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Minnesota science



UNIVERSITY OF MINNESOTA
AGRICULTURAL EXPERIMENT STATION

interview with the DIRECTOR

On July 1, 1972, the USDA's major research arm, the Agricultural Research Service (ARS), underwent a major organizational change. ARS was split into four regional components, and several area directors were appointed within each region. The four regions are also being served by research planning and coordinating groups made up of USDA administrators, state experiment station directors, representatives of the deans of home economics, forestry, and veterinary medicine colleges, and one advisor from the Agricultural Research Institute, representing a segment of the agricultural industry. The task before these regional groups is to review what types of research programs are being conducted and then to set priorities and recommend shifts in the allocation of funds for future research.

This major shift in ARS organization formally recognized a grow-

ing trend toward decentralization of federal agricultural research efforts during recent years. Establishment of the U.S. Meat Animal Research Center at Clay Center, Nebraska and the Animal Health Center at Ames, Iowa, are the most notable examples. But the outward movement of other research facilities to various agricultural regions all over the nation has been steadily mounting.

For at least 25 years, state agricultural experiment stations have cooperated on a regional basis. As one of the 13 states in the North Central Region, Minnesota has participated in long-range planning and research coordination activities during this time. Dr. William F. Hueg, Jr., director of the Minnesota Station, has played an active role in both the old and the new groups. We asked him how the new ARS organizational setup will affect research programming.

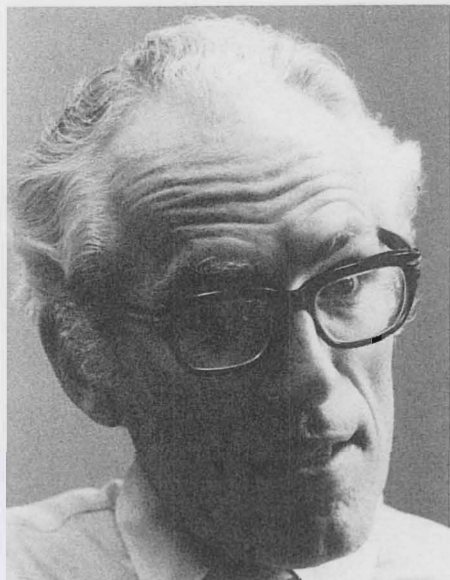
EDITOR: Dr. Hueg, state experiment stations have been cooperating on a regional level for several years. What possible advantage does the new, but similar, ARS regional setup offer?

HUEG: Several advantages, really. The current economic climate has brought far greater emphasis on accountability of how public resources are used. During the past two years, most experiment stations have been forced to hold the line on budgets or have experienced actual cutbacks due to the effects of inflation. The ARS regional organization will enable us to coordinate research programs between and among states and the federal research agencies better than we have done in the past.

EDITOR: How does this differ from the older regional programs?

HUEG: Well, it will obviously be a much more extensive effort to coordinate research between federal and state units. The older regional groups were loosely knit with respect to federal participation. No systematic effort was made to evaluate each region's program of research, to set priorities on research problems, or plan research activities on a national scale.

EDITOR: Are you saying that the new regional approach will succeed where the older regional groups failed?



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HUEG: No. The old regional groups accomplished a great deal. The fact that ARS adopted the regional model for its reorganization speaks louder than any glowing assurances I might make about its effectiveness. The difference is the total commitment of federal funding, administrative expertise, and research talent to program planning and development in the four regions. The chief administrator of ARS will still be located in Washington, D.C. but his staff will be assigned to regional offices and report directly to him

EDITOR: Does this mean that state experiment stations will have less say in how federal funds are spent in their state?

HUEG: That question has two answers. First, state stations will have more say in how ARS money is spent in their state. This will come about because station directors will serve on the advisory committee in each region that evaluates the present level of programming and determines priorities and shifts in allocations for future research programs.

EDITOR: And the second answer?

HUEG: Many state station directors are already finding that budgetary and program decisions are being forced on them. As appropriations become increasingly difficult to obtain the economic situation will dictate termination of certain projects and delay of new projects that are needed.

EDITOR: Why has this situation come about?

HUEG: Well, let's ignore the present state of our economy and look at a less obvious explanation. The United States has arrived at the point in its social development where most people are two or three generations away from the land. This distance has made the general public less aware of and less sympathetic to the need for a strong program of food and fiber research. Evidence of this is apparent in the public clamor over high meat prices, special study committees of the Congress and state legislatures, and the efforts of many environmental and public interest groups who shoot first and ask questions later.

EDITOR: What about the future of agricultural research?

HUEG: The next decade will be a major test for public research programs. However, by constantly evaluating existing programs and shifting resources to higher priority needs, we can insure that these programs continue to serve the public well. And I believe that the shift to a regional approach to planning and coordination will enable us to make these adjustments more effectively and with a better sense of purpose.

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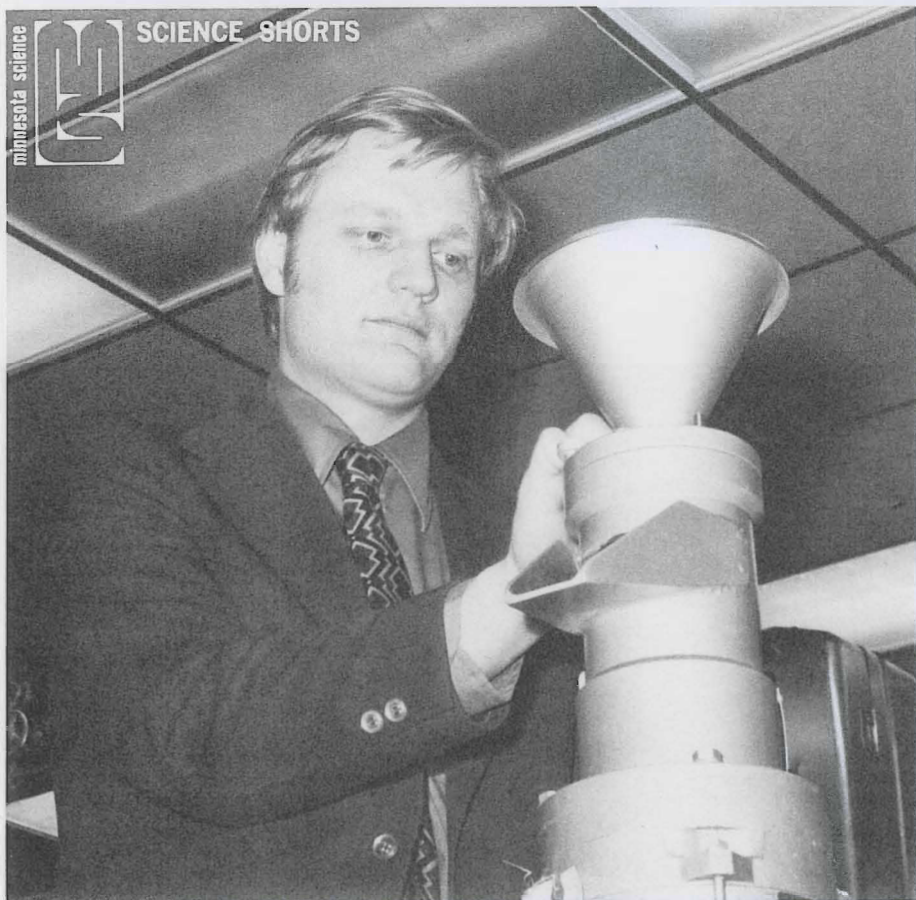
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Food scientist John Rosenau readies equipment in his laboratory. The research group hopes to develop a process to obtain a protein isolate from sunflower seeds that could be used to boost nutritional values of present day foods.

