here was the situation, as Hogberg tells it: "The legumes in my pasture had mostly 'run out' and the remaining grasses were growing so poorly that my 18 head of dairy cows last year needed 33 acres for enough grazing. Even then, I always had to start feeding hay in August to keep milk production up. Yet, I was mighty skeptical about how much good fertilizer would do on grass."

The agents made a suggestion: "See what just a little fertilizer will do." So in late April, Hogberg spread a sack of ammonium nitrate fertilizer around the edge of the field. Ten days later, the fertilized strip was so dark green and lush, that it made the rest of the field look barren.

"That convinced me," Hogberg says. "I then had the soil tested and found that nitrogen was the only plant nutrient needed in that field." According to Heikkila's recommendation, he applied 150 pounds of ammonium nitrate per acre in late May and put on a second application later in the summer.

The cows grazed a 14-acre area for a short time in the spring, while Hogberg was setting up his rotational grazing system. After that, he let the cows graze on one strip for five or six days, then moved them to a fresh one. As the summer wore on, he moved them every four days. Yet, with less than a third as much pasture, milk production was as good as ever.

With fewer acres needed for pasture, Hogberg had more land for hay--a precious item for a farm which has only 60 acres of crop land.

Dairy cows aren't all that benefited from nitrogen fertilizer on the Hogberg farm. The same application for dairy pastures also went on eight acres of sheep pasture. The result? Mrs. Hogberg tells it this way: "Before, our 80 lambs and ewes ran on 15 acres of wooded area that really didn't give them much feed. We had to give them quite a bit of hay.

"Now," she says, "They're getting all they need from the eight acres, which we have divided into two fields, for 'alternate' grazing. The pasture takes care of them so well that we even took a hay cutting from one of the fields. And if the second fertilizer application does as much good as the first, we may be able to fatten the lambs on grass alone--something that was never possible before."

PELLETS DON'T INCREASE GAINS IN DAIRY CALVES

It apparently doesn't pay to feed a pelleted forage-grain mixture to dairy calves, say J. B. Williams and W. A. Olson, University of Minnesota dairy cattle scientists.

In recent feeding trials, calves fed a calf starter ration in meal form gained 1.18 pounds per day, while pellet-fed calves gained .97 pounds.

Both groups of calves received the same ration; the only difference was in the form in which it was fed. The starter contained alfalfa hay, beet pulp, shelled corn, molasses, wheat bran, soybean oil trace mineral salt, steamed bone meal and supplemental vitamin A and D.

The researchers also compared the same forage-grain formula with a simple grain mix and long hay. This time, all calves received fresh skim milk and vitamin A. Calves fed forage-grain pellets gained .97 pounds daily, those getting it in meal form gained 1.18 pounds and calves on long hay and grain averaged 1.43 pounds per day.

Williams and Olson explained that long hay seems to help the rumen start functioning better than will the forage-grain formula used in these tests. They recommend that calves be fed long hay, grain and fresh water within a week after birth. This helps the calf get an early start toward development and use of its four stomach compartments.

To supplement any liquid feeding system, they advise farmers to use leafy, green hay, along with a simple grain mix of 40 pounds coarse ground ear corn, 30 pounds ground oats, 20 pounds wheat bran, 10 pounds soybean oil meal, 1 pound trace-mineralized salt and a pound of steamed bone meal.

ADDITIVE FOR CALF RATION ISN'T NEEDED

Although it may speed up early growth, there's still no good reason for feeding Dynafac to dairy calves.

W. A. Olson and J. B. Williams, dairy cattle researchers at the University of Minnesota, tried this feed additive in calf rations, with these results:

Among calves getting fresh skim milk and the additive, average gain was 0.99 pounds per day from birth to 42 days of age--the period when Dynafac was fed to them. Calves not getting the chemical averaged 0.85 pounds daily during the same period.

During the second 42 days of the trial, however, there was a different story. Calves which had received the Dynafac gained 1.59 pounds while those which had not received it averaged 1.86 pounds per day. For the entire 84-day trial, the no-Dynafac group averaged 1.38 pounds per day, against 1.29 for those fed the chemical.

In other words, Williams concludes, if a calf grows a bit slowly during the first 6 weeks, chances are it will just grow that much faster during the next month and a half. This means the added gain from Dynafac in the first 42 days was no real help at all.

Just why Dynafac made a difference to begin with isn't known, says Williams. It didn't affect calves at any age when fed along with dried skim milk.

DHIA RECORDS MORE POPULAR ON MINNESOTA FARMS

Charts that separate "boarder cows" from the real money-makers are becoming more fashionable on milkhouse walls in Minnesota.

These charts are Dairy Herd Improvement association records, which give month-by-month butterfat and milk production records for each cow.

According to Ramer Leighton, Ralph Wayne and Harold Searles, extension dairymen at the University of Minnesota, nearly 100,000 milk cows in 3,943 herds--about 7 percent of the state milk cow population--are on one of three DHIA programs. This is higher than ever before.

In 1957, the average Minnesota cow on DHIA test produced 377 pounds of butterfat, compared to the state average of 245. This makes a big difference in returns. On a grade B market the farmer with state average production level makes about $34 annual labor income per cow, while at the DHIA average, he would make more than three times as much--$117 per cow. At grade A prices, the labor returns run about $78 per cow for state average and $183 at DHIA average levels.

The three DHIA programs are:

* Standard Test, accounting for 90,401 cows, in which a local DHIA supervisor takes monthly milk samples, runs the tests and returns a report on test and production.

* "Owner-sampler," in which the dairyman takes his own milk samples and the local DHIA supervisor does the testing and returns a report. This accounts for 6,680 cows.

* "Weigh-a-day-a-month," involving about 2,200 cows--a plan in which the farmer simply records the weight of milk produced by each cow during one day of each month. Production for the entire month is calculated at a local center from the farmer's figures.

DHIA work started in 1910 in Minnesota, when the first cow testing association was set up near Albert Lea. The program grew to 30 associations in 1922, 96 in 1930, then slumped to 30 during the depression and 33 at the close of World War II. It started climbing in the late '40s and has been gaining steadily since.

RATION-A-DAY PLAN STRETCHES PASTURE

No dairy farmer would throw down enough hay in a single winter day to feed the cows for a month.

But it's equally wasteful to let the dairy herd run over the entire pasture acreage the first time you let them out, says Ralph Wayne, extension dairyman at the University of Minnesota.

The bovine is a mighty wasteful creature when she isn't managed properly. Left to graze a large area, she will eat off the fresh growth and trample the rest.

So to get the most mileage from pasture, you need to give it to the cows in daily portions--just as you do with the winter hay supply. This means, wherever possible, "ration-a-day" grazing. You can do it this way:

Divide the pasture, with electric fences, into six or seven strips. Then divide the strips with a cross wire, so the cows get a fourth or a third of a strip daily.

You can determine the exact size of the daily lot according to how much the cows need to get filled up. Watch them closely for the first three or four days, and you'll be able to judge it quite accurately from then on.

Don't turn the cows out too early. But don't let bluegrass get too much of a start, either. If you have both bluegrass and legume pasture, put the cows on bluegrass first. Once this grass goes to seed, you can practically cross it off as far as pasture value is concerned--unless it is heavily fertilized and has plenty of rain.

GRAIN SORGHUM IS ALL RIGHT FOR DAIRY COWS

Both grain and forage sorghum varieties can be fed to dairy cattle.

Grain sorghum is quite similar to corn in feed value; it's generally considered worth about 90-95 percent as much per pound in total feed value as shelled corn. Forage, or "sweet" sorghum can be used for silage.

Donker points out, however, that TDN content of sorghum silage is somewhat lower than corn. There is a smaller proportion of grain in it and more of the grain passes through the animal undigested than is true with corn. This means sorghum forage needs to be supplemented with legume hay and with a protein-rich concentrate to make a complete ration for dairy cows.

Sorghum is not a good crop to pasture or "green-feed," according to Donker. When fresh and green, it may contain dangerous amounts of prussic acid. After it has been stored, though, there is no longer any prussic acid danger.

Sorghum grain can be substituted for corn, but it's best to crush or grind it for adult cattle. Donker advises farmers not to feed heavy amounts of grain from sweet sorghum, because these varieties are bitter and cattle may not eat them well.

FORAGE FEEDING SYSTEMS COMPARED

Most dairy farmers would be better off by improving their present summer forage feeding systems than they would by changing to a different plan.

J. D. Donker, dairy husbandman at the University of Minnesota, says recent research shows little difference in milk production per cow between different grazing systems, green-chopping--also called "soiling"--and silage feeding in summer.

Quality of the forage, not the way it's fed makes the most difference, according to Donker. Which system a farmer adopts depends mostly on how much pasture land is available, adaptability of land, buildings and equipment to change, labor available and personal preferences.

Studies have shown, however that some form of "rotational grazing" can reduce the number of acres needed by 30 to 40 percent, in comparison to letting cows graze a whole field. Rotational grazing means dividing the pasture into several plots. Then the cows graze one plot at a time.

Green-chopping means confining the cows to a feeding lot and hauling fresh, chopped forage to them daily. This practice, when used with tall-growing crops such as sudan grass or oats, saves material that otherwise would be lost through trampling or contamination. On the other hand, with short-growing crops, cows need fewer acres if pastured than if fed green-chopping, too. It requires more labor and equipment than grazing and wet weather makes the operation difficult.

Harvesting and storing the entire forage crop, then feeding silage, grain and hay overcomes some of the disadvantages of green-chopping. But again, this system is one that will fit only in certain situations.

FERTILIZING MEANS HEIFERS NEED LESS PASTURE

Fertilizing pastures can nearly cut in half the amount of grazing land needed for young dairy hei-

fers, according to research at the University of Minnesota's Northeast Experiment station, Duluth.

W. W. Nelson, agronomist at Duluth station reports that heifers on fertilized pasture areas in 1957 required only 52 percent as much grazing area during the season as did their twin sisters on unfertilized grass.

Since the experiment started in 1955, the fertilized areas have received 60 pounds nitrogen and 40 pounds each of phosphate and potash each spring, plus 33.5 pounds of nitrogen top-dressing per acre in the summer. Fertilized plots also received 4 tons of lime per acre the first year.

Each year, identical heifer twins or sister heifers were divided so that one of each pair would be on fertilized pasture and one on unfertilized grass. The heifers received no other feed.

There was no difference in the amount of pasture used by heifers on fertilized compared to unfertilized areas in 1955. But in 1956, those on fertilized pasture required only 62 percent as much area as did heifers on unfertilized grass. Last summer, it took twice as much area to feed the heifers on unfertilized pasture.

Also, heifers each summer gained more rapidly on the fertilized pasture. In 1957, the daily gains averaged .93 pounds for fertilized grass and .64 pounds on the unfertilized area. Fertilized pasture produced 436 pounds of heifer gain per acre in 1957, compared to only 148 pounds per acre on the unfertilized pasture.

TELL REASONS WHY FAT TESTS VARY

Why do butterfat tests vary from time to time?

There are several reasons--some known and some not yet determined--says Harold Searles, extension dairyman at the University of Minnesota.

He lists these causes of fat test variation:

* Differences between breeds and between individual cows. These are due to inheritance. Common feeds have little effect on such variations.

* Stage of lactation. Tests tend to rise as milk production decreases.

* Condition of flesh. There is a tendency for high tests for a short time after freshening, if the cow carries considerable extra flesh.

* Temperature. Test usually drops in hot weather and when cows go to pasture. Throughout the summer, tests usually average lower than for the rest of the year.

* Completeness of milking. The first milk drawn at milking time is low in fat; the strippings are high. Incomplete milking can mean lower test.

* Feed. In the long run, feed has practically no effect on test. Ground soybeans, though, may raise the test .1 to .2 percent and small amounts of cod liver oil may depress tests. Ground hay also tends to lower tests.

* Milk fluctuations. A sudden drop may result in higher test and an especially big milking may lower it somewhat.

* Udder infections, such as mild mastitis attack.

* Unknown causes. Both milk production and test vary from day to day for no apparent reason. But such variation is normal.

CHEDDAR CHEESE MELTING QUALITY VARIES WITH HARDNESS

Dairy industry scientists at the University of Minnesota have developed a method for predicting melting quality of cheddar cheese.

They found that the softer cheddar cheese is, the higher its melting quality is likely to be. But they found little or no relationship between melting quality and fat content, moisture content or acidity.

This study was done by R. W. Weik, W. B. Combs and H. A. Morris, dairy products researchers.

"Melting quality" in cheese involves time required for melting, appearance of melted cheese and amount of free fat separation in melted cheese. Good melting quality depends on what the cheese is being used for; what makes satisfactory melting quality for one purpose may not be desirable for another.

In the past, cheese makers have not had a good way to control or check for melting quality in cheddar cheese.

Weik, Combs and Morris used time required for melting as the standard for melting quality. They determined hardness by the amount of force needed to push a wire through the cheese.

In general, they learned that when little force was needed on the wire, the melting time was shorter and the melting quality was better.

Entomology and Economic Zoology...

INSECT "LIBRARY" AIDS BASIC RESEARCH

One of the largest "libraries" of its kind is aiding University of Minnesota entomologists in their basic research projects.

There are no books in this particular library. Instead, it contains about $2\frac{1}{2}$ million insect specimens. About 85 percent of them are from Minnesota and the rest are from around the nation and the rest of the world.

This collection plays a key role in basic research. C. E. Mickel, head of the department of entomology and economic zoology points out that a big problem in insect control is identifying the pests when they first appear. With the collection they now have, University entomologists can make accurate identifications much faster.

Basic research--as well as applied studies--in the department of entomology and economic zoology is concerned with much more than just insect control, Mickel points out. Many insects are helpful and can be useful, such as honeybees and other bees that pollinate legume seed crops.

Also, as the name of the department implies, it is concerned with studies in wildlife and fish. There are basic studies underway in all of these areas. Some of them are:

1. Insect physiology. Entomologists are giving some thorough study to the cuticle, or outer shell, of insects. The scientists hope to gain a much better knowledge of just what the role of this shell is. In another project, the entomologists are studying the importance of "symbiotes"--minute organisms living inside the body cells of insects.

2. Insects in grain storage. Plant pathologists and entomologists at the University have already found that certain insects can increase spoilage in stored grain. Weevils can carry mold organisms on their bodies, research has shown. But there are still basic, unanswered questions which the scientists are studying. For example, it's still not entirely clear whether these insects actually need the mold organisms for their own survival.