Researchers Seek Protein Isolate

Sunflowers might play an important role in meeting human nutrition needs if Experiment Station research is successful in producing a high protein powder from sunflower seeds.

Food scientist John Rosenau and David Thompson, an agricultural engineer, have been assembling equipment in their St. Paul Campus laboratory to study processing methods. Rosenau says they hope to have "something to show" within the next year. That "something" would be a powder—a protein isolate that could be used to boost the nutritional value of present-day foods. It might be blended into cookies, breads, muffins, sausage, and other foods, they say.

Two types of sunflower plants are currently grown: those that produce seeds used as a snack or bird seed and others that are processed for their oil—regarded by industry as a top quality,

edible oil.

The oil-bearing seed, however, has a difficult-to-remove hull. In many oil-pressing plants, the hull is mashed with the seed's meat by a machine called an expeller. The expeller extracts the oil from the meat of the sunflower. The meal that is left over from processing is sold as cattle and poultry feed.

The process that the two scientists hope to develop is aimed at getting the oil—not the meal, which they regard as the material for the high protein isolate. They will carefully examine the extracting process from beginning to end to determine what refinements will be necessary in the new process. They already know that in the present process, the meal is toasted, depriving the proteins of their natural properties.

Other complications make development of the isolate extraction process difficult. The method used to extract

the isolate, for example, can alter the amount and type of protein. Also, when acid in the sunflower seed is mixed with protein in the presence of air, a dark green, unappetizing mixture results. Adding sulfite to the isolate or using a salt extraction technique are ways of overcoming the coloration problem.

About a half-million acres of sunflowers were planted in northwestern Minnesota and neighboring parts of North Dakota and Canada last year. A long upward trend for sunflower seed consumption is expected to continue in the future. Two medium to high yielding sunflower varieties, Arrowhead and Mingren, were developed by Experiment Station agronomists and continue to be recommended varieties for Minnesota growers. Arrowhead is said to be excellent for birdfeed production; Mingren's large seeds are used for dehulled and whole seed food uses and the smaller seed for birdfeed.

DDT TESTS WITH HENS UPSET POPULAR BELIEF

Recently completed tests with DDT have cast some doubt over the commonly held belief that the pesticide harms animal life and presents a hazard to man. Experiment Station animal scientists fed extremely high levels of DDT (300 parts per million) to laying hens and found that neither egg weight nor shell thickness was affected.

The month-long experiment was conducted by animal scientists George Speers and Paul Waibel, and undergraduate assistant Gil Waibel.

Speers says the test raises some question of how dangerous DDT is to animals. If such a high level doesn't affect chickens, then it is questionable that exposure to lower levels of DDT over a longer time would affect other animals. He acknowledges that other experiments have shown that high levels of DDT fed to ducks and quail have reduced eggshell thickness, causing many eggs to break. And, he says, DDT probably doesn't affect all animals in the same manner.

However, other tests where chickens were fed DDT at the 300 ppm level also showed no adverse effects, Speers says.

The Minnesota scientists also investigated what effect charcoal might have in the hens' diets. Three percent charcoal reduced DDT deposition in the hens' body fat and in egg yolk.

The test demonstrated how easily

DDT can spread in the environment. Researchers separated hens fed DDT from those fed a normal diet. But small quantities of DDT were found in the body tissues of hens not fed the chemical.

Speers feels that DDT still should be used in certain instances, even though it has been banned in most parts of the U.S. "It is one of our most efficient pesticides." He thinks some critics may have gone overboard in their reaction to commonly used chemicals such as DDT. "Maybe our society can exist without it, but other parts of the world need it to control malarial mosquitoes. In the future, we are going to have to make a more rational comparison of risks versus benefits in evaluating chemicals used to control pests and diseases of plants and animals."

INSECT PARASITES USED TO COMBAT SAWFLIES

Experiment Station scientists have imported live "weapons" to aid in their attack on the yellow-headed spruce sawfly, an insect that damages spruce trees in northern U.S., Canada, and Alaska. The weapons actually are fly and wasp parasites of the destructive sawfly.

Diseases and predators native to Minnesota have failed to control the pest adequately, according to Herb Kulman, head of the team of entomologists investigating the problem. So the researchers are introducing sawfly parasites from other states—Michigan, Maine, Alaska, or from a Rocky Mountain location in the U.S. or Canada. If these parasites prove ineffective in tests conducted near Grand Rapids, others may be obtained from Europe or Japan.

Heavy infestations of the sawfly have plagued white spruce plantations in the Grand Rapids area for several years. A grant from Blandin Foundation of Grand Rapids provided funds for the study.

The sawfly defoliates spruce trees through a cyclic process. The female makes slits in new spruce needles in the spring and deposits her eggs singly in each slit. Five to twelve days later, the brood of small yellow-green caterpillars chews its way out of the eggs. They feed on new spruce needles and move on to older foliage only after nearly all the new foliage is eaten.

When caterpillars are about an inch long, they drop to the ground and dig into the soil. Then they spin a cocoon, which becomes their winter home. In

late May or early June, soon after the buds of white spruce expand, the adult sawfly cuts its way out of the cocoon and again deposits eggs in the needles.

Kulman says that chances are about 50-50 the sawfly can be controlled by introducing a new parasite. But even if they fail to do so, the parasites might at least hold sawfly populations down—preventing some damage to spruce forests and reducing the frequency of insecticidal spraying.