3. Leafhoppers on potatoes and alfalfa. University of Minnesota entomologists are cooperating in a large-scale, basic study on leafhopper migration. The leafhopper is a problem both in potatoes and in alfalfa in Minnesota, yet it cannot live over winter here. Recent studies show that leafhopper migration is affected to some extent by the weather; it tends to move when favorable weather fronts appear.

4. Fish population studies. Scientists are continually searching for more basic information on how populations of all animal life grown and react in nature. In one current long-term project, scientists are studying fish populations in Minnesota's Red Lake. This study has already been underway for about 9 years.

5. Animal population studies. A similar population study, but this one on external parasites on mice, is being conducted in the University's Cedar Creek Forest north of the Twin Cities. The scientists are not concerned about the mice or parasites themselves but, instead, regard these creatures as ideal "research tools." By observing these animals in a natural environment, they may learn new but basic principles of population growth. Such basic principles could very well be related to other animal life.

REGIONAL STUDY SHEDS NEW LIGHT ON CORN BORER SEVERITY

Agricultural scientists may have a new index for predicting in mid-summer how much corn damage there will be from European corn borers.

In a four-year cooperative study, research workers in Minnesota, Iowa and Ohio found that the number of borer-caused cavities in corn plants at the end of the "first-brood" infestation in early August gives a strong indication of corn yield reduction for the season.

This method, the scientists found, is better than the old system, which meant counting the number of borers in the fall. If proven after more research, the new index could help agricultural workers to more precisely measure damage from borers.

However, the new, mid-summer method won't replace the currently-used fall survey. The cavity count in early August could be used to estimate loss in yield, while the fall survey would continue to be used as an estimate of over-wintering borer populations.

The study also showed that corn damage estimate from the index depends on a number of things: the weather, the region, the hybrid, planting date and level of infestation.

This research was conducted from 1953-56 at Waseca, Minn., Ankeny, Iowa and Wooster, Ohio. H. C. Chiang and F. G. Holdaway, University of Minnesota entomologists, took part in the research, along with T. A. Brindley and T. R. Everett, Iowa State College and U.S. Department of Agriculture, and E. T. Hibbs, Ohio State University.

In general, the study showed a strong tie-up between weather, time of planting, corn borer "resistance" in hybrids and borer damage. But the relationship wasn't the same from state to state.

For example: As rainfall increased in Iowa, there were heavier attacks of second-brood borers. In Ohio, the reverse was true. Also, two particular hybrids in Ohio had more damage from second-brood than first-brood borers, while the opposite was the case in Iowa and Minnesota.

During the four-year study, Minnesota had the lowest borer infestation of the three states. This doesn't mean the borer problem is past in the Gopher state; it could be that we're simply in the low point of a "cycle," Chiang and Holdaway point out.

Breeding corn borer resistance into new hybrids

is the principal method now being followed by Minnesota scientists dealing with these pests, and the three-state study gave more evidence of the merit in this approach. There was much less damage from both first and second-brood borers on the resistant hybrid than there was on the borer-susceptible plants. There were also some differences in infestation and damage between early and late planting, although the differences were not as important as the differences due to borer resistance. In general, early-planted corn was attacked less by second-brood borers than was late-planted corn.

DEER HUNTING CAN AID FOREST MANAGEMENT

Deer hunters can actually be a big help in forest management, a long-time study at the University of Minnesota's Cloquet Experimental forest shows.

Wildlife management researchers found that opening the Cloquet forest to public deer hunting--a policy followed since 1947--resulted in less deer damage to the forest than occurred before when the area was completely protected.

Donald W. Burcalow, Minnesota Conservation department worker and William H. Marshall, wildlife management specialist at the University, made the study.

Records kept over the years showed that the deer herd in the 3,300 acre forest developed from a small number in the late 1920's to 15 or more animals per square mile by 1945.

The white-tails were so numerous they caused severe damage to natural tree reproduction in the forest during World War II. They browsed heavily on seedling pine trees, destroying or damaging about 90 percent of them in the winter of 1946-47. Also, shrubs in the swamp that normally provide good deer "browse" were severely cut back.

In 1947 the forest was opened to hunting with firearms, and has remained open annually during the deer season, except in 1950 when there was no state-wide season.

Hunting proved to be a remedy for both the abnormally high deer population and the damage it caused in the forest. Annual kill has averaged about three deer per square mile, while the population in recent years has been about ten deer per square mile, based on spring census. Since hunting began, deer browsing has not been heavy enough to harm forest reproduction.

SYSTEMICS OKAY FOR STOPPING CATTLE GRUBS

Treatment with a "systemic" insecticide in the fall may be a good answer to the grub problem in your beef cattle.

But don't use these materials on milk animals, warns John Lofgren, extension entomologist at the University of Minnesota. There is a danger of chemical residues showing up in the milk.

Trolene and Co-Ral are two systemics presently approved for use on meat animals. Both control grubs. In addition, Co-Ral can be used against lice, ticks, horn flies and screw worms. Trolene comes in "bolus" form and Co-Ral is a spray.

With either systemic, Lofgren says, make one treatment after the flies have deposited their eggs and before the grubs show up in the backs. Between early September and late October is a good time.

But don't treat cattle with Trolene during a "stress period." This includes just after weaning, recovering from illness, shipment, or changing feed. Give the animals plenty of feed and water before and after treating. They need exercising room, too.

Trolene and Co-Ral must not be used within 60 days of slaughtering, and Co-Ral shouldn't be used for calves under 3 months or for sick animals. Calves between 3 and 6 months should get only a light application. Also, Co-Ral must be used as a spray only, not as a dip or oral treatment.

Systemic insecticides, as the name suggests, enter the animal's bloodstream and other parts of its system. This makes the material present to combat insects like grubs wherever they appear.

SEVERAL WAYS AVAILABLE TO STOP LICE

Farmers have several "weapons" to arm themselves with in fighting cattle lice this fall.

But which material you use depends on whether you're treating milk cows or beef animals. Here are lice control recommendations from John Lofgren, extension entomologist at the University of Minnesota.

For milk cows, use either rotenone or pyrethrins. Rotenone can be applied dry, in the 1 percent dust form. For a spray, you can mix a pound of 5 percent rotenone powder in 100 gallons of water. Repeat this treatment in 15 days.

Pyrethrins comes in spray form only. This must also be repeated 15 days after the first treatment.

For beef cattle, you can use rotenone, pyrethrins or any one of the following materials: Co-Ral, lindane, malathion, methoxychlor or toxaphene. Warning: Don't use any of the last five chemicals on milk cows.

For using these materials on beef cattle, follow these tips:

*Co-Ral--Mix 16 pounds of 25 percent wettable powder in 100 gallons water. Don't treat within 60 days of slaughter.

*Lindane--Use as spray or dip. Mix a pound of 25 percent powder in 100 gallons water or 1.3 pints of 20 percent emulsion in 100 gallons. Don't use within 30 days of slaughter.

*Malathion--Use 16 pounds of 25 percent powder in 100 gallons water or 3 quarts of 50 to 57 percent emulsion in 100 gallons water. Treat only animals more than a month old.

*Methoxychlor--Use as spray or dip. Put 8 pounds of 50 percent powder in 100 gallons water.

*Toxaphene--Mix 8 pounds of 50 percent wettable powder in 100 gallons water or put 5 pints of 60-66 percent emulsion in 100 gallons water. Don't use within 28 days of slaughter.

Plant Pathology and Botany . . .

PLANT PATHOLOGISTS PROBE MYSTERIES OF PLANT LIFE

Disease-resistant crop varieties save Minnesota farmers millions of dollars each year.

Behind the development of these varieties are years of basic, or "fundamental" research on plant diseases, according to J. J. Christensen, head of the plant pathology and botany department at the University of Minnesota.

Recent scientific developments have resulted in tremendous emphasis on basic research. But Christensen points out that University scientists have been relying on their own basic research for years in their never-ending struggle to bring Minnesota farmers better crop varieties.

For every major plant disease which has struck crops in the Midwest in recent years, a crop variety with some resistance to the disease has been developed by agricultural scientists.

Behind the scenes in these developments are the plant pathologists, like those at the University, who are quietly probing the fundamental mysteries of plant diseases. Such research played a key role in the recent development of Forrest barley and Minhafer oats at the University. Forrest barley has resistance to stem rust and Minhafer has an all-around combination of disease resistance never before available in any oat variety.

Basic research in plant diseases, Christensen explains, produces information that the plant breeders can use in developing these disease-resistant varieties.

Plant diseases are caused by living organisms which are themselves extremely simple forms of plants--such as fungi and bacteria. "One of our most basic projects," Christensen says, "involves studying the way these organisms can change in their own genetic make-up."

The big problem with plant disease control is that the disease organism itself may suddenly change, either through mutation or by hybridization. The result may be a new variety or strain of the disease organism that attacks crops immune to other races of the same disease.

Forty years ago, for example, stem rust was thought of as just one disease. Today, scientists know there are at least 300 strains of this rust disease that attack wheat alone. The disease organism lives over winter on straw and in the spring infects barberry plants, where it often hybridizes and produces new strains.

University plant pathologists and plant breeders, in cooperation with the U. S. Department of Agriculture, are leading the battle against stem rust. Every year, they collect some 15-20,000 samples of stem rust-infected wheat and barberry leaves from around the nation and use these samples to locate new races of the disease. As soon as they notice a new strain, the plant pathologists test all present varieties of wheat for resistance to it. This helps scientists keep ahead of new diseases.

"To find out how serious a new disease may be," Christensen says, "we must study the 'range' of changes that may occur in the organisms." To learn this range, the pathologists deliberately cause mutations. If they can determine the complete range of changes that might naturally result from mutation and hybridization of a plant disease, they can cut the time and work involved in finding resistant crop varieties.

To bring about these changes in microorganisms, University plant pathologists are using two principal methods--radiation and chemical treatment. By bombarding fungi with nuclear rays, they are producing all sorts of changes. And as a by-product of this research, they are learning more about the effect of radiation itself in producing genetic changes. Similarly, the scientists are also creating changes in disease organisms by treating them with certain antibiotics.

Another aspect of basic research in plant pathology involves using radioactive "tracers" as tools. By treating amino triazole, a chemical, with radioactive isotopes, University plant physiologists recently found that the chemical doesn't affect growth in all parts of Canada Thistle plants. They found that, apparently, sugar from unaffected parts of the plant moves into leaves that were affected by the chemical, enough so the plant may recover. Such discoveries give important background needed in developing better anti-weed chemicals.

These are only a few examples of the basic research being conducted by University plant pathologists. Other studies include corn ear and stalk rot, virus plant disease, decay in wood products, resistance to disease, grain storage and plant disease epidemics. As Christensen says "We feel that, in the long run, basic research is really mighty practical."

"FOREIGN" BARLEY AIDS RESEARCH

Barley that originally came from Turkey, Ethiopia, Manchuria and other foreign lands may help meet an urgent farm problem in the Red River Valley.

The problem: developing new, locally-adapted malting barley varieties that can withstand some serious plant diseases.

Some 10,000 different barley plots are under study at the Northwest Agricultural Experiment station, in the most intensive barley research project ever conducted in Minnesota.

Part of these plots are raising barley varieties which have been brought in from other nations. Some of them are resistant to the troublesome barley diseases of this region and therefore are useful as "parents" in developing new, disease-resistant varieties. By crossing the foreign barleys with adapted varieties, it is often possible to select "offspring" that combine disease resistance with the other desirable characteristics.

The research workers are looking for resistance to many different diseases. Worst ones at present in barley are septoria leaf blotch, spot blotch and net blotch. But the scientists must be on guard against others, too. It's never known when a new plant disease, or a new strain, will appear and attack varieties which resisted other serious diseases.

Cooperating in the barley projects at Crookston are J. W. Lambert, and B. H. Beard, agronomists, J. J. Christensen and Karl Fezer, plant pathologists, O. C. Soine, Crookston station agronomist, B. E. Youngquist, superintendent of the Crookston station and other station workers.

ANTIBIOTICS HAVE BIG ROLE AGAINST PLANT DISEASES

Antibiotics, already doing yeoman service against diseases in humans and livestock, may also be a formidable weapon against farm crop diseases.

The fact that antibiotics can slow down or completely kill some plant disease organisms has been known for some time. About all that remains is to develop economically practical methods of treating crops with materials containing antibiotics.

Antibiotics are now used on a few high-value, intensively-grown crops. For example, some apple growers use antibiotic-containing sprays to control fire blight in their trees.

This doesn't mean that scientists have all the information they need on antibiotics. But one thing is certain: antibiotics have some remarkable--and often weird--effects on organisms that cause plant diseases.

J. J. Christensen, head of the plant pathology department at the University of Minnesota, says these effects have some terrific potentials for future application.

Some of the effects of antibiotics on plant diseases would help farmers and some wouldn't. For example, Christensen and Patricia Allison, formerly a plant pathologist at the University, recently found that one antibiotic causes cancerous growth in spores that cause a blight disease in grain. Is this change harm or help? At present, no one knows.

Antibiotics, Christensen explains, are substances produced by one organism--such as a fungus, or bacterium--which are poisonous to other organisms. Penicillin, streptomycin, aureomycin and terramycin are common antibiotics used to combat diseases in man and domestic animals.

One effect of antibiotics may be to either slow down growth of a disease organism, or to kill it. Which effect occurs may depend upon the dosage; a high concentration of an antibiotic may kill the disease organism, a low concentration might only inhibit the growth.

Antibiotics have other effects, too. Sometimes, more resistant individual organisms will increase in a mixture of these organisms, while weaker ones are killed by antibiotics. This can build up a population more resistant to the antibiotic.

Another effect of antibiotics may be mutations --sudden changes--that an organism may pass on to its descendants. These mutations are common in plants and animals, and may result in a new race or strain of a disease-producing organism that attacks plants which are resistant to prevalent races of the disease.

In one experiment, Christensen and other plant pathologists found that mutations of Helminthosporium sativum, a blight organism of grasses and cereals, occurred 10 to 100 times as rapidly in organisms treated with antibiotics as was true where antibiotics were not present.

With one particular treatment of an antibiotic called filipin, Helminthosporium spores germinated, but developed into a mass of tumor-like cells. These cells resembled those formed in some plant galls, and in some respects, they resembled certain animal cancers. Yet, when the antibiotic was removed from these cells, they seemed to recover.