"In Canada, seven or eight species of forest insect pests have been successfully controlled by use of parasites or insect diseases on a regional basis. Four other species were partially controlled, two species are still under study, and 10 other species were not controlled at all," Kulman says.

The researchers say chemical control is highly effective against the sawfly, but it must be repeated frequently. With biological control, once the parasitic insect becomes established, it remains indefinitely and reproduces and spreads to adjacent areas.

The amount of damage that occurs using biological control may be greater than if spruce stands were sprayed with insecticides, Kulman says. "But a single year of heavy defoliation or continual light defoliation apparently has little detrimental effect on spruce."

SOYBEAN RESPONSE TO NITROGEN IS IRREGULAR

Soybean response to nitrogen in Experiment Station field tests has been too irregular to make nitrogen fertilization of soybeans a standard practice. However, soybeans respond as well as corn to potassium and phosphorus fertilizer, according to soil scientist George Ham.

"Tests have demonstrated soybean yield increases from nitrogen, but consistent increases in yield have not been obtained every year and at all locations," Ham says.

"Nitrogen fertilizer tends to reduce the amount of nitrogen added by soybean nodules. When nitrogen fertilizer is added, competition arises between the fertilizer and the nodules to supply the plant. Usually the fertilizer wins out and the nodules fail to contribute as much nitrogen when fertilizer isn't used," Ham explains.

Phosphorus and potassium fertilizer have boosted soybeans up to 18 bushels per acre at the Lambertson branch station when soil levels of these elements were low. If soil tests show phosphorus

levels are less than 30 pounds per acre or potassium levels less than 200 pounds per acre, the likelihood of response to fertilizer is good, Ham says. No soybean response to such micronutrients as copper, zinc, iron, manganese, or boron has been demonstrated in tests.

BALD EAGLES STUDIED

Bald eagles inhabiting northern Minnesota's forests may be forced to seek the seclusion of more remote locations as a result of man's logging and recreational activities, according to Experiment Station researchers. The team studying the bald eagle says that the most remote eagle nests seem to produce the most young.

The researchers are carrying on their observations of about 40 nests and 20 eagles in a limited area of the Chippewa National Forest in Cass County. Forestry professor L. D. Frenzel is heading the study and is assisted by graduate students Joel Kussman and Greg Juenemann, and U.S. Forest Service Biologist John Mathisen.

Frenzel says there is a well established breeding population of bald eagles in the Chippewa Forest. However, once young eagles gain the ability to fly, they leave and don't return. The research team is trying to find out whether the eaglets survive to bolster eagle populations in other parts of the United States. Well established breeding populations of the bald eagle are now found mostly in Illinois, Michigan, Minnesota, and possibly Wisconsin. But in recent years, the total bald eagle population has waned.

Despite man's encroachment on the eagle's remote hideaways, man may have unwittingly helped the eagle survive in the Chippewa Forest. Some 30 years ago, a policy was established to preserve certain large trees in the national forest area. Since bald eagles require large trees for nests, the policy benefitted them as well as the trees.

Tracking the young eagles after they left the nest posed problems for the research team. One week before the eaglets were ready to leave the nest, the wildlife scientists climbed up to nests—about 80 to 90 feet above the ground—and lowered 12 birds. All were wing-marked with a color-coded pattern, measured, and then banded. Four young eagles were also fitted with a radio transmitter harness. All the eagles were returned to their nests.

Researchers found that much of the

(Continued on page 15)

FAMILY FARMS

Do They Have a Future?

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Will 400 or 500 super-sized farms control America's agricultural production and marketing system by the 21st century? If large-scale farms do take over, it will not be due to superior production efficiency, contends Philip Raup, University agricultural economist. Almost all research studies show that well managed one- and two-man farms are the most efficient, measured by cost per unit of output. The only exceptions are a few types of farming operations such as poultry and beef cattle feeding operations, and some types of orchard and vegetable crop production.

Presently, only about one percent of U.S. commercial farms are incorporated, and more than 90 percent of those are family corporations, set up primarily to facilitate the passage of the farm from one generation to another.

MARKET CONTROL AND TAX ADVANTAGE

"Farm people will bring about large-scale farming, if it does eventually dominate the rural scene," Raup says. "They will do so because they have concluded that only in this way can they mobilize political power to control prices and secure a share in higher incomes. Market power looms as a potential advantage for large farms. These large operations could assume more control over their markets by controlling supply, altering demand through advertising, and attracting outside capital.

The nature of farm business makes it especially attractive for the wealthy investor. With inflationary trends of the past decade, rising land values, and a tax policy favorable to corporate investment, "it should not be surprising that interest in corporation farming has expanded recently. A landowner with nonfarm income or an investor in a farm will usually find it rewarding to convert farm income into assets that can ultimately be taxed at a lower rate as capital gains. Capital gains are possible for a large fraction of total farm assets. The bulk of farm investment is represented by the most durable asset of all—land," Raup says.

A classic illustration of the capital gains treatment is the beef cattle ranch. Most of the investment is in land and a breeding herd. Orchards, groves, and vineyards present similar opportunities for low capital gains tax rates, he says.

"A bonus for bigness has been unintentionally built into our system. Authority to use a cash instead of an accrual basis for accounting is monetarily valuable to the large farming concern. But it is of little value in reduced taxes to the small or medium-sized farm.

"Allowable deductions for expenditures on soil and water conservation or land improvement are primarily useful to farmers with large incomes. The taxation of capital gains at not more than 25 to 30 percent is of significant value only for those with very large incomes.

TAX SHELTER OR PROFIT MOTIVE?

It's hard to tell who's seeking a tax shelter, according to Leonard Kyte, a Michigan State University economist. "Farmers with off-farm income are hard to separate with regard to the tax law.

"Farmers' concerns about tax-loss farming are under-



"Farm people will bring about large-scale farming, if it does eventually dominate the rural scene," says agricultural economist Philip Raup. "They will do so," he says, "because they have concluded that only in this way can they mobilize political power to control prices and secure a share in higher incomes."

standable. On many occasions, they have observed wealthy business and professional people buying a farm as a rural residence and a tax shelter, which happens in a free country. These might be units that skirt the 'hobby farm' tag by the Internal Revenue Service, or a bonafide attempt to operate at a profit. Who can say what the intent was? Some attempts at profitable investment are ill-conceived and unprofitable."

WHAT IF ALL FARMS ARE LARGE?