Christensen admits that the complete significance of these finding is not known. But they do show some of the different things that can happen to microscopic organisms when treated with antibiotics. Besides, these studies may have a wide application to other fields and in a way that can't be foreseen at present.

CONTROL LEAFHOPPER TO STOP ASTER YELLOWS

To stop aster yellows, you first need to knock out the insect that carries it.

The virus spreads from infected overwintering plants by the six-spotted leafhopper, according to Herbert Johnson, extension plant pathologist at the University of Minnesota.

The aster yellows virus symptoms for a few crops are:

- Flax--plants often stunted, yellowed; flowers have no color; bolls do not form.
- Potatoes--on this crop the disease is called purple top wilt; purple color may or may not be present depending on the variety; leaves curl inward; plant slowly wilts and eventually dies.
- Celery--stems twist and curl; breaks occur and turn black; leaves turn yellow.
- Carrots--leaves turn yellow or bronze; numerous shoots arise from the crown; numerous small roots arise from the main tap root; carrot takes on an off-flavor.
- Onions--plants stunted and yellowed; bulb becomes soft and spongy.
- Leaf lettuce--growing tip dies and no new leaves are formed; plant eventually withers and dies.
- Ornamentals--plants generally turn yellow; flowering and growth stops.

To control aster yellows virus, you must control the leafhoppers. DDT or Malathion sprayed or dusted at 5 to 7 day intervals for several weeks during the first half of the summer have been effective in some cases. It's a good idea to make additional chemical applications immediately following rains.

Symptoms of the disease do not appear until 3 to 6 weeks after the leafhoppers carry the virus to the plant. Therefore, control measures must be used long before the trouble is evident, says Johnson.

RESEARCH SHOWS ANOTHER WAY TO CONTROL OAK WILT

University of Minnesota scientists have found another way to help prevent oak wilt from spreading from one area to another.

Plant pathologists D. W. French and John Ohman have learned that sodium arsenite treatment on trees which start wilting in July or August will force these trees to produce wilt fungus spores in mid or late summer, when there is practically no danger of the disease spreading to other areas.

Also, this treating causes the trees to produce fewer spores.

Only trees which start wilting in either July or August will normally be producing spores during the "danger" period for infection the following spring.

The scientists warn, however, that sodium arsenite is toxic to animals and humans. It must be used with extreme caution.

In red oak trees--the species most frequently infected by oak wilt--the disease spreads in two ways: first, through natural root grafts between trees and, second, by spores which insects carry from infected trees to fresh wounds on healthy trees.

Sodium arsenite treatment prevents spread by the second method, not the first. But this could mean confining the disease to locations where it already exists. The principal way it normally enters new areas is via insect carriers.

To transmit the disease from one area to another, insects must first pick up the spores and then deposit them on fresh wounds of the healthy tree. Trees contract the disease this way only at certain times of the year--during all of May, late April and early June.

In three years of tests, French and Ohman studied several different treatments on trees which started wilting in July and August. Untreated trees wilting in these months all produced spores the following spring.

Sodium arsenite treatment confined the time of spore production to a 10-day period, which occurred shortly after treatment. The researchers removed a 6-inch cylinder of bark around the tree, close to the ground, then liberally painted the sodium arsenite on the exposed sapwood.

Deep girdling--cutting away a cylinder of bark and outer layers of the trunk, down to the heartwood--prevented the July-wilting trees from producing spores the following spring. However, girdling did not shorten the spore-production period for trees which started wilting in August. Other chemicals were also ineffective.

Sodium arsenite would be most useful, French and Ohman say, in treating large areas of infection. Where only a few trees are wilting, it may be better to cut and remove them.

The fungus which causes oak wilt grows in the outer sapwood of the trunk, just under the bark. It causes vessels which normally conduct food and water from the roots to upper parts of trees to plug up, resulting in death of the tree. The fungus may produce masses of spores on mats of "mycelium" under the bark. The so-called "pressure pad" in the center part of these mats forces out and ruptures the bark, exposing the fungus. Only red oak produce these mats; white and bur oaks do not.

Since insects can transmit the spores only to freshly wounded areas of healthy trees, it's important that no oak trees be pruned in May--the main "danger" period. If oaks are cut or wounded in any way, the wound should be immediately treated with a dressing. An effective dressing, French and Ohman have found, is .1 percent phenyl mercury nitrate in gilsonite varnish. The varnish alone, or asphaltic varnish, may also prevent infection.

To prevent spread of wilt within already infected areas, both infected trees and those immediately surrounding them must be destroyed. By the time symptoms of wilt appear on one tree, the fungus may have already spread through root grafts to nearby trees. When trees are removed, the trunks should be poisoned with such chemicals as mixtures of 2,4-D, 2,4,5-T or sodium arsenite.

It's also possible to trench around an infected tree, to cut the roots and prevent the fungus from spreading through root grafts.

In Minnesota, oak wilt is most prevalent south and east of the Twin Cities. It also occurs as far west as Mankato and north as far as St. Cloud and Taylors Falls.

SOYBEAN SEED TREATING PAYS

It definitely pays to treat soybean seed with a fungicide before planting, University of Minnesota studies show.

Plant Pathologist T. D. Wyllie says three years of trials show that soybean seed treated with Arasan fungicide yielded, in some seedlots, up to six bushels per acre more than untreated seed.

How much it increases yields on individual farms, however, will depend on general growing conditions and seed condition, Wyllie says. The biggest increase occurs in lots of poorer quality seed. With high quality seed, there may not be a marked increase from seed treatment.

These trials were conducted on samples of commercial Renville and Blackhawk and Chippewa seed, which had been sent in to the state seed testing laboratory by Minnesota farmers.

Treating kills many disease organisms which may interfere with plant growth.

The advantage from treating may be somewhat less in a good growing year for beans, such as summer, 1957. Also, in these trials, the biggest yield increases from treating occurred in seed samples having germination below 85 percent.

The treating only costs about 30 cents per acre for materials. But that is a cheap investment when compared to the "insurance" it gives. If it only increased yields by a half bushel per acre, the farmer would still be money ahead.

One final point: treating is especially important in fields which have been raising soybeans continuously for several years, because these fields may have greater populations of disease organisms.

NEMATODES HIT ALL PARTS OF GOPHER STATE

Nematodes haven't missed a single area of Minnesota.

These tiny, worm-like plant parasites are present in soil around the state, reports Donald Taylor, nematologist at the University of Minnesota.

In a survey of more than 350 soils samples during the last two years, Taylor found that every major crop in the state is suffering nematode damage.

Nematodes are not new. Actually, they've been around for hundreds of years, but only recently have they been thought of as a farming problem. Taylor's survey, done in cooperation with county agents and other agricultural workers, was the first to show the general importance of nematodes in this state.

Taylor identified some 40 species of menatodes. Of these, there are six major types of Minnesota--the dagger, stylet, pin, spiral, root-lesion and lance nematodes. These pests leave tiny holes in plant roots. Feeding by itself, damages crops, and the holes may be pathways for disease organisms.

In recent field trials, according to Haglund, pea yields were increased 21 percent by experimentally killing nematodes with soil fumigation. This doesn't mean that fumigation is practical for the average farmer--it's too expensive for widespread use except on crops high in per acre value. But it does show how much damage nematodes can cause. It would vary from crop to crop, though.

So far, the most practical approach to nematode control seems to be in developing crop varieties with resistance to the pests, Taylor says.

ALFALFA STOCK RESISTANT TO BLACK STEM

Crop scientists at the University of Minnesota have scored a major victory in their battle against one of the worst diseases in alfalfa.

They have found that two kinds of alfalfa from the Mediterranean area are very resistant to black stem. This disease in 1957 knocked out an estimated 15 percent of the total alfalfa tonnage in Minnesota. Ranger and Vernal, the only two alfalfa varieties currently recommended in the state, are both susceptible to the disease.

The finding was made by B. L. Renfro, plant pathologist, and E. W. Sprague, former USDA agronomist at the University, after testing scores of different alfalfas from around the world.

Renfro points out, however, that it will be several years before results of this research can be put to work on farms. Both of the resistant alfalfas are wild types which wouldn't be suitable for farmers in their present form.

Instead, they will be used in intensive breeding programs, designed to "take out" the disease-resistant characteristics and combine them with other characteristics needed in good field varieties.

Black stem--really two different diseases--ranks along with bacterial wilt and common leaf spot as one of the worst problems in alfalfa raising. It kills young alfalfa shoots and causes the protein-rich leaves to drop off. As a result, fields hit by the disease suffer both in hay quality and in tonnage.

The disease is often hard to see in growing alfalfa. The tops of the plants--or "umbrella" --may appear perfectly normal. It can be spotted at once, though, by spreading the tops apart and looking at the stems.

CROPPING SEQUENCES AFFECT WEEDS, TOO

"Cropping sequences"--known for years to affect yields of many crops--may also have a pronounced effect on weeds.

Thor Kommedahl, agricultural botanist at the University of Minnesota, found this true in recent field tests. Flax in fields planted to the same crop the year before had about half as many yellow foxtail plants per square yard as did flax following oats.

Yet, despite the numbers, the weed problem in flax-after-oats, because weeds grew higher in fields that raised flax the year before. When measured on a "dry-weight" basis, foxtail in flax following flax weighed as much per square yard as it did in the other plots.

Also, flax following oats yielded about 3 bushels per acre more than flax-after-flax. But Kommedahl adds that the weed problem wasn't necessarily the only thing causing the yield difference. Plant diseases, for example, could have been more of a problem in the fields planted to the same crop the year before.

This study supported the standing recommendation that flax be planted in fields that raised some other crop during the previous year.

WEED PROBLEM NOT MEASURED BY "NUMBERS"

You can't measure a weed problem according to the number of weed plants in a field.

At least, that's the indication from recent field tests conducted by Thor Kommedahl, agricultural botanist at the University of Minnesota.

He found there were only half as many yellow foxtail plants per square yard in flax following flax as was true in flax following oats.

Yet, when measured on a "dry-weight" basis, the foxtail in flax-after-flax actually weighed as much per square yard as did foxtail in flax-after-oats. Also, despite the smaller number of foxtail plants, flax plots which had raised flax the year before actually appeared weedier than where flax followed oats. This was because the foxtail plants were bigger in the flax-after-flax plots and outgrew the flax.

Flax following oats also yielded about 3 bushels per acre more than flax following flax. Fertilizer applications on the two sets of plots were the same. The only difference was in the cropping sequence.

Poultry Husbandry . . .

SCIENTISTS CONDUCT BASIC RESEARCH ON POULTRY PRODUCTION, GENETICS

Basic research in poultry feeding has led to some of the most spectacular changes in farming known today.

Elton Johnson, head of the poultry husbandry department at the University of Minnesota, points out that it wasn't too many years ago when a turkey ate up to 7 pounds of feed for each pound it gained.

Today, Minnesota turkey producers routinely turn out Thanksgiving turkeys that average a pound of gain from only 4 or even 3/4 pounds of feed.

A good deal of the basic nutrition research behind these developments was conducted at the University of Minnesota. These fundamental studies produce facts that may not be significant by themselves, but may be valuable in feeding studies later on.

In one phase of basic nutrition work, University poultry scientists are studying basic amino acid requirements of both chickens and turkeys. They already know that it takes a certain percentage of protein in a bird's feed to get the most egg or meat production.

But protein percentage isn't the whole story. Like other farm animals and humans, too, chickens and turkeys require certain types of protein. And protein varies according to which amino acids --the "building blocks" of protein--it contains.

University poultry scientists are conducting basis research in several areas. They include:

1. Nutrition. In addition to the protein studies, poultry researchers are studying utilization of birds of basic sugar compounds, starch and fiber. They are investigating the effect of diets and specific chemicals on "aortic rupture," a problem of excessive bleeding in turkeys. They are also studying the effect of sources of fat in poultry feed on the composition of carcass fat in laying hens.

2. Poultry products. One of the big problems in eggs is blood and meat spots. Just what cases them isn't known. But basic studies at the University are giving some important background information on them. Scientists have found that they apparently are two different things. It has often been thought that meat spots are simply blood spots which have darkened.

3. Egg quality. Basic studies on what goes on inside the egg during storage could eventually be a big help to producers and marketing agencies alike. Minnesota poultry researchers are closely studying storage changes, such as albumen (egg white) thinning, and deterioration of the vitelline membrane. This membrane is the one that surrounds the egg yolk. Scientists are also testing effects of different gases on the fowl, and how these gases eventually effect poultry products.

4. Poultry genetics. University poultry scientists are not developing new breeds of poultry, but they are gaining important basic information for the people who do the breeding work. These studies involve extremely complex studies of inheritance. The key to this work is in the "gene," the invisible components of the animal cells which carry inherited characteristics. The scientists are studying basic combinations of these genes which are "dominant"--and can be measured by statistical techniques and how gene interactions are affected by diets and other factors.

GOSLINGS NEED HIGH-ENERGY RATION

Young geese need a high-energy ration to make maximum growth on the least amount of feed per pound of gain, according to a University of Minnesota poultry scientist, Paul Waibel.

In one recent experiment, goslings receiving a 28 percent protein ration containing 15 percent animal fat and 28.5 percent corn--a high-energy ration--weighed 5.41 pounds at 4 weeks of age, and required only 1.37 pounds of feed per pound of bird.

Birds on a low-energy, 20-percent protein ration weighed 4.38 pounds at 4 weeks and required 1.97 pounds of feed per pound of gosling. This ration contained 30 percent ground yellow corn, 15 percent wheat standard middlings, 10 percent wheat bran and 10 percent ground oats.

However, Waibel points out, even this feed efficiency from low-energy rations is remarkable when compared with efficiency that can normally be expected from other forms of poultry, such as chickens or turkeys, of comparable size.

The diets also were fortified with soybean oil meal, fish meal, alfalfa meal, dried whey, distillers dried solubles, and vitamin and mineral supplements. Emden and Toulouse-Emden crossbred goslings were used in the studies and were kept on raised wire mesh floors in batteries.

PREMIUM EGG MARKET GROWS IN STATE

The "premium" egg market is growing steadily in Minnesota.

It is offering more and more egg producers in the state an opportunity to receive a price increase that can pay well for their extra effort, according to Cora Cooke, retired extension poultry specialist at the University of Minnesota.