One of Raup's main concerns is "What happens if all farms are big?" One present advantage of large scale operations is volume buying at discounts. For example, a large farm can order 100 tires at a discount by simply by-passing the local retailer and going directly to the wholesaler or jobber. But what happens to this discount when we have all large farms? What looks now like an added efficiency would disappear since we'd have destroyed the supply distribution system, Raup maintains. In other words, large agricultural firms would have to go to the manufacturer at Akron, Ohio, to get tires.

"Under our present system, small farmers pay some of the distribution costs for large farmers who by-pass local retailers," Raup says. "We generally have a good retail system for spare parts in the United States, but it's harder to get spare parts in areas characterized by large farms. The large collective farms of the Soviet Union have a very poor spare parts system compared to ours," says Raup, who has traveled and studied extensively in Russia.

But possible social decay is the most worrisome part of the trend toward large-scale farms, Raup contends. "If corporate ownership is absentee, if profits are not reinvested in the community, and if management success is judged solely in terms of corporate profits, then the large farm may pose a social threat to the rural community.

"But this is not necessarily a condemnation of all types

of corporation farming. If the corporation is predominantly a family affair, and its officers and stockholders reside in the community, there's no clear reason why this form of farm business organization should pose a social threat to rural life.

"The least desirable situation could be one in which farm corporations are larger than family-size and are absentee owned, but are not national in scope or scale of operation. This could lead to a type of petty-corporatism, comparable with the petty-landlordism that has been the curse of slum areas in urban centers.

"It is quite possible to have farming corporations that are too small, as well as to have individually owned farms that are too small. It would be a tragic error if we exchanged a structure of family farms, thought to be too small by economic tests, for a structure of corporate farms that proved to be too small by social tests. We could have the worst of both worlds if we emerged from this period of change with a structure of medium-sized corporate farms, financially weak and socially irresponsible," Raup argues.

RECOMMENDATIONS

There's nothing irreversible about the trend towards large-scale agriculture, says USDA economist Donald Paarlberg. "Legal tools are available to check the trend, such as prohibitions of one sort or another, graduated taxes, and limitations on the amount of government payment going to any one farm.

"With representative government, the people can have any kind of agriculture they want.

"The trend has been in the direction of large-scale farm units, but this doesn't mean that this trend must continue until it embraces all of agriculture. Nor does it mean that large-scale farming units should be abolished. I see no good reason to prevent us from having a farming system that is partly large-scale and partly family farms. Those who be-

lieve in market competition should also believe in the appropriateness of competing institutional forms," Paarlberg says.

Attempts to prohibit corporation farming by law, Raup points out, may not achieve what is uppermost in the minds of those who urge the action. North Dakota law prohibits



Instead of prohibiting corporate farms, Raup says, we should insure that farm corporations are not given "intended or unintended advantages in competition among sizes and types of farms. For competition to result in an economically and socially desirable structure, it's necessary that the rules of the game be fair."

corporation farms; Kansas, Oklahoma, and Texas have some restrictions regarding the type of farm unit that may be incorporated. Recent Minnesota law requires corporation farms to report acres owned and their location.

Instead of prohibiting corporate farms, Raup says, we should insure that farm corporations are not given "intended or unintended advantages in competition among sizes and types of farms. For competition to result in an economically and socially desirable structure, it's necessary that the rules of the game be fair." He recommends these steps:

1) Reforming tax laws and practices to remove existing and largely unintended advantages for the large or corporate farm.

2) Modernizing and revitalizing agricultural cooperatives to include more managerial assistance to farmer members.

3) Strengthening research and extension programs to insure the availability of technology and management services to medium-sized farms capable of achieving gross sales of \$20,000 to \$100,000 per year.

4) Expanding environmental protection, waste disposal, and pollution control programs to include all of agriculture. The cost advantages of large-scale corporate farming would be reduced if firms had to pay for pollution control programs on their operations.

5) Extending labor and welfare legislation to cover the entire farm labor force. "Large agricultural firms will surely have unionized labor in the future, but it's doubtful that a firm paying union wage scales can compete in the cost of growing crops with family labor," according to Raup. "To refuse to extend labor-protective legislation to agriculture is one of the most irrational agricultural economic policy decisions possible. The refusal does nobody good, and the family-type farmer seems likely to suffer the worst injury."

6) Imposing ceilings on government payments to farmers with "some real teeth in them. The current limit of \$55,000 per farmer is a joke—why not make the maximum payment \$20,000 or even \$10,000? Farm price support programs should be overhauled. Present programs tie benefits to acres and product quantities, and a powerful incentive has been created for the establishment of very big farms."

"There are those who say it's unfair to single out farm corporations for special attention or regulation. The answer to this argument is that the nation's land resources are still one of our most precious endowments," Raup says.

"The danger today is not that we will overstress the importance of agricultural land policy, but that we will fail to safeguard the public interest in how our private lands are held. There's a 'point of no return' in the process of farm incorporation. If it takes place on too vast a scale before we've thoroughly studied whether it's in the best interests of the people, we've taken an irreversible step.

"We shouldn't throw out a system of family farm ownership, which has proven successful for 6,000 years, because of short-run conclusions reached in the last two generations. We need to recall that not all growth is good, and not all change is progress. The ultimate test of agriculture, or any sector of our society, is the quality of people it produces, not the production of goods."

TRADING STAMPS AND FOOD PRICES

If you get trading stamps at the supermarket, do you pay more for groceries than if you had shopped where the gummed tokens are not offered? University agricultural economist Mary Ryan says it is difficult to determine what effect, if any, trading stamps have on retail prices. Some studies indicate little difference in overall prices exists between stores that give and those that don't offer trading stamps.

A U.S. Department of Agriculture survey of price differences in several cities does not support the commonly held notion that stamp stores charge higher prices for foods not regularly purchased by housewives. Prices for all items in stamp-giving stores in 5 of 21 cities surveyed averaged 2.2 percent higher than stores not giving trading stamps.

The USDA study indicates that average prices paid by consumers in stamp stores are six-tenths of one percent more than in stores not giving stamps. The difference in price, according to Ms. Ryan, is equal to about 30 percent of the average merchandise value of the trading stamps.

"It is difficult to determine what effect, if any, trading stamps have on retail food prices," according to agricultural economist Mary Ryan. She says a USDA survey indicated that average prices in stores giving stamps were six-tenths of one percent higher than in stores not giving stamps. The difference in price was equal to about 30 percent of the average merchandise value of the trading stamps.

"It would appear that, on the average in the 21 cities studied, consumers who save and *redeem* stamps can more than recoup the relative price difference between stamp and nonstamp stores," USDA researchers conclude.

Ms. Ryan suggests that consumers evaluate grocery store prices and the merits of stamp-obtained merchandise the same as they would in any other buying situation.

Some supermarkets give the impression in their ads that they have dropped trading stamps so they can reduce grocery prices. It's not uncommon, especially in Metro-area markets, for supermarket chains to experiment with marketing techniques by dropping stamp distribution. Meanwhile, local outlets of another grocery chain, which hadn't previously offered stamps, may begin to distribute stamps. It's part of a cycle in grocery marketing—stamps are in or out, depending on a retailer's current marketing strategy.

The Trading Stamp Institute of America, Inc. disputes the advertising claim that 'dropping stamps lowers food prices.' "Don't count on lower prices when your trading stamp bonus is gone," the Institute says. "Food store history proves it doesn't work that way. In cities where leading food stores have dropped stamps, their prices might seem a tiny bit lower at first. But then they jump right back up again," the stamp organization claims.

Yet some stores that have dropped the trading stamps report that consumer reaction to stamp discontinuance is mild and that stamps are one expense that can be cut with no real problem.



CROP PRODUCTION And The Minnesota Economy

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Statistics cover virtually every aspect of agriculture. Suppose you want to know the price of millet in 1959. Or how many tons of bananas were imported from Jamaica in 1971. Chances are good that agricultural statistics will provide the answer.

Agricultural statistics have been presented and interpreted in many different ways. Often, the way statistics are presented may unwittingly suggest an improper interpretation. For example, look at the statistics in figure 1. Each year, figures similar to these are published by the state.

Judging by the statistics given in figure 1, it is obvious that those who classify Minnesota as a livestock and livestock product state are justified in doing so. Since 68.5 percent of Minnesota's cash farm sales comes from livestock and livestock products, we might expect most Minnesota farmers to be primarily engaged in beef feeding, hog raising, dairy production, poultry feeding, egg production, and other activities related to livestock production.

But compare this picture with the actual kinds of activities that go on at the farm. You then get the feeling that crop production activities must play a more important role than these statistics indicate. Most cattle feeders and dairy farmers spend a large part of their time producing crops to feed their animals. However, the 31.5 percentage merely represents cash receipts from corn, oats, hay, soybeans, barley, and other crops that are actually sold on the market. Feed grains and roughages that are not sold on the

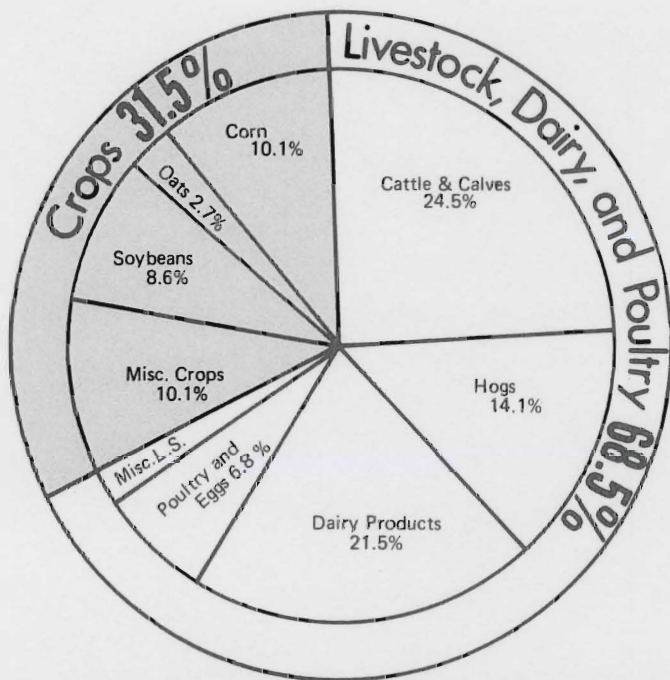


Figure 1. Minnesota cash farm income, 1969, allocated to final product only.* Miscellaneous crops include wheat 2 percent, sugar beets 1.4 percent, potatoes 1.1 percent, hay 1.1 percent, barley .8 percent, flax .8 percent, and other crops 2.9 percent.

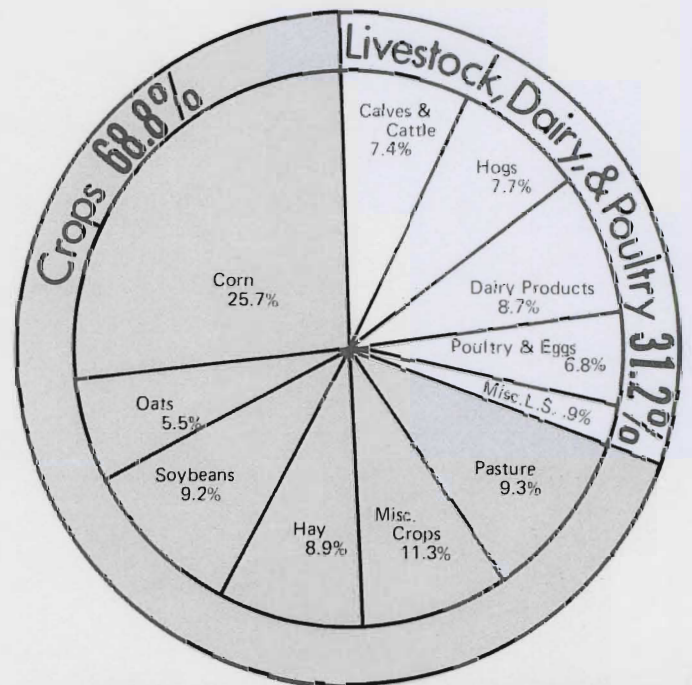


Figure 2. Adjusted Minnesota cash farm income, 1969; allocated by value added to final product. Miscellaneous crops include wheat 2.5 percent, barley 1.5 percent, sugar beets 1.5 percent, potatoes 11 percent, flax .8 percent, and other crops 3.9 percent.



Crop production activities play a more important role than some agricultural statistics indicate, say University economists Dale Dahl and Jon Anderson. Most cattle feeders and dairy farmers spend a large part of their time producing crops to feed their animals. Since these crops are not marketed, they are not counted as cash receipts from crops.

market and, instead, are fed to livestock, are not counted as cash receipts from crops. Nonetheless, crops grown for feeding purposes are a vital part of the state's cattle, hog, poultry, and dairy production.

VALUE-ADDED BASIS OF CROPS

To get a more accurate picture of the economic importance of various on-farm activities, each activity must be measured in terms of the value it adds to total cash receipts. For instance, take the total cash receipts received by farmers in 1969. Let's place a market value on the corn fed to livestock. When we do this, corn accounts for 25.7 percent of all cash receipts (see figure 2).