"Premium" eggs are considered better than grade A eggs as normally received, because producers on a premium plan follow a program specially designed to produce eggs higher and more uniform in quality.

To get on a premium program, a producer contracts with a buyer who specified which production practices will be followed. These practices may vary from one buyer to the next, depending

on the requirements of the particular outlet supplied.

In all cases, though, premium egg contracts call for confining the flock during the entire year. The contracts generally specify the number of times the eggs must be gathered daily, the number of deliveries weekly, and, to some extent, the methods used in casing and holding eggs.

Some premium programs require dry cleaning eggs, a mechanical cooler and spray-sealing eggs to slow up quality loss.

In return, the buyer contracts to pay a specified premium over a selected market price.

Miss Cooke says the premium program has definite promise for Minnesota. It could ultimately increase the volume of high-quality eggs being shipped out of the state and could increase demand for Minnesota eggs.

The new Minnesota egg law encourages these programs, by authorizing the Commissioner of Agriculture to approve contracts made on this basis between producers and buyers.

"FACE-LIFTING" FARM ENTERPRISE ADDS TO PROFIT

NEW PRAGUE--Colorful egg cartons stamped "grade A" have become profitable replacements for milk cans on a small farm here in Scott county.

The Leonard Kubes family found that shifting from small-scale dairying to a 2,500-hen laying flock was the answer to their low income problem.

Leonard Kubes delivers a freshly-gathered basket of eggs to his wife. The children are, from left, Bonita, Thomas and Janet. The new poultry house is in the background.

A few years ago, the Kubes' faced a two-horned dilemma. As Leonard tells it: "Our herd of a dozen or so milk cows was too small to make a good profit. Second, we would have needed a completely new barn, milkhouse and bulk milk system to keep more cows and sell on a grade A milk market."

At the time, Leonard and Mrs. Kubes were cooperating in a "Farm and Home Development" project with Arnold Sandager, Scott county agent. Farm and Home Development is one aspect of Agricultural Extension work in Minnesota. It involves intensive work between agents, specialists and individual farm families, as a demonstration of what thorough farm and home planning can accomplish.

The Kubes family pondered its problem. Should they make the dairy expansion? That would be quite an expense. Other livestock? No. Beef cattle or an expanded hog operation would call for more feed than their 100 crop acres could furnish.

Poultry--which also fit the Kubes' personal preferences--seemed the best choice. They started the change two years ago and finally sold off the dairy herd last fall. They kept some hogs before and still raise about 100 pigs annually, in addition to the poultry.

From timber on a back forty, Kubes cut enough logs to supply the framework for a two-story, 84 X 40-foot poultry house which he built in 1956. Total cost of the structure: less than $9,000. A first-rate set-up for a 25-cow dairy herd would have cost even more.

Although the Kubes' so far have only 2,500 hens, the building is designed to hold 1,500 laying hens on each floor at full capacity. Yet, Leonard says "I figure these hens are making as much profit as would 25 or more milk cows."

Only an intensive feeding program and careful egg quality control make such an income possible for the Kubes family.

The building itself features dropping pits in the center of the laying floors, feed storage on the top floor for easy handling, roll-away nests, automatic waterers and built-up litter on floors that need only one cleaning per year.

The laying hens get an all-mash ration, made up from home-grown corn and oats and a commercial supplement.

In a "sub-basement" area of the building, Kubes has an egg-processing and storage room. Here, he has an automatic egg washer in which he cleans the eggs after gathering--three times a day. After washing, the eggs go into the storage compartment where they are cooled to about 55 degrees.

A day or two after gathering, Kubes candles and grades the eggs, packs them in grocery cartons and stores them in the cooler again until hauling them to market. For following such intensive "quality control," Kubes usually receives a premium from the nearby store buying his eggs.

How do the Kubes' like their new style of farming? "Fine," they say. "While a poultry operation like this keeps us busy, we personally like the schedule better than we did dairying. We've eliminated the early morning and late evening chores, and the manure-cleaning problem in winter."

Naturally, such a total change brings some other problems, but Kubes has a way to deal with

each. "Without dairy cows, the land doesn't get the benefit it used to from manure. Chickens manure is all right, but we have much less of it. Also, there's a big change in our crop rotation; chickens can't use forage crops."

To make up for the manure loss, Kubes is turning to heavier fertilizer rates. To help maintain soil organic matter, he plans to annually plow down several acres of alfalfa undersown in his oats. He figures that with a good fertilizer program, he can raise corn year after year on the same land--at least on the most level fields on the farm.

OIL PROTECTS EGG QUALITY

Farmers can market higher quality eggs by spraying them the day they're laid with "processing oil"--if enough oil is used.

A University of Minnesota poultry scientist, Milo Swanson, says that for best results, there should be 3-4 grams of oil used on every "filler flat" of eggs in the packing case. This, he said, is more important than how the oil is applied.

Applying 3-4 grams of oil would mean holding an aerosol bomb of oil over the flat for 3-4 seconds, Swanson says. With a hand sprayer, this would amount to a gallon of oil for about 95 cases (30-dozen) of eggs--just a few strokes for each flat.

Minnesota researchers compared hand sprayers, aerosol bombs and complete dipping for treating eggs with oil. They treated naturally clean eggs the day they were gathered.

Either the sprayer or the bomb--more practical for farmers than dipping--worked well when 3-4 grams of oil were put on each 30-dozen "filler-flat" of eggs. Eggs sprayed this way were still mostly grade A in quality after being stored 10 days at room temperature. When less oil was used, the eggs were correspondingly lower in quality. Unsprayed eggs averaged grade B after the same period.

Egg-processing oil holds the natural carbon dioxide in eggs for a longer time. This, in turn, helps keep the egg quality high longer. Egg processors have been using this oil for years, but only recently has it been tried as an on-the-farm practice.

LIMITED USE SEEN FOR EGG VENDING

Selling eggs through mechanical "vendors" may have some possibilities for Minnesota, but the practice is limited to sales in areas of large population.

William H. Dankers, extension marketing specialist at the University of Minnesota, points out that about 70 percent of all eggs produced here are sold in some other state. And of the 30 percent marketed in Minnesota, only part could conceivably be sold through mechanical vendors.

Dankers says a vending machine must be easily accessible to purchasers. Good possible locations are housing areas, factory lobbies, office buildings, roadside markets, and near roadside restaurants and gas stations. If the vendor is located in an outside area, there must be plenty of room for customers to park nearby.

One eastern U.S. study showed that 60 dozen eggs (two cases) had to be sold daily in order to make the vending machine pay. Another study indicated that sales needed to be twice that great to make it worthwhile.

Although the results differ, Dankers says the studies make it evident that vending machines are profitable only when the volume is fairly large and steady; where the machine is located can make or break the seller.

CHILLING DOES NOT IMPROVE CHICKEN FLAVOR

Poultry processors can't improve the natural flavor or juiciness of chicken or turkey by chilling the dressed birds is ice slush.

But proper cooling can help keep the meat from drying out, according to G. W. Froning, and M. H. Swanson, University of Minnesota poultry researchers.

Froning and Swanson, conducted "taste panel" studies involving chicken broilers which had been chilled by a variety of different methods. In general, he found, the method of chilling had no effect on flavor.

Many poultry processors chill chicken broilers in ice slush for 3-4 hours after dressing the carcasses. Turkeys are often chilled 24 hours. Many people have wondered whether this wouldn't make the birds juicier and more appetizing.

The Minnesota experiments showed that chilling in ice slush would increase moisture content. But much of this moisture was lost in thawing and cooking. Besides, high moisture didn't necessarily mean "more juicy" to people on the taste panels.

However, ice-slush cooling for the normal amount of time did have one advantage: birds cooled this way didn't seem to dry out as much as did air-cooled birds. But when birds were cooled in ice-slush for prolonged periods of time the flavor seemed to "leach out," Froning said.

FINDING MADE ON TURKEY HEMORRHAGE

An important research finding on a costly hemorrhage problem in turkeys was reported recently by the University of Minnesota.

P. E. Waibel, poultry researcher, and B. S. Pomeroy, veterinary scientist, have found a way to experimentally produce aortic rupture in growing turkeys.

This should make it possible to speed up studies on control and prevention of the condition. Before, it was extremely difficult to study because scientists were unable to produce it in the laboratory.

Waibel and Pomeroy produced aortic rupture in turkeys 10-15 weeks of age by feeding a chemical called beta aminopropionitrile (BAPN). The resulting hemorrhage was indistinguishable from that seen in field conditions, they say.

Recent research at the University of Wisconsin showed that BAPN produced similar hemorrhages in turkeys just a few weeks old. The Minnesota tests, however, were the first to be conducted on older birds.

Aortic rupture occurs when one of the large blood vessels near the kidneys breaks. The resulting hemorrhage always kills the bird. This problem has hit many turkey flocks in Minnesota during recent years, often causing heavy losses.

Cause of the condition in actual flocks isn't known, but the scientists say their newly-discovered research technique should help yield some important clues.

EFFECT OF UNKNOWN FACTORS MAY VARY

Poultry scientists have found that whether "unknown growth factors" are any help to growing turkeys may depend on whether the birds hatch from eggs laid early or late in the hatching season.

Paul E. Waibel, University of Minnesota poultry nutritionist, learned that unknown growth factors added to a corn-soybean diet made little growth difference in poults from eggs laid 2 to 4 weeks after hens started production. But for poults from eggs laid 10-14 weeks after laying started, the unknown factors boosted growth by 12 percent.

Waibel supplied the "unknown growth factors" by adding 6 percent fish meal, 3 percent alfalfa meal, 3 percent distillers dried solubles and 2 percent dried whey to the ration.

Scientists have been studying these factors in certain poultry feeds for several years. Although still literally "unknown," these factors play an important role in poultry nutrition.

Also compared were the effects of grass juice --which contains growth factors--and Aureomycin in rations. Only the antibiotic increased growth in earlyseason birds, but both made increases in late-season trials. The difference could be due to a "depletion" of unknown factors as the hatching season moves on, Waibel says. It's possible that the longer turkey hens lay, the less of the factors they pass on to their young.

Another explanation, Waibel adds, might be differences in environmental "stress" for early and late-hatched birds. Early in the season, the brooding facilities are likely to be less contaminated with "sub-clinical," or unnoticed, infections. Later on, with birds continuously occupying the brooding room, contamination may build up to a point where unknown factors reduce the subclinical infection and result in increased growth.

MINNESOTA STANDARD SYSTEM STILL LOOKS GOOD FOR TURKEYS

The well-known "Minnesota Standard" and restricted feeding systems for turkeys continue to show up well in University of Minnesota research.

Both programs recently resulted in higher profits at the Northwest Experiment station, Crookston, than did "complete" rations in either pellet or meal form.

The tests also showed that:

1. It pays to fortify the standard 25-percent protein ration with methionine, a protein component in which the ration ordinarily is a little deficient.

2. Surprisingly enough, a complete ration in meal form produced slightly faster growth than the same feed in pellets. The opposite had been expected. However, pellets resulted in less feed wastage and therefore lower feed ingredient cost per pound of turkey produced than meal.

This research is reported by Elton Johnson, head of the poultry department; Paul Waibel, poultry nutritionist; and A. M. Pilkey, poultry husbandman at the Crookston station.

The standard system involves corn and oats fed free-choice, along with a 25-percent protein supplement, fortified with vitamins and trace elements.

Complete feeds have the supplement and grain all mixed together, either in meal or pelleted form.

Also compared in the trials were daily and twice-weekly feed restriction after the birds were 8 weeks old. This meant feeding corn and oats free choice and feeding a 34-percent protein supplement, but restricting it to certain amounts, depending on the age of the birds. In some cases the mash was fed daily and on two days per week in other tests.

The researchers tried different systems on turkeys from hatch to 8 weeks and from 8-24 weeks, or market weight.

For the first 8 weeks, most efficient gains--2.33 pounds of feed per pound of poult, came from using the standard system with 0.1 percent methionine added. A 28-percent protein "starter," either in meal or crumble form, took more feed per pound of gain and resulted in a higher feed cost. The same was true for a prestarter and starter system.

For the 8-24 week period, the complete feeding systems brought greater gains but less profit than the standard or restricted systems. Total gain per bird was 16.7 pounds per bird for the 16-week period, both for the standard ration and for the daily restriction program.

Turkeys getting complete feed in meal averaged 17.5 pounds and birds on pellets gained 17.2 pounds in the same period. However, the complete feeds cost more and resulted in lower profits.

For the entire 24 weeks, Johnson, Waibel and Pilkey found that following a standard feeding system all the way through returned about $75 more above feed ingredient costs per 1,000 turkeys than did using a restrictd feeding system for the last 16 weeks. The standard system was $463 above a system involving complete feed in meal form for the last 16 weeks and about $301 greater than feeding complete feed in pellets after the turkeys were 8 weeks old.

The researchers raise a point of caution on these comparisons, however, since there were different ingredients in the rations studied. Therefore, the difference is not necessarily due to feeding system alone, and much more study is needed on the problem.

Rural Sociology ...

YOUNG PEOPLE LOW ON INTEREST IN COMMUNITY BUILDING

Minnesota's older adults need to give more attention to young people's organizations--if young adults are to make important contributions to the community.

A recent University of Minnesota survey shows young men and women have little enthusiasm for work such as organizations require to maintain organized older youth activities. But the study pointed up some definite possibilities for effective older youth organizations, if handled right. Young people are interested in many other activities.

The study was conducted by Marvin Taves, rural sociologist, and Robert Pinches, now assistant state 4-H Club leader at the University of Minnesota. They surveyed 271 Minnesota men and women, 18-30 years of age.

Each subgroup gave the highest rating to "Having a wholesome religious life." Study and discussion of "How to make money" was also put close to the top by most groups. Other activities rated high were: selection of clothing, citizenship, fixing up the house, improving personal grace and grooming, home entertaining, wise use of credit, first aid and study of improving family relationships.

Most subgroups gave low ratings to: membership drives and planning programs, square dancing, plays and skits, farm partnership organization and learning to do needle or fancy work.

There were some big differences from one group to another, though. Child care and training was rated high in interest by women and married men, but low by single men. Women gave high ratings to "Preparing meals on a small budget;" men rated it low. Younger groups were more interested in learning how to find good jobs than were older people.