The same thing can be done for oats. Oats sales accounted for only 2.7 percent of 1969 cash sales. But this percentage doubles when the distribution is expressed in terms of value added to the final product. The value of hay increases from a modest 1.1 percent when viewed as cash crop to 8.9 percent when viewed as a cash crop plus a feed crop. And, again, the value of pasture assumes much greater significance on a value-added basis. It comprises 9.3 percent of all cash farm receipts.

When we view cash receipts in this light, the relative importance of crop and livestock activities is almost completely reversed. Instead of being credited with only 31.5 percent of Minnesota's agricultural income, crops account for 68.8 percent on a value-added basis. So we can say that an average of \$2 of every \$3 Minnesota farmers receive as cash income is related to crop production.

FARM INCOME DISTRIBUTION

Relative prices of crop and livestock products influence distribution of farm income regardless of how it is allocated. For instance, if feed grain prices are high, the value added by crop activities tends to be relatively greater than the value added by livestock activities. On the other hand, low crop prices increase the relative value added by livestock activities. Also, in years of low crop yields, livestock producers often purchase feed from outside their area. When this happens, the value added by crop activities is quite low compared to livestock.

Year-to-year variations of prices and crop yields cause fluctuations in the distribution of agricultural income. Although total cash receipts have increased markedly since

the end of World War II, the distribution of crop and livestock income has fluctuated within narrow limits (see figure 3). On the basis of sales of final products, the portion allocated to crops has generally remained between one-fourth and one third. On a value-added basis, crops account for between 55 and 70 percent of Minnesota's total farm income (see figure 4). This indicates that the distribution of farm income in 1969 was typical of the last 25 years. Crops definitely have been a major agricultural enterprise in Minnesota during this time.

CROP COUNTIES

In most corn belt and dairy belt areas of Minnesota, cash income from livestock and livestock product sales exceeds cash crop sales. Only 12 counties in the state can be considered "crop counties" (see figure 5). A "crop county" is any county that obtains over 50 percent of its cash farm sales from crops. Most "crop counties" are located in the

Red River Valley plus a few in intensive corn-producing areas and the Metro area.

However, using the value-added method of identifying "crop counties," we find that most major agricultural counties can easily be classified as "crop counties" rather than "livestock counties" (see figure 6). The only major agricultural counties classified as "livestock counties," using the value-added method, are the intensive dairy areas of southeast Minnesota and southwest of the Metro area, heavy beef-feeding counties of southwest Minnesota, and areas of concentrated poultry and dairy production in central Minnesota. Other counties classified as "livestock counties" are not major agricultural counties.

EMPLOYMENT PICTURE

Another way to determine how important crop production is in Minnesota is to look at total employment, both on the farm and in ag-related industries. Although many agribusinesses are related to both crop and livestock production, many can be separated as crop related or livestock related. An example of a crop-related agribusiness is the fertilizer industry. If crop production were not an important activity in the state, Minnesota would not have a major fertilizer industry. The same is true of livestock production and the meat packing industry.

We can analyze the contribution of crop production to the state's farm economy by looking at total employment on the farm; in industries that handle, process, and distribute farm-produced goods; and in industries that supply inputs to agriculture. About 438,000 people were employed by agribusinesses in 1970. Nearly 40 percent were on the farm. Output processing and distributing industries employed 47 percent, while 13 percent worked in the input industries.

Total crop-related employment accounted for 60 percent of the total agribusiness employment in 1970 (see figure 7). About 27 percent were engaged in crop-related employment at the farm level, 24.7 percent were engaged in activities related to processing, transporting, or distributing crop items, and 7.5 percent were engaged in manufacturing and distributing inputs used in crop production. This means that about 263,000 Minnesota workers support themselves and their families because of crop production activities carried out by state farmers.

LONG-RUN EMPLOYMENT TRENDS

Long-run trends in statewide employment indicate that total employment has increased. But agribusiness employment has declined (see figure 8). Decline in agribusiness employment is the net result of a substantial decline in farm workers coupled with a moderate increase in employment by ag-related industries. In 1947, for example, employment in farming or businesses related to agriculture made up 50 percent of all employment in Minnesota. By 1970, that percentage dropped to 27.4. While total agribusiness employment declined between 1947 and 1970, crop-related employment held a large share of the total agribusiness employment.

Today, about 16 percent of Minnesota's work force is engaged in some form of activity related to crop production. One of every six Minnesotans employed deals with crop production either in the form of manufacturing or distributing items used in crop-producing activities, producing crops on farms, or transporting, processing or distributing the products of crop production.

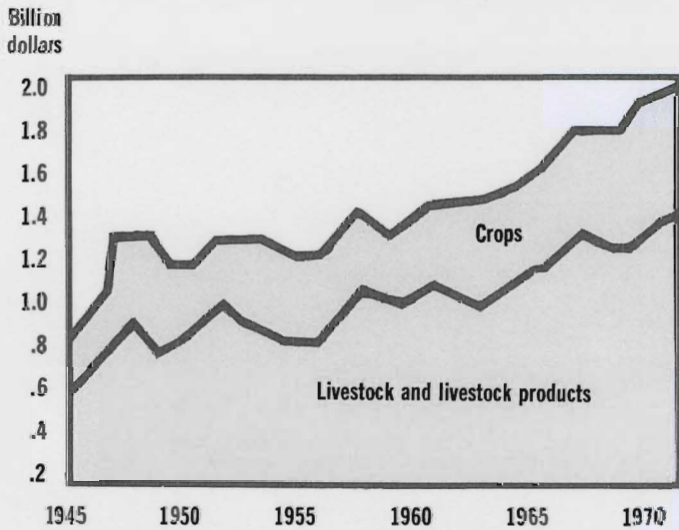


Figure 3. Cash receipts from farming in Minnesota, 1945-1970; based on final product sales only. Source: "Minnesota Agricultural Statistics, 1970."