Most single groups gave high ratings to "How to choose a life partner." And most men--but few women--were interested in discussions on getting started in business. Single town men rated photography high; other men rated it low.

Despite the lack of general interest in youth organization building, two things stood out: One was a high interest among younger married farm women in discussions on community organizations. Second, older married farm men showed high interest in discussions of "Foreign affairs and how they affect us." Most other groups showed only moderate interest in foreign affairs.

Taves says the differences in interests among the subgroups point up important needs in communities for special interest groups. Such groups must usually be drawn from the whole community, because no one young adult group--such as a church club--is likely to have enough highly interested persons for effective subgroups in all the possible fields of interest.

The study also emphasized the passing of once-sharp lines between farm and town people. Only 11 percent of all the people preferred groups made up mostly of farm folks. Another 11 percent wanted mostly town people, but 78 percent didn't care where the group members lived.

Low ratings given to many community building activities show a need to impress upon youth and young adults their duties to their community. The sociologists say that to encourage youth in this, it's particularly important to provide rewards. And young adults need to understand more clearly the contribution their participation can make to the community.

This, the sociologists say, might be done in two ways:

First, by channeling efforts of young adults in projects of obvious community value.

Second, by having older adult organizations recognize--publicly--the accomplishments and contributions of young adults.

YOUNG MEN HAVE HIGH FUTURE HOPES

Young men in outlying Minnesota have some high hopes for the future, but how many will realize their ambitions is still a question.

A recent survey of 739 high school graduates between 1948 and 1956 in northeastern and southwestern areas of the state shows that a minority has achieved its goal.

A third of the men in both areas are not only in a different occupation than they had hoped to enter, but are also in a lower occupational category than they originally chose. Another fifth have found employment in their chosen line of work but at a definitely lower level than they expected.

The study was conducted under direction of Marvin Taves, University of Minnesota rural sociologist. He points out that some of these young men may still enter their chosen fields, but for most this isn't likely.

However, the young men showed they haven't consciously changed their minds much in recent years on their aspirations. More than half hadn't changed their goals since leaving high school and a fourth had changed only once. When their reported preferences at graduation and later were compared, more had changed their mind.

Only 5 percent of the northeastern young men wanted a lifetime of farming, while farming was the choice for 21 percent in the higher income southwest. However, a fourth of the northeast men wanted skilled or semi-skilled vocations, compared to only 14 percent in the southwest.

Purpose of this study, according to Taves, is to determine "mobility" patterns of people in low and higher farm income counties, and to note the problems which moving geographically or vocationally make for the individual and his community. Such information is important for better vocational counselling and for groups planning rural development and other programs designed to increase general living satisfaction.

SURVEY SHOWS NORTHERN FARMERS ARE "STABLE" GROUP

As a whole, farmers in northern and northeastern Minnesota are not people who move around a lot.

Actually, a recent survey shows, they are quite stable. Four out of five have been in the same county for more than 10 years and three-fifths have been on the same farm for that long.

The survey involved 575 operators and wives in 13 counties and is reported by George Donohue, extension rural sociologist.

About 85 percent of the persons interviewed said they intended to stay in the area. The other 15 percent were going to move, but few wanted to go toward the Twin Cities; instead, most said they would go westward.

The rural sociologists found these people had a wealth of farming experience. About a fifth had been full-time farmers for their entire lives. Two-fifths were originally in some occupation other than agriculture, but were either full-time or part-time farmers when interviewed.

Despite the stability of the people, the survey underscored the fact that the 13 counties make up a low-income area, agriculturally speaking. Only 10 percent of the respondents had more than $7,000 gross income from farming and only 30 percent reported more than $4,000 gross. About 36 percent had between $1,000 and $3,000, and 11 percent--mostly part-time farmers--had less than $500 gross income from farming.

"Gross income" here means total returns from farming, before any expenses at all are paid.

SURVEY SHOWS ACCIDENT RATE IN ONE COUNTY

According to a recent survey, chances are one in six that someone in your family will be accidentally injured during the next 12 months.

Of 327 families in a southern Minnesota county, more than 16 percent said some member had been an accident victim in the past year.

George Donohue, extension rural sociologist at the University of Minnesota, reports preliminary results of the study.

Cuts and fractures together made up more than 40 percent of the injuries. Almost 14 percent of the mishaps required treatment or a recovery period.

Most accidents occurred among males. Husbands and sons each accounted for about a third of the cases, wives for 7.5 percent and daughters made up 13.4 percent of the victims.

Persons between 15 and 20 had 16.4 percent of all accidents, more than for any other age group. Next highest age groups, in order, were 5-10, 20-29 and 40-49 years old.

Recreation and driving each resulted in more than a fifth of all accidents, compared to 15 percent from field work and 6 percent from housework.

Four-fifths of the families kept poison out of children's reach, but only half had fire extinguishers and half had first aid kits. Hardly more than two-fifths had rails on all stairs.

FARMERS HAVE MIXED VIEWS ON PRICE SUPPORT PROGRAMS

Farmers in northern and northeastern Minnesota have mixed reactions toward farm price support programs, a University of Minnesota survey shows.

Almost half of 575 farmers interviewed favored rigid price supports and slightly less than a fourth preferred no price support program at all. About one-tenth favored flexible supports.

Slightly more than half said support programs have not helped them and about 42 percent thought supports have been beneficial.

And while 73 percent said supports haven't hurt them, about a fourth of these farmers felt they have been injured by price support policies.

Reporting on this study are George Donohue and Lowry Nelson, rural sociologists. In 1956, a survey team interviewed full-time and part-time farmers in two regions: the mining area and the "western" area of northern Minnesota.

For the entire 13-county area, 49.6 percent of the farmers favored rigid support programs, 23.4 percent wished for no program at all, 11 percent favored flexible supports and 16 percent preferred some modified form of support program.

There was a definite difference between the mining area and the western counties on attitudes toward support programs preferred, but there was no difference in these attitudes according to age of operator or whether he was a full-time or part-time farmer.

In the mining area, 55 percent favored rigid supports, 22 percent wanted some other type program, 16 percent wanted no supports and only 6.5 percent preferred flexible supports.

In the "western" counties, almost twice as high a proportion of farmers--13.4 percent--preferred flexible supports. Also, 46.6 percent preferred rigid supports, 11 percent wanted a different type support program and 27.5 favored no support program at all.

The higher a farmer's net worth, the survey showed, the more likely he is to favor flexible supports or no program at all. Of those with high assets above debts--$10,000 or more--only 42.2 percent desired a rigid support program.

In the "medium" assets group--$5,000 to $9,999--54 percent wanted rigid supports and 52.9 percent of the "low" assets group--under $5,000--preferred such a program.

Of the high income group, 17.4 percent preferred flexible supports, compared to 8.9 percent of the "medium net worth" group and 6.5 percent of the "low net worth" group.

More than half of all farmers questioned said the support program so far had not helped them in any way. Slightly less than 42 percent said the programs had helped them. And most of this 42 percent said the help was primarily in maintaining higher prices for their products.

When operators were asked if supports had hurt them in any way, 73.7 percent said "No."

School of Forestry ...

FORESTERS CONDUCT BASIC RESEARCH ON TREE GROWTH, USE

The lowly-regarded aspen or "popple" trees in northern Minnesota may someday have much higher prestige.

Scientists doing basic research in the University of Minnesota's School of Forestry are searching for fundamental facts that may provide the break-through needed to develop more uses for this tree.

There are vast areas of aspen in Minnesota. While it can be used for some types of lumber and pulp, it is generally a low-quality wood. There is not enough high quality aspen and still too little demand for low-quality aspen to make it very profitable for the timber owner.

One of the problems with aspen for pulpwood is that it has much colored wood, inferior for making high quality paper. Foresters are conducting basic studies on this colored wood to learn more about its chemical composition and whether new processes might be developed to utilize it in high quality paper.

Another preculiarity about the aspen is that it has much better quality in some areas of Minnesota than in others. Yet, why this is so has never been determined. Basic studies on environment and growth, now being conducted by University foresters, may give some of the answers.

Such are examples of basic research in forestry at the University. As in any field, the purpose of it is to give background information for "applied" research later on. Other basic studies in forestry include:

1. Effect of chemical on trees. Certain chemicals can be used to kill undesirable forms of brush and some can be used to make pulpwood and poles peel easier. Results from these chemicals aren't always the same, however. Basic researchers are studying what happens inside chemically-treated trees and brush, to learn how the chemicals move and how they affect the plants.

2. Lignin in wood. Wood contains a material called "lignin," which cements, or holds the wood fibers together. This substance is important in lumber, but it presents a problem in paper-making. In the most commonly-used pulping processes, lignin must be separated out and cast off as waste. Unfortunately, it reduces the oxygen content of water and may therefore be indirectly toxic to fish. Foresters are looking for basic clues that may help find better ways to dispose of or utilize this material.

3. Water movement. How water "infiltrates" the forest cover is a big question facing forest and soil conservationists. They need to know how fast water moves in forests compared to open fields and how this movement varies in different types of forests. Such basic information would be a big help in planning watershed management. Studies on this question are now underway in Minnesota.

4. Tree improvement. University foresters are collecting jackpine trees from around North America. The trees are used to find out how well different varieties are adapted to Minnesota and whether faster growing strains exist. Similar tests are being made on other trees, such as blue spruce and aspen.

5. Effect of tree thinning. While thinning forest stands is an "applied" practice, there are several basic aspects of it on which foresters need more information. For several years, they have been studying the effect of thinning on soil temperature, humus decomposition and changes in plants on the forest floor.

6. Tree flowering and pollination. Foresters are looking for basic reasons why certain trees won't cross in nature but can be crossed under different growing conditions. This type of study could eventually lead to production of better tree varieties.

BALSAM FIR AND SCOTCH PINE ARE POPULAR CHRISTMAS TREES

Twin Cities residents are most likely to have a medium-sized balsam fir tree in their living rooms at Christmas.

University of Minnesota foresters E. T. Sullivan, D. P. Duncan, R. L. Beazley and C. J. Shiue last December surveyed customers in two Christmas tree lots--one in Minneapolis and another in Hopkins.

Balsam fir was by far the most popular tree species at both lots. Fifty-nine percent preferred this species in Minneapolis and 43 percent in Hopkins. Next ranking species was Scotch pine, which was preferred by 23 percent of the suburban customers but only by 8 percent in the city.

Most people preferred medium height trees, but this preference varied from one lot to the other At the city market, 61 percent liked medium height trees and 28 percent wanted taller trees. At Hopkins, an overwhelming 86 percent picked the medium height and only 12 percent preferred trees taller than that.

Of 286 persons interviewed in Minneapolis, about 57 percent wanted a "flaring" taper--wide at the bottom. About 69 percent liked dense foliage.

However, these preferences varied with kind of tree. Forty-six percent of persons picking balsam fir selected normal taper, while only 37 percent of all patrons wanted normal taper. Of people who liked Norway pine, 86 percent wanted a flaring tree. Same thing held for people selecting white spruce. But persons picking black spruce leaned toward a "candlestick" taper.

Of customers picking flaring trees, 92 percent also wanted dense foliage. Only 9 percent of all customers wanted "sparse" foliage on their trees.

One result the foresters find hard to explain. Persons 30 or younger wanted medium-height trees,

while the tendency was for taller trees among older people. Why this relationship occurred hasn't been determined; there was no tie-up whatever among income, education or occupation and kind, size or shape of tree.

WINDBREAK BECOMES PROFIT "WINDFALL"

MORA--Christmas came a month early for John and Mrs. Bartelma.

It came in the form of a $700 check for 400 Christmas trees, cut in mid-November from a 3-acre stand of Norway pines planted "just as a windbreak" in 1952.

That's better than $230 per acre!

But wait, you say. There were five years when that land brought no income at all. All right, then, spread it out over 6 years. It still comes to some $116 per year, or about $39 per acre.

"That," John says, "is more than any other crop would bring on that sandy land."

Sound like a get-rich-quick scheme? Well, it isn't quite as simple as it sounds. But the Bartelmas have demonstrated one mighty good way to supplement farm income in an area where much of the soil doesn't bring high crop yields.

John Bartelma cuts one of his Norway pines for the Christmas tree market.

They have a 200-acre dairy farm just south of town. In operating this place, they've received a good deal of help over the years from county extension workers. They're also cooperators in the Kanabec County Soil Conservation District--a fact which led to their tree business.

Jerry Sullivan, SCS farm planner, seven years ago suggested to John that he set out a shelterbelt of trees to the north and west of the buildings. Seemed reasonable enough; the land was not the best, but a soil survey showed at least two acres there were ideal for trees.

So in spring, 1952, Bartelma planted 2,000 trees--mostly Norway pine, but with some white pine and spruce thrown in, too. On the better land, the trees made phenomenal growth. By this fall, many were 8-10 feet tall.

Up to a few months ago, the Bartelmas still thought of their trees as little more than protection against the wind. "We did think maybe we could sell enough Christmas trees locally for $50 or $75 'Christmas money,'" Mrs. Bartelma says. "But we didn't expect much more."

Then one day County Agent Roland Skelton and Parker Anderson, extension forester from the University of Minnesota, called on John to talk over tree planting and pruning. John asked them: Is there a good market for Norway pines as Christmas trees? Parker assured him there was and gave John a list of potential buyers.

Bartelma soon contacted a tree salesman who picked 400 of the best trees in the area--for $1.75 each. "We had other offers for them, too," he adds.

What does it take to grow good Christmas trees? "Well, first, I think, is ground preparation," according to Bartelma. "I disked, plowed and disked the ground again before planting in 1952. Then we planted the trees every 7 feet in rows 9 feet apart.

"Most important," he adds, "is pruning when the trees are growing. We found it out at selling time. A poorly-shaped tree just won't sell.

"We were fortunate, because many of our trees were just naturally shaped well. But some aren't and they need to be pruned for several years before they're marketed."

Of the remaining trees, some will be sold as Christmas trees in future years, and some will be left to grow into pulpwood and logs. The 5 rows nearest the buildings will be kept as a permanent farmstead shelterbelt.

After their success with their first 3 acres, the Bartelmas are naturally going to raise more trees. "But we aren't going into it wildly," John adds. "Parker Anderson says about 2,000 new trees a year is all one person can handle well. We have 40 acres of good Norway pine land, which we hope to eventually have in trees."

WOOD CHIPS CAN BE USED AS BEDDING

If changing crop patterns ever result in a shortage of straw for bedding, farmers can no doubt turn to wood chips for keeping their livestock comfy.

But pound for pound, it will take at least twice as much chips bedding as straw to do the same job, University of Minnesota foresters have learned.

They recently found it takes about 2 pounds of red pine, aspen or jack pine chips or 3 pounds of birch chips to absorb as much liquid as a pound of straw. However, the chips absorbed as much liquid as did ground corncobs, sawdust or shavings.

Threshed straw, combined straw and corn stalks were all about the same in moisture-absorption ability, and ranked above all other materials tested.

With more and more acreage given over to row crops, there is a trend toward less grain in many areas in Minnesota. More farmers are combining grain and leaving straw in the field. Corn stalks are usually plowed under nowadays. These changes could cause a future bedding shortage.

This is where chips bedding comes in. Chips have already been used by eastern farmers and, in Minnesota, could furnish one more use for low quality trees, such as aspen.

Ability to absorb moisture is a critical feature for bedding. First, this kepts livestock dry and more comfortable. Second, more than half the nitrogen and three-fourths of the phosphate in cattle manure is in the liquid portion, which must be soaked up by the bedding if it is to be saved for spreading in the field.

TREATED POSTS LAST LONGER

A simple treatment that costs just 25 cents per post can double or even triple the "fence life" on your farm.

Besides, the treating cuts the average yearly cost and means less bother every spring with rotted and broken posts.

Marvin Smith, extension forester at the University of Minnesota, figures it this way: By the time you cut, peel, set and tamp a home-cut red oak post, that post will have cost about 65 cents--including value of the wood, labor, and everything.

Without treatment, this post will last 5 years on the average and cost will be 13 cents per year. Treating it would cost a quarter or more and boost total cost of the post to 90 cents, but extend the life to about 20 years. The cost then, is less than 5 cents per year and there is still the economy of not having to set new posts every 5 years or so.

Smith recommends the "cold-soak" treatment in 5 percent "Penta" solution for on-the-farm use. Use a tank big enough for several posts at a time. Simply submerge the post in the solution for 48 hours and the job is done.

The penta treatment works well on jack and red pine, and red oak and can also be used though less effectively for tamarack, northern white cedar, ash, and white oak. It's least effective on basswood, maple, elm and white birch, but they can be used if these are the only trees you have around.

NEW DEVELOPMENT IN USE OF ASPEN IS REVEALED

A system for making better use of aspen lumber in packing crates is being tested by forestry researchers at the University of Minnesota.

Foresters Walter B. Wallin and Donald M. Markstrom are working out a method for selecting aspen "members" for crates according to the exact strength required for a certain load. Since it means more efficient use of aspen, this method could eventually mean more use of this tree species.

Aspen is generally considered a low-quality, surplus tree in Minnesota. Packing and crating accounts for about 90 percent of the aspen lumber manufactured and for more than a fifth of all aspen use in the state.

In the past, manufacturers have selected aspen lumber for crating mostly according to experience. This often results in either heavier crating than is needed--and unnecessary expense--or undersized crate members which might break during shipment.

The new system would tell the crate builder just how big each member must be. If a manufacturer wishes to ship a 400-pound refrigerator, for example, the system would tell him to use aspen members $2\frac{1}{2}$ inches wide and 5/8 inch thick, for the base of the crate.

At present, the aspen grading system is based on "green strength" of the lumber. If it proves itself after thorough field testing, the system may be applied as well to other species. One crate manufacturer is already using it.

FORESTRY PROGRAM AIDS FARMERS

GRAND RAPIDS--Despite his popularity in north country folklore, Paul Bunyan's way of "putting the axe" to vast stretches of timberland is rapidly being discarded in northern Minnesota's Itasca county.

Instead of cutting sections of forests wholesale, hundreds of farmers here are giving their trees as much care as they would their finest cropland.

As a reward, they are finding that what they once thought of as almost "worthless" trees are now a steadily growing source of income.

One of the big reasons behind this better use of woodland is the Itasca county extension forestry program, led by Floyd Colburn, county forestry agent, and one of the first agents of this type anywhere in the U. S.

Since he came to the county in 1946, Colburn has:

* Helped about 150 farmers in the county draw up complete, long-range woodlot management plans.
* Aided more than 1,000 local farmers in cruising woodlots, planning cuttings, finding markets and carrying out reforestation projects.
* Visited about 200 local farms every year for individual consultation or advice on tree farming--at the request of the farmers.
* Promoted forest management to the point where about a third of Itasca farmers who own sizeable woodlands follow recommended forestry practices.
* Started an extension tree planting program in which more than a million trees have been planted.
* Acquainted local farmers with the different market possibilities for forest products.
* Helped dozens of Itasca county youngsters get started in 4-H forestry work.

Such improvement cuts alone, sold as poles and piling timbers, have brought about $1,500 to Lampi during the past 5 years. Add the $7,800 lumber income and the total is $9,300 that Lampi has received from his woods over the years.

While Colburn is helping local farmers carefully harvest their present forest growth, he is also helping them build for the future through a tree planting program. The Blandin paper company, Grand Rapids, became so interested in county reforestation that 4 years ago they gave the county extension office two tree planters, to be used by any local farmer wanting them, under Colburn's general supervision. Then two years ago, the First National Bank of Grand Rapids provided a third planter to be used the same way.

Farmers planting trees use these planters free, except for a small maintenance charge. The farmer has to pay only for the tractor driver--who usually does the work for a penny a tree--and, of course, furnishes a man or two to work on the planter.

Under this program, Itasca county farmers have planted 1,090,000 trees on some 900 acres since 1949, are now averaging about 300,000 per year.

ASPEN HAVE VALUE FOR FARM BUILDING

Those aspen, or "popple" trees, on your back forty are really a hidden dollar supply.

Parker Anderson, extension forester at the University of Minnesota says home-grown aspen can save you a lot of money in building construction and improvement around the farm.

Aspen is actually becoming popular for lumber. If piled and air-seasoned, it can be used for many desirable building purposes. Saw it in winter, properly pile it, and you can use it for building the following summer or fall. Good piling is necessary to prevent warping and twisting.

Anderson says that for beams, joists and rafters, aspen is equal to white pine lumber. While it isn't durable, aspen does hold paint well.

You can use aspen lumber for girders, girder posts, studding, rafters, sheeting and roof boards, sub-floors and flooring, interior finish or as drop siding for exteriors.

Here's an important point to keep in mind with aspen, though: Since it isn't durable, it shouldn't be used without preservative treatment in places where it is subject to decay.

Also, for sills, it's better to use a white oak, northern burr oak, northern white cedar or other more durable woods.

WOOD TREATMENT IS "INSURANCE"

Chemical preservative treatment is like an insurance policy for wood fence posts and wood for farm buildings.

Forestry research workers at the University of Minnesota, say that wood treatment calls for just one "premium payment." And it pays good dividends.

For example, a 60 x 120 foot barn has about 1,000 board feet of lumber in the sill. On the average, this sill must be replaced once in the life of the building, and the replacement costs several hundred dollars in labor and material.

If the bottom of the siding or bottom of the studding also starts to decay, the sill replacement is even more costly. At present rates, though, you can treat this sill for $20 or $30 and it would never need to be replaced during the life of the structure.

In animal housing structures, preservative treatment can avoid costly decay in other critical parts of the building, too. These places include plates, rafters and even roof boards. Decayed pieces may break apart and result in damage or even loss of the entire building. Using preservative-treated wood can prevent this damage.

The story is similar with fence posts. An untreated wood post, by the time it is in the ground, costs about 65 cents and will last around 8 years. That's an annual cost of about 8 cents for each post in the fence.

A well-treated wood post costs about 20 cents more, giving a total cost of 85 cents. But this post can give 30 or more years' service, leaving an annual cost of only about 3 cents per post.

This means that 20 cents worth of wood preservatives on one post can save $1.50 over the 30-year period. In a fence with 100 posts, you would save $150 by using treated posts.

RED PINE MAKES MOST GROWTH ON LEVEL SITES

Red pine trees make more annual growth in height on level sites, such as upland or terraces, than they do on slopes.

Forestry researchers at the University of Minnesota, make this conclusion after recent studies in six southeastern Minnesota counties.

They studied plantations set out by the Civilian Conservation corps between 1935 and 1942 and measured height growth during the last seven years.

The studies also showed a tendency for more red pine height growth on upland and upper slope locations than on bottomland or lower slopes. And there was more annual height growth on soils having high silt and clay content than on soil with lower silt and clay contents. All soils studied were somewhat sandy in texture.

CHEMICAL SPRAYS INCREASE "BROWSE" FOR DEER

A chemical widely used by farmers for battling weeds may turn benefactor for deer in Minnesota's vast north country.

Scientists have found that 2,4-D sprayed on mountain maple will stimulate close-to-the-ground regrowth. This makes ideal "browse" for deer to munch on during subsequent winters.

Mountain maple is a common shrub in many areas of northern Minnesota.

So promising is the spraying method that the scientists say it could provide the best solution yet for deer feeding problems wherever the mountain maple grows.

Reporting this research are L. W. Krefting, biologist for the U. S. Fish and Wildlife Service and H. L. Hansen, University of Minnesota forestry researcher.

It's been common knowledge for years that the whitetails like mountain maple. The trouble is, however, that when the shrub matures the leaves are too high for even the tallest buck to reach.

The obvious way to solve the problem is to get the shrub to produce new "shoots" or "suckers" at the base of the stump, or directly from the roots. Foresters learned 20 years ago that it is possible to stimulate this shoot regrowth by top-killing the mountain maple. Until recently, though, there was no cheap way to do this. Cutting wouldn't be feasible for a large area.

In woodland experiments in northern Minnesota, the scientists tried spraying the topgrowth of mountain maple with 2, 4-D and 2, 4, 5-T--two chemical herbicides. They also compared chemical treatment with burning and cutting but found that 2, 4-D alone did the job best at least cost.

Spraying with 2, 4-D at breast height in spring tripled the amount of regrowth, compared to untreated mountain maple. Checks the following winter even showed that deer liked the shoots from chemically-treated trees.

It took a concentration of 12 pounds of actual 2, 4-D in a hundred gallons of oil to do the job effectively. The scientists sprayed from the ground, but see no reason why aerial spraying might not be practical in large areas.

"ZIG-ZAG" FENCE PROVEN AT ROSEMOUNT STATION

A "quick-up and quick-down" woven wire fence--just the thing for temporarily confining pigs, lambs, calves or chickens--has proven itself after 8 years of tests at the University of Minnesota Rosemount Agricultural Experiment Station.

This fence is non-electric and is built in a "zig-zag" pattern. As far as construction is concerned, it's the last word in ease and simplicity. It requires no fence stretcher, no special tools other than a hand-type post driver, and only two diagonal braces, one on either end.

The slack in the wire is taken up by line posts, each of which lean sideways in the direction opposite to the preceding and succeeding posts. This gives the fence its "zig-zag" appearance.

John Neetzel, University forestry and fencing researcher, says the novel fence was first tried in 1950 for separating different groups of experimental animals. But the idea worked out so well he feels many farmers could put it to use.

Here's how to build it: Roll out the necessary amount of wire between two sunken wooden posts, one at each end of the stretch being fenced in.

Attach a "two-by-six" piece of lumber to each end of the woven wire and tie this member to an end post with galvanized wire. Then, starting at one end, drive steel posts at an angle against the woven wire, putting each one on the opposite side of the wire and leaning it in the opposite direction of the one before. Each post helps tighten the wire, until, when you drive the last one, all the slack should be taken up.

Neetzel recommends steel posts with small "humps" on the wire side to keep the wire from moving up or down. Space the posts about 15 feet apart.

A stretch of "zig-zag" fence at the Rosemount Experiment station.

It shouldn't take two men more than 30 minutes to roll out the wire, tie the ends and drive line posts for a 20-rod stretch of zig-zag fence, according to Neetzel. And when the fence is taken down, you can leave the two-by-sixes attached, roll up the wire, and use for another zig-zag enclosure later on.

SHELTERBELT CAN BE PLANTED IN DIFFERENT WAYS

The "snow-trap" idea often used in farmstead shelterbelts really isn't necessary, as far as keeping snow drifts away from the buildings is concerned.

Four years of shelterbelt tests on exposed sites at the University of Minnesota's Rosemount Agricultural Experiment Station have shown this to be the case.

Donald P. Duncan, forestry researcher, compared three different shelterbelt arrangements.

In one, there were two rows of shrubs 50 feet out from the main part of the shelterbelt, which contained nine rows of trees. This is the "snow trap" often recommended for shelterbelts in the past. The idea is that much of the snow will drop in the 50 feet of open space between the shrubs and the main shelterbelt, with less snow blowing over toward the buildings.

In another shelterbelt, the outer shrubs were 25 feet from the main band of trees and the spacing was just 10 feet in a third.

Duncan found that in the winters of 1955, '56, '57 and '58, the drifts on the farm building side of the shelterbelt varied from about 6 to 24 inches in maximum depth. But the distance between that outer shrub row and the main belt made little or no difference.

Here's what did happen, though: Where the "snow trap" was used, a lot of snow piled up in the 50-foot or 25-foot open space. Where the outer

shrubs were in close, more snow dropped on the trees in the main shelterbelt. This could mean extra moisture for the trees and better tree growth.

The foresters found no limb breakage in this planting.

Still, there is an advantage to the "snow trap," Duncan says. Trapping more snow in the 50-foot open area puts more moisture there. This could be a big help in a dry year, if the strip is used as a garden.

OLD RED PINE SEED GROWS IN RESEARCH

Red pine seeds 29 years old recently produced some healthy seedlings at the University of Minnesota's School of Forestry.

And as far as the foresters know, this is the first evidence that red pine seed would germinate so long after it was produced.

According to Knud E. Clausen, University forester, this finding can be a big help in forest tree improvement.

One of the problems with red pine is that it has a good seed crop only once in three to seven years. This means seed must be stored over a long period of time, to maintain a supply for reforestation. It now seems certain that such long-time storage is possible.

In making this study, Clausen and Rudolf used red pine seed collected in 1928, and sealed since then in glass bottles. In March, 1958, they sowed 4,800 of these seeds in steam-sterilized sand. Some of the seed was kept in a fruit cellar, some in a coldroom and the rest in a seedhouse attic.