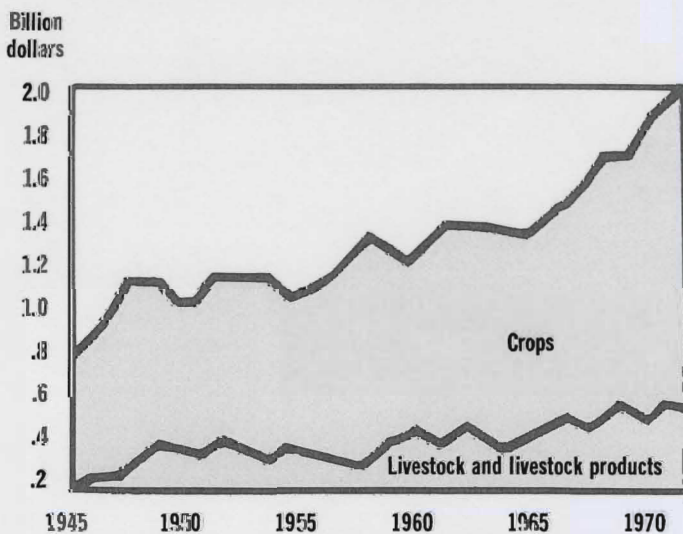


Figure 4. Adjusted cash receipts from farming in Minnesota, 1945-1970; based on value added to final product. Source: "Minnesota Agricultural Statistics, 1970."

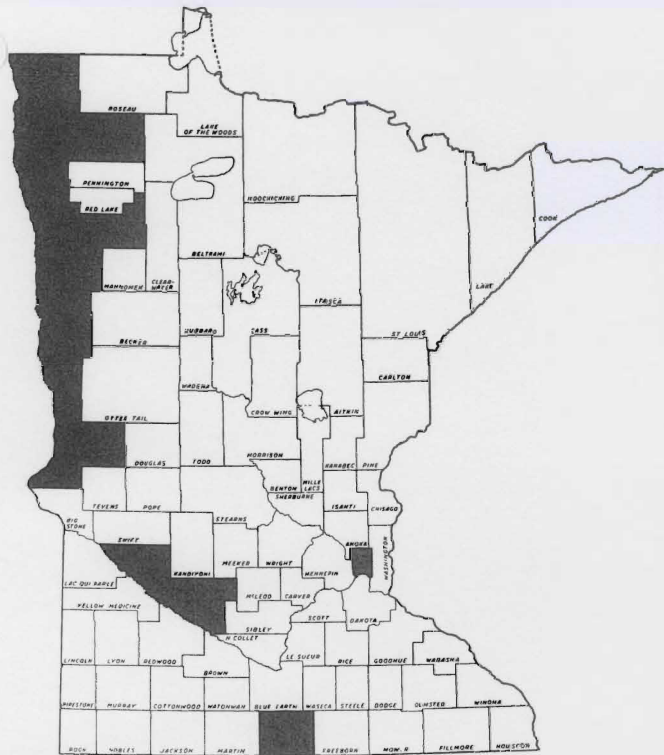


Figure 5. Minnesota counties with over 50 percent of cash sales derived from crops (1968), allocated on the basis of final product sales only. (1968 figures used because it is latest year for which complete statistics are available.) Source: "Minnesota Agricultural Statistics, 1970."

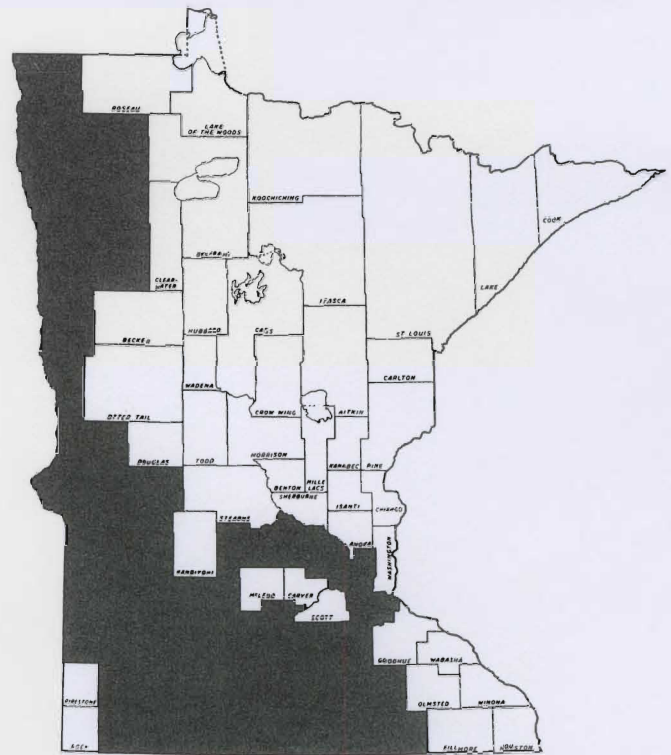


Figure 6. Minnesota's "crop counties"—counties with over 50 percent of adjusted cash sales coming from crops (1968), allocated on the basis of value added to final product. Source: Derived from "Minnesota Agricultural Statistics, 1970."

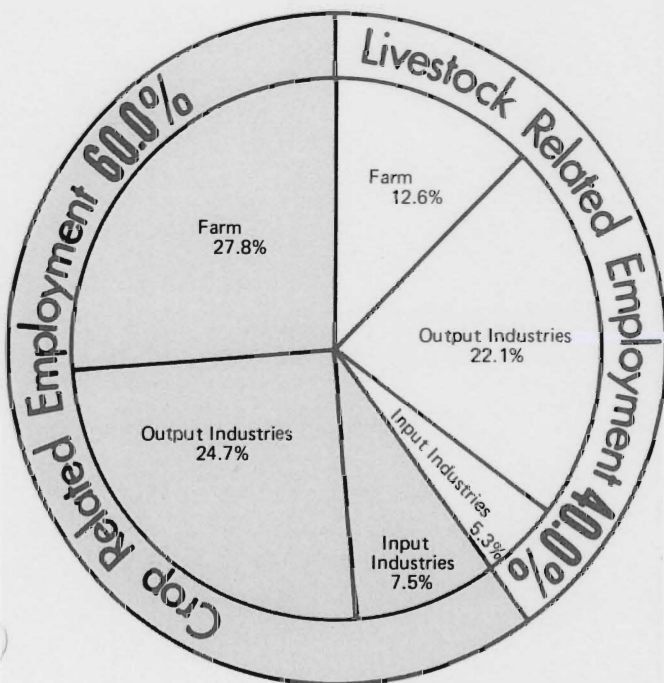


Figure 7. Agribusiness employment in Minnesota by major enterprise source, 1970.

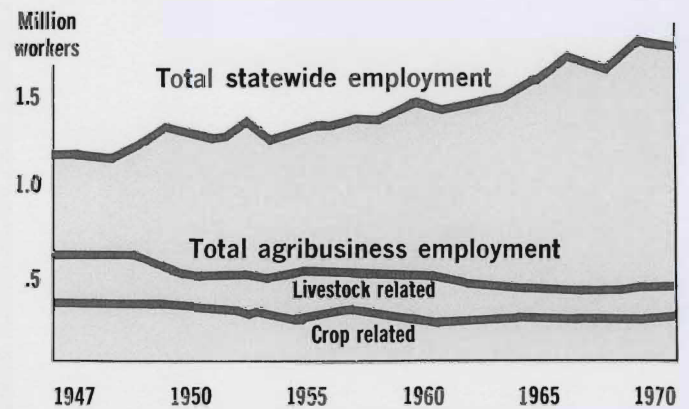


Figure 8. Total and agribusiness employment, Minnesota, 1947-70.