A little more than 4 percent of all the seed started growing. Best germination of all--29 percent--was in the cellar, where the seed had been stored at 6.5 percent moisture. Poorest germination was in the attic.

FARMER LOWERS BUILDING COSTS WITH HOME LUMBER

MORA--A farmer can often find the answer to high building costs right in his back forty.

Roy Tokle, dairy farmer northeast of here in Kanabec county, last winter cut 10,000 board feet of good lumber out of a swamp "wasteland"--enough to make his barn 40 feet longer this winter.

"That lumber would have cost about $75 or $80 per thousand board feet at going prices," Tokle says. "But after paying all the sawing costs and figuring $10 per thousand for my labor, it cost me just about $40 per thousand."

Tokle cut the lumber from a swamp area adjoining his own farm, but owned by his mother. As far as he knows, it was the first time anyone ever made use of the timber in there. In warm weather, the ground is so soft it's nearly impenetrable, but by doing the cutting after the freeze-up, Tokle found this was no problem.

About a third of the lumber was aspen, which will be used as boards. The rest is for "dimension" lumber--beams, studs and plates.

There's been some careful planning behind this barn expansion. When Roy and Mrs. Tokle moved on the place three years ago, there were stanchions for only 15 cows in the main part of the barn. There was an open lean-to on one side which had been used for beef cattle.

Roy wanted a bigger dairy operation, and that called for some remodeling. But he had a question: Should he tear out all the stalls and use both the barn and lean-to floor area as a "loose housing setup?" Or should he expand the barn and make room for more stalls?

He put the question to Roland Skelton, Kanabec county agent, and D. W. Bates, University of Minnesota extension agricultural engineer. They suggested expanding the barn and putting in more stanchions. In this case, they said, stanchions would be better than loose housing.

Roy Tokle, right, shows Kanabec county agent Roland Skelton some of his home-grown aspen lumber.

Already, Tokle has remodeled the 24 x 40-foot lean-to. He put in 10 stanchions, a cement floor and drinking cups, and built a completely new wall around the section. Total cost for this project was only $400.

Eventually, though, Tokle will take the stanchions out of the lean-to and use it entirely for calves and heifers. The new addition will make this possible; he will have 35 stanchions in the main part of the barn, a feed room and a milkhouse equipped to meet grade A requirements.

Tokle already is milking 30 or more cows. He bought this herd when he came on the farm, and already it's producing 327 pounds of butterfat per cow--75 pounds above state average.

Soils . . .

"LIFE OF THE SOIL" IS SUBJECT OF BASIC RESEARCH

Soil is definitely not a lifeless substance, soils scientists will tell you.

On the contrary, it contains billions of microscopic organisms that are essential to crop growth. In fact, there is often as much live plant tissue in these organisms beneath the soil surface as there is in the crop above.

This "life of the soil" is the focal point of intensive basic research in the soils department of the University of Minnesota. W. P. Martin, head of the department, points out there are many things about this mysterious subterranean realm that scientists still need to know. The information they seek could help farmers make more efficient use of their cropland and fertilizer.

Soils scientists have known for a long time that tiny bacteria, fungi and other organisms transform nitrogen in fertilizer and decayed plants into forms that growing plants can use. But many of the details of the relationships between nitrogen and microorganisms are obscure.

The scientists are studying, for example, the exact nature of organisms that cause this transformation. They are attempting to find out what is produced, in addition to available nitrogen, in the process. They hope to learn how different types of soil and soil conditions affect activity of these organisms, the availability of nitrogen produced and effect on crop production.

Already, soils scientists have identified a new fungus involved in this change, which was once thought due to bacteria alone. They have also found that by increasing soil acidity to meet demands of certain organisms, it's possible to influence decay of cellulose, the main component of fresh organic matter in soils. This finding could eventually have extreme importance to farmers in planning crop management. Other basic projects in soils research include:

1. Radioactive tracers. University soils researchers were among the first in the nation to use radioactive isotopes to "tag" fertilizers. This way, they can use a Geiger counter to trace the movement of fertilizer in soil and in plants themselves. This helps them learn, for example, how absorption varies with type of phosphorus fertilizer, location of the fertilizer in soil and other factors. This technique has already shown that different corn hybrids vary in their ability to absorb phosphate fertilizer.

2. Iron-deficiency chlorosis. This is a problem in many crops in Minnesota. It occurs in alkaline soils when the iron in the soil is in a chemical form that plants can't use. Without iron plants cannot produce chlorophyll, the substance which makes plants green. This causes them to turn yellow, or become "chlorotic," and go down in yield. Basic research at the University has already shown that the problem can be corrected with "chelates" -- compounds which hold iron in a form plants can use. So far, however, cost of the treatment has been too high to be feasible for most farmers.

3. Physical soil characteristics. This includes studies on how soil water, aeration, soil temperature and arrangement of soil particles affect soil drainage and plant growth. Scientists in this project are also studying the effects of different kinds of organic matter on soil structure, and what differences they make in plant growth and soil erosion. These findings may have an important effect on soil management practices. For example, field tests already show that farmers in many areas can get as good or better crop yields by tilling the soil less.

4. Origin of soil. These are basic studies on soil formation; on why soils vary from one place to another. The scientists say in general, soils vary according to "parent" material from which soil was formed, vegetative cover on the area in past years, kind of micro-organisms in the soil, climate and the length of time during which the soil has been developing. There are eight "great" soils groups in Minnesota, which are made up of 27 major "soil associations," which in turn are divided into about 300 different soil types.

LIQUID FERTILIZER CAN EQUAL SOLID FORM

Liquid mixed fertilizer can produce at least as high corn yield increases as will fertilizer in dry form.

Robert C. Anderson, University soils researcher, compared both solid and liquid "starter" fertilizer on corn raised on three different soil types in west central Minnesota. In each case, the corn getting liquid fertilizer yielded 2-4 bushels per acre more than that getting solid form.

Anderson had applied both forms of starter fertilizer at the rate of 12 pounds nitrogen, 36 pounds phosphate and 18 pounds potash per acre.

Since these are only one year's results, such a small difference can't be considered important. But the tests do show the possibilities in liquid fertilizer.

In the last four years use of liquid fertilizer has grown from nothing to about 5 percent of all fertilizers applied in the state. Last summer, farmers used around 20,000 tons of liquids, out of a total use of 443,000 tons.

Liquid fertilizers have both good and bad points, according to Anderson. On the favorable side, they help speed up the corn planting operation. The liquid is handled by pumps, meaning there are no sacks to lift. There is little or no plugging in the equipment as often happens with dry fertilizers.

Biggest disadvantage of liquids is that it takes special equipment to handle them. Also, up to now, liquid mixtures have been limited in the amount of

total plant food they contain, but that may be changed in the future, Anderson says.

Robert Anderson, assistant county agent in Kandiyohi county in summer, 1958, and later soils researcher at the University, at left checks the fertilizer level in one part of the research machine used in the dry vs. liquid tests.

EXTRA DOSES OF ORGANIC MATTER SOMETIMES HELP

Does it pay to add extra organic matter to the soil?

A recent University of Minnesota experiment on that question brought these results:

Extra organic matter--wood chips and straw, both used first as bedding--each increased potato yields, but only during the year applied. And where the organic matter did help, the benefit was greater when extra nitrogen was also added.

These studies were conducted by Nils Grimsbo, research worker at the North Central Experiment station, Grand Rapids, in cooperation with A. C. Caldwell, University soils scientist.

The researchers applied straw bedding, wood chip bedding, and "untreated" chips (not used as bedding) to research plots in 1956. The two bedding treatments that year increased potato yields by 31 and 25 percent respectively. Adding 60 pounds per acre of nitrogen fertilizer made the increases even higher.

Last summer, however, the organic matter which had been applied in 1956 made no difference in yields of any of the crops--potatoes, hay or oats. Also, even during the first year, there was no consistent benefit in hay and oats and untreated chips were no help in any of the trials.

PRACTICAL CURE FOR "CHLOROSIS" NOT YET FOUND

There's a way to cure the iron-deficiency "chlorosis" problem in soybeans and other crops, but the treatment still isn't economically practical.

R. G. Burau, soils research worker at the University of Minnesota, found that adding iron in "chelate" form will correct the chlorosis condition. However, the treatment cost around $20 per acre--much too high to be feasible.

Chlorosis is a condition which occurs in soybeans and some other crops growing on high-lime soils. The lime ties up the iron that normally is present in the soil, and keeps this iron in a form that plants can't use. As a result, the plants turn yellow and may go down in yield or even die.

This condition is most bothersome in western and northwestern Minnesota. Soils men figure that soybean yields are often reduced by two or three bushels or more per acre as a result of chlorosis.

Chelates (pronounced key'-lates) are compounds which hold in a form available to plants. Burau and J. M. MacGregor, soils scientist, in two years of tests found that applying a pound of chelated iron per acre would correct the yellowing from chlorosis and therefore prevent the yield loss.

There is a chance, of doing the job with lower rates of certain chelates, Burau said. Future research will be conducted to see if that's possible.

In recent basic research, Burau found that in addition to lime content, manganese and soil moisture also may have something to do with the chlorosis problem. More yellowing occurred when the plants contained a high proportion of manganese in relation to the iron content. This has also been found true in other states, according to Burau. Some scientists, he adds, feel there may possibly be a toxic effect from the manganese: when the manganese-iron ratio reaches a certain point, something may happen to make the iron less available to plants.

SOIL TESTS SHOW PLANT FOOD NEED

More than half of Minnesota's fields need more plant food than they're getting. That conclusion comes from John Grava, soils worker in charge of the soils testing laboratory at the University of Minnesota.

For example, recent test samples from the Clarion-Nicollet-Webster soil area in southern counties show that about 60 percent of these soils need more phosphorous.

Also, 56 percent of the fields there could use more fertilizer containing potassium. This is despite the fact that these soils are often thought to be high in this nutrient.

In the same area, about a third of the soils need some lime.

Summaries from other areas show that more than 75 percent of the soils in a dozen West Central counties are low in phosphorous. And in the area north of the Twin Cities and in the extreme Northeast, 90 percent of the samples have been low in potassium.

FERTILIZER BRINGS HIGH SOYBEAN YIELDS

Four dollars' worth of phosphate fertilizer can boost net profit from soybeans by as much as $12 per acre in west central Minnesota.

A. C. Caldwell, University of Minnesota soils scientist, found this true in experiments at the West Central Experiment Station, Morris.

This gain from fertilizing was possible despite high yields where no fertilizer was used. Soybeans without fertilizer yielded 36 bushels per acre, adding 40 pounds phosphate per acre 7.3 bushel increase.

The phosphate fertilizer cost about $4 and the 7.3 extra bushels of soybeans were worth almost $16. This left an increased net return of $12 per acre.

These tests were conducted in cooperation with Roy Thompson, station agronomist.

Similar experiments showed phosphate was also the most important nutrient needed for alfalfa in this region, according to Caldwell. Eighty pounds of phosphate per acre boosted first cutting alfalfa yields last year by .72 tons per acre. Adding either nitrogen or potash alone to alfalfa actually reduced yields in this area.

LONG-TIME STANDS ARE POSSIBLE IN ALFALFA

If necessary to control erosion, many Minnesota farmers can keep fields in alfalfa for 6 or 7 years and still get good, high-quality forage yields.

University of Minnesota researchers have done it at the Rosemount Agricultural Experiment station. These long-time establishments called for plenty of phosphate and potash fertilizer, but extra nitrogen didn't pay.

According to J. M. MacGregor, University soils scientist, these fields were seeded in 1950. The researchers tried 30 different fertilizer treatments.

Most successful--and practical--was 300 pounds of 0-20-20 applied the spring before seeding, with annual spring applications of 200 pounds of the same fertilizer from then on. Plots fertilized this way averaged 4.7 tons forage per acre annually, for 7 years.

Boosting the initial fertilizer rate to 1,000 pounds brought no higher yields than did the 300-pound rate. Using nitrogen and trace elements in addition was no extra help, either.

Whether the fertilizer was applied in spring or in fall made little difference. But using a heavy initial fertilizer rate--1,000 pounds--and then applying 200 pounds every other year brought lower yields and profits than did a 300-pound rate followed by annual topdressing.

CONTINUOUS CORN FEASIBLE IN MINNESOTA

Corn raised 5 or 10 consecutive years on the same field--that's possible in many areas in Minnesota.

W. P. Martin, head of the University of Minnesota soils department, says, "continuous" corn raising, as the practice is called, can be a big help to farmers shifting to more intensive livestock production. But it must be limited to low, level fields where there is little erosion danger, he adds.

Some research plots at the Rosemount Experiment Station, have raised nothing but corn since 1953. Yields, have been as high as 133 bushels per acre.

Continuous corn has been a major question in Minnesota recently. Farmers keeping greater livestock numbers often need more corn than they get from normal crop rotations--those with several years of legumes.

One objection to continuous corn is that it doesn't keep up soil organic matter. But Martin says that with heavy fertilizing, corn stalks can supply nearly as much organic matter as will legumes. Continuous corn, he says, calls for:

* Heavy fertilizer rates--up to 800 pounds of complete fertilizer per acre in the spring, a 200-pound treatment at planting time, and side-dressing.
* High corn plant population--18-20,000 plants per acre.
* Chemical weed control.
* Treatment with soil insecticides to prevent an insect build-up in the field.

Martin feels that crop rotations including several years of forages are still best on rolling land. But on level fields, a farmer can fit continuous corn raising in as an integral part of his overall farm plan.

WHEEL-TRACK PLANTING PROTECTS SOIL, FIGHTS WEEDS

OWATONNA--Wheel-track planting is a powerful antidote for soil erosion and weed problems in the corn field, a Steele county farmer has learned.

Marvin Meixner in 1957 found that corn planted by the wheel-track method yielded 70 bushesl per acre--five bushels more than where he planted it in the usual way.

There was less soil erosion in the wheel-track-planted corn and weeds didn't grow as well there.

Besides, Meixner found there is much less field work involved in wheel-track planting. This practice means hitching the planter so it plants in the wheel tracks of the tractor on undisked, but freshly-plowed land.

Meixner made the comparison on yellow clay soil. On one part of the field, he spring plowed disked the field, went over it with a spring tooth and dragged it. He then planted corn, dragged the field once more and cultivated the growing corn twice.

On the other part of the field, he spring plowed the land, planted the corn in the tractor wheel

tracks with no further field tilling and cultivated only once.

Why did wheel-track planting bring such good results? J. Russell Gute, Steele county agent, explains it this way: "The soil compaction caused by the tractor provides the only seedbed preparation necessary. This leaves the soil loose between the rows and provides a poor seedbed for weeds."

With regular seedbed preparation, weed seeds usually have two or three days head start on the corn, meaning the farmer must cultivate the corn when it is small. This cultivation, unless done very carefully, can kill many corn plants. But with wheel-track planting, corn and weed seeds in the row germinate at the same time, while weed seeds between the rows remain "dormant." That means the corn is usually 6-12 inches high before any cultivation is needed.

Also, the loose soil between the rows absorbs water readily. This helped Meixner reduce soil erosion.

RESEARCH SHOWS RESULTS OF SOIL COMPACTION

Crop yields can definitely be reduced when the surface soil is packed too much, research at the University of Minnesota has shown.

This is more evidence that many farmers could get yields as high or higher by practicing "minimum tillage"--working the soil less. That would mean eliminating much of the tillage with disks, drag harrows and other implements that often cause excess surface compaction.

George Blake, University soil physicist and Rollin Dennistoun, assistant superintendent at the Rosemount Agricultural Experiment station, compared corn yields on compacted and uncompacted soil in 1957. They compacted the plow layer with a specially built, $2\frac{1}{2}$-ton tractor wheel, and compacted surface soil with a truck loaded so there were about $3\frac{1}{2}$-tons of weight on each real dual wheel.

Corn planted on uncompacted soil yielded 84.1 bushels per acre, while yields where the surface soil was compacted were reduced to 77 bushels. Compacting the subsoil alone didn't affect yields but where both the surface and subsoil were compacted, yields were 72 bushels per acre. In general though, the surface compaction is what made the biggest difference, say Blake and Dennistoun.

They planted corn at 24,000 plants per acre in these tests, then thinned the population to 20,000. This is still higher than the average Minnesota farmer plants, which shows that excess surface compaction can cut yields even with high populations. Besides, Blake and Dennistoun say that under normal field conditions, packing itself would tend to reduce corn plant emergence, which would mean an even sharper yield decline.

The researchers found that the packed soil "puddled," resulting in poor soil structure. There was less air space in packed soil and poorer draining ability. Also, packed soil was harder and the young corn plants had a tougher time breaking through it.

HIGH CORN YIELD POSSIBLE ON LIGHT SOIL

OGILVIE, MINN. -- A hundred bushels of corn per acre is no trick for dairy farmer Duane Pearson, even though he has light soil and never uses a disk to get the seed bed ready.

His corn-raising formula includes heavy manuring, fertilizing according to soil test and planting the corn in the tractor wheel tracks on freshly plowed but undisked ground. The money he saves by not disking almost covers the cost for the starter fertilizer he uses.

Pearson has followed this pattern for the past four years on his 280-acre Kanabec county farm. For three years he has been first place zone winner in the Minnesota X-Tra Corn Yield contest.

Pearson harvested 102.9 bushels per acre from his fertilized plot last summer, compared to 81.3 from the unfertilized plot. Even that is a good yield from a plot that received no fertilizer, but there's an explanation: Peason had spread 10 tons of manure on each acre of all his corn land during the previous winter.

On his X-Tra yield plot, he applied 140 pounds 5-20-20 per acre as starter fertilizer in the corn row. He didn't use a sidedress fertilizer application during the growing season because, as he explains, "I've found in the past that it doesn't pay off where I've used such a high manuring rate."

The field had also received 300 pounds of 8-16-16 fertilizer broadcast in 1956 and was limed 4 years ago.

Wheel-track planting is one of the key points in Pearson's corn program. He plows all his corn land in the spring. Then, within a day after a field is plowed, he narrows the tractor wheels and hitches his corn planter behind the tractor so that it plants in the wheel tracks. This way, the tractor wheels do all the "seedbed preparing" that's necessary. There is no disking or harrowing at all between plowing and planting.

This practice is recommended by University of Minnesota extension soils specialists and Kanabec county agent Roland Skelton. By not disking or harrowing, a farmer can save up to $5 or more per acre in seed preparation costs. And $5.25 per acre is all it cost Pearson for his starter fertilizer for corn in 1957.

GRASS PASTURES CAN PAY OFF

Old permanent grass pastures can be a tremendous "feed reservoir" for dairy herds in eastern Minnesota.

A demonstration at the University of Minnesota's North Central School and Experiment station at Grand Rapids in 1957 showed that with nitrogen fertilizer and proper management, pastures of bluegrass, timothy and bromegrass can:

* Yield in total feed value what would amount to 5 tons of hay per acre annually.
* Provide all the grazing needed for 33 high-producing cows for 13 days on just one acre.
* Produce total digestible nutrients (TDN) at a lower cost than a farmer would pay for many

other feeds that he would need to buy if he didn't have such good pasture.

This demonstration was conducted by research workers at the Grand Rapids station, in cooperation with Charles Simkins, extension soils specialist, and Ermond Hartmans, extension farm management specialist at the University.

They kept complete feed and milk production records on a 33-cow Guernsey herd grazing on 10 acres of permanent grass pasture--80 percent bluegrass and the rest timothy and bromegrass. The pasture was divided into one-acre plots. Two received no nitrogen and on the others, research workers compared treatments of 50, 100, 200, and 300 pounds of nitrogen per acre.

The entire 10-acre field supplied all the pasture the herd needed from May 30 to Sept. 5. A series of electric fences made it possible to give the cows only as much pasture as they would graze in one day. When one field was grazed, the cows were moved to the next tallest pasture.

After the cows finished a field, the workers clipped the pasture and spread the manure spots with a drag harrow.

Cows require a certain amount of TDN to produce each 100 pounds of milk and to maintain each 100 pounds of their body weight. So by subtracting the TDN from other feed given the cows during the summer and keeping records on weight of the cows and milk they produced, the research workers and specialists closely determined how much TDN came from each acre of pasture.

The best yields came from applying 200 pounds of nitrogen per acre. Applying the first 100 pounds of nitrogen cost about 80 cents for each 100 pounds of TDN, and the cost was about $2 for each 100 pounds of TDN produced by the second 100 pounds of nitrogen fertilizer.

These costs are no higher than a farmer would pay for each 100 pounds of TDN in alfalfabrome hay or oat silage, and are lower than the TDN cost in corn grain or silage, oats or in a 16-percent-protein dairy concentrate.

Where no nitrogen was used, the cows produced only 3,178 pounds of milk per acre, compared to 6,121 pounds on plots where 50 pounds was used and 8,564 where the application rate was 100 pounds per acre. Cows on the plots receiving 200 pounds nitrogen per acre produced 10,705 pounds of milk--or 125 10-gallon cans--from each acre of pasture. The cows also received grain, though, meaning that the increased milk yield did not all come from pasture.

On plots where nitrogen fertilizer was used, the pasture was ready to be grazed two weeks earlier in the spring and two weeks later in the fall. It was possible to graze each acre of unfertilized plots only 5 days, compared to 7.5 days on the 50-pound plots and 11 days where 100 pounds of nitrogen were used.

The research workers and specialists emphasize that the demonstrations show high rates of nitrogen on pasture pay off only when the farmer follows the right management practices. These include ration-a-day grazing, clipping ungrazed forage and spreading the manure after each grazing.

FERTILIZER, GOOD MANAGEMENT CAN TRIPLE CROP RETURNS

By wisely applying fertilizer and adopting better management, Minnesota farmers could almost triple their net returns from field crops, a pair of University of Minnesota extension specialists claim.

Ermond Hartmans, economist, and Charles Simkins, soils specialist, say that in a 27-county area of south central Minnesota, net returns from all crops could be increased from the present $8 to $20 per acre.

For a farm with 320 crop acres, this would boost crop returns from $2500 to $6400 annually. For the entire 27 counties, it would mean an extra $100 million in net farm income and $50 million in increased fertilizer sales. These estimates are based on current cash values of farm crops.

To make such increases, farmers need to use 5-6 times as much fertilizer as they are now using, the specialists said. The present fertilizer expenditure: $1.50 per crop acre annually. The needed level: $3.80 worth of additional nitrogen, $3 more phosphorus and $1.25 more potash per acre. These figures are for needed fertility levels in a rotation with 40 percent corn, 15 percent soybeans, 15 percent alfalfa and 20 percent small grains.

Hartmans and Simkins state that corn yields in this area for the past 10 years averaged 48 bushels per acre. But if all farmers applied lime and fertilizer according to what soil tests show the land needs, this average could be raised to 75-90 bushels on most fields. And each dollar spent for fertilizer applied by soil test will return at least $2 in net profit, the specialists point out.

They said these estimates are really conservative, and are based on long-time studies of soil potential in the 27 counties.

NITROGEN DOESN'T INCREASE CORN MOISTURE

Farmers looking for ways to avoid the soft corn problem in the future won't help it any by applying less nitrogen fertilizer.

In fact, nitrogen is more likely to be a help where the high-moisture corn problem is concerned.

Field tests at the University of Minnesota in recent years have shown that average ear corn moisture in late September is about the same in corn receiving heavy nitrogen doses as it is in corn receiving either no fertilizer at all or a no-nitrogen fertilizer.

J. M. MacGregor, University soils scientist, says this holds true whether the nitrogen comes from ammonium nitrate, anhydrous ammonia or urea fertilizer.

In 1955 tests, scientists compared unfertilized corn with plots receiving rates of 60, 120, 180 and 300 pounds of nitrogen per acre, alone and with 40 pounds each of phosphate and potash per acre. None of the fertilizer rates changed the corn moisture percentage by more than 1 percent.

Actually, proper fertilizing can help avoid a soft corn problem, MacGregor says. He reasons this way: Excessive moisture often results from corn freezing before it matures. Corn plants that receive an adequate supply of plant nutrients will grow faster and will therefore be more likely to get ripe before the first frost.

UREA FERTILIZER IS EFFECTIVE IN MINNESOTA

If it ever becomes cheaper, urea nitrogen will be used much more often on Minnesota soils.

University of Minnesota experiments show that urea is equal to other forms of nitrogen in increasing yields. At present, though, urea nitrogen costs about 15-16 cents per pound, compared to around 10-14 cents for other common forms of nitrogen.

In field trials in Minnesota's Isanti county, Soils Scientist J. M. MacGregor at the University compared urea and nitrate nitrogen on oats at two different rates--20 pounds and 40 pounds of nitrogen per acre.

Plots receiving 20 pounds of nitrate nitrogen per acre yielded 20.6 bushels of oats per acre, compared with 23 bushels from plots receiving urea nitrogen at the same rate.

At the 40-pound rate, nitrate nitrogen plots produced 26.2 bushels and urea plots yielded 28.4 bushels per acre.

NITROGEN CAN BE APPLIED IN FALL OR SPRING

It usually won't make any difference whether you apply nitrogen fertilizer in the fall or in the spring.

While field tests have shown some advantage from spring application in some cases, the difference usually isn't very big and doesn't always hold true.

J. M. MacGregor, University of Minnesota soils scientist, says three years of tests with nitrogen before 1954 showed no yield differences at all between fall and spring treatment.

During the past two years, research workers compared fall and spring applications of nitrate and ammonium forms of nitrogen. They used 40 and 80 pound-per-acre rates.

At the Northwest School and Experiment Station, Crookston, there was no difference between yield increases from fall or spring application or between different kinds of fertilizer.

Tests at the West Central Experiment Station, Morris, showed that spring application at both rates brought bigger increases in every case except with the 80-pound rate of nitrate fertilizer. In that case, fall application boosted yields by 15.3 bushels per acre over unfertilized plots, compared to a 12.3 bushel increase on a plot receiving a spring application.

WHEEL-TRACK PLANTING GAINS FAVOR IN WASHINGTON COUNTY

STILLWATER -- A corn-planting procedure that saves the farmer's time, cuts costs by as much as $5 per acre and helps keep the soil in good condition is getting a thorough test here in Washington county.

The practice is "wheel-track" planting. Nearly two dozen farmers in Washington county alone have adopted it for good.

In general, all these farmers get yields just as high from wheel-track planting as where they use conventional procedures, according to Clifton Halsey, Washington county extension soil conservation agent.

Wheel-track planting is one form of "minimum tillage." It means planting corn in the tractor wheel tracks on freshly plowed but undisked and undragged soil. Eliminating disking and harrowing can save an hour of working time on a 5-acre field and can cut costs by up to $5 per acre.

In addition, the reduced tillage also avoids excess soil compaction.

Julius Monson, Scandia, has followed the practice for two years. He hitched the planter behind a small 4-wheel tractor, with the wheels set about 42 inches apart.

"There were practically no weeds between the rows, because the soil there was so loose that the weeds couldn't grow well," according to Monson.

"The practice worked well on all kinds of fields --old sod, former hay pasture, rough fields and gumbo and in clay areas. We had nice, clean corn and it yielded well--from 101-130 bushels per acre, depending on the maturity of the corn and the number of plants per acre."

Lloyd Marier, Forest Lake, compared 13 acres of corn planted in wheel-tracks with another acre planted by the conventional method. He harvested 91 bushels of corn per acre from wheel-track planting and 89 bushels from the rest.

Even though he had a severe quackgrass problem, Eugene Zahler, Stillwater, said that his corn planted in wheel-tracks actually yielded as well as it did in the past when he disked and dragged the fields before planting. Others said:

Gene LaCasse, Hugo: "I used a 4-row planter, set the rear wheels 40 inches apart and modified the front axle so the front wheels were 120 inches apart. The corn planted this way turned out very well."

Elmer Nielson, Lake Elmo: "There was very little erosion where the corn was wheel-track planted--less than after disking."

Wilbert Hauser, Lake Elmo: "The practice worked so well and weeds in the loose soil between the rows grew so poorly that I didn't need to cultivate until the corn was knee-high. Yet, the corn averaged 90-100 bushels per acre."

Gerald Simon, Lake Elmo: "Even though I only cultivated it once, my wheel-track planted corn yielded 90-100 bushels per acre."

Louis Wright, Hastings: "I used a 4-row planter that has its own press wheels to make 'tracks' for the planter. I compared disked with undisked soil and found the disked area had many more weeds."

Tom Seeger, Hastings: "Wheel-track planting works well even with soybeans on my farm.