CONCLUSION

Statistical reports may lead you to believe that Minnesota farmers spend most of their time engaged in livestock enterprises. But these statistics tend to underemphasize the importance of crop production. When statistics are presented in a form that accounts for the value added by each type of activity, a different picture emerges. On a value-added basis, crop production accounts for over two-thirds of Minnesota's total agricultural income. Crop-related activities, both on and off the farm, account for the employment of one of every six Minnesotans. When you consider these facts, crop production must be regarded as a major income-producing and employment-generating segment of Minnesota's economy.

New Harvest System Cuts Soybean Losses

Soybean harvest losses that now cost Minnesota farmers over \$16 million annually may eventually be cut in half by a new harvesting system being developed by Experiment Station agricultural engineers.

The new soybean harvester employs two rollers that rotate on either side of the soybean row. The rollers secure the plant without shaking off as many beans as the traditional reel and sickle mechanism. Rotary cutters sever the plant near ground level and it is moved into the combine for processing, says agricultural engineer Cletus Schertz, head of the research project.

Field tests with the roller system have shown harvest

losses were reduced about two-thirds and one-third with two soybean varieties compared to conventional sickle and reel harvesters, Schertz says. Such efficiency on a per farm basis could mean a savings of about \$2.75 per acre on farm operations averaging 30 bushels per acre. Conventional equipment produced average harvest losses of 7.2 percent on 15 farms studied. But losses ranged from a low of 3.3 to a high of 12.6 percent of the net yield.

Researchers are also testing a belt gathering device that works on the same principle as the cylindrical rollers. Belts move continuously on rollers on either side of soybean rows. They close first near ground level and suck soybean plants back to rotary cutters. Both the roller and belt system deposit soybeans on a conveyor after plants have been cut. Plants are then transferred to the cross auger. Bean losses between the rollers or belts and the transfer conveyor are prevented by a transition pan. It catches plants that do not fall directly on the conveyor and holds them until the conveyor picks them up.

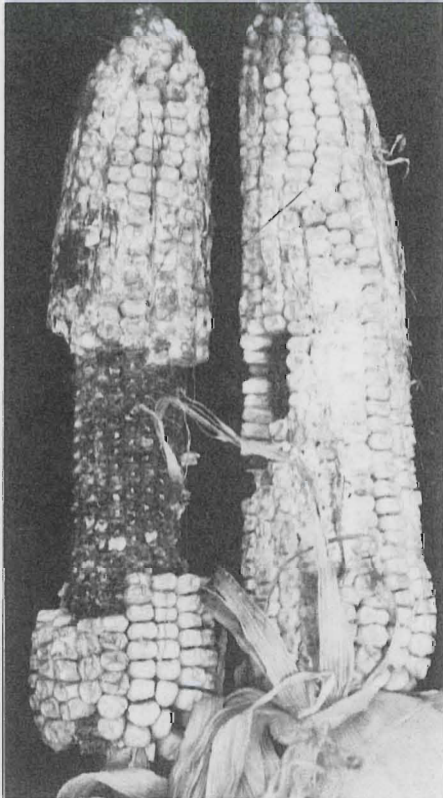
Schertz says that field tests with the belt gathering system have shown harvest loss reductions similar to the roller system.

Agricultural engineer Cletus Schertz examines a soybean plant cut by the experimental harvester he developed. The twin rollers (shown in background) close on the plant and secure it until it is cut — without shaking off as many beans as the conventional sickle and reel harvester. Harvest losses were reduced up to 60 percent in field tests of the new system.



HIGH-LYSINE'S FUTURE CLOUDED BY PROBLEMS

Since 1963 when two Purdue scientists discovered that a mutant gene could substantially improve the protein quality of corn, researchers elsewhere have been trying to overcome weaknesses of early high-lysine hybrids. Minnesota Experiment Station tests



Typical invasion of high-lysine corn by the fungus *Fusarium moniliforme*.

EAGLE STUDY

(Continued from page 5)

eagles' initial activity took place on the ground, perhaps making them vulnerable to hunters, injury, and predation. Often, the marked eagles were found around lake shores eating dead fish. "Their key to survival is being able to get an energy base out of the shore of that lake, its fish, and nothing else," Frenzell says.

The team also discovered that extra empty nests in the Chippewa Forest did not mean that the eagle population was declining. One eagle pair often uses two or three nests. One is used for raising young and extra nests are used for perching or resting.

recently confirmed that a newly developed high-lysine corn variety contains more of the sulfur amino acids that limited protein value in earlier high-lysine varieties for poultry feeding. The new variety is a combination of two recessive genes—Opaque 2 and Floury 2—which gives it a better balanced protein than older lines of high-lysine corn. Seed supplies of the new variety are expected to be available to farmers by spring 1973.

Despite this success, high-lysine corn, like regular dent varieties, still poses problems that challenge the resources of corn breeders and plant scientists. One of the problems is the susceptibility of some high-lysine varieties to ear rots. Heavy invasion and decay of some high-lysine lines was especially prevalent last fall in Illinois where large plantings of high-lysine corn were hit with ear rot caused by a fungus (*Fusarium moniliforme*).

Fusarium moniliforme fungus is present in many varieties of normal yellow dent corn in very small amounts—but in a moderate to high percentage. Ordinarily, though, it causes little decay of kernels of normal dent varieties.

Minnesota research showed that no ill effects occurred when pigs and other animals were fed a ration containing high-lysine corn invaded by the fungus. All the pigs appeared healthy, sleek, well-fed, and sound. In fact, pigs fed the ration containing fungus-invaded high-lysine corn gained an average of 32 pounds compared to 29.7 pounds for pigs on rations containing normal corn.

It has been suggested that other fungi, some capable of producing potent toxins, might follow *Fusarium moniliforme*, making the corn unwholesome. But Experiment Station researchers say that so far this is only a theoretical possibility. They report "there's no evidence of this having occurred in the field."

FROM SUNFLOWER HULLS TO KITCHEN CABINETS

Imagine the enormous headache facing operators of sunflower processing plants that de-hull and process thousands of tons of seeds for oil each year. If present trends are any indication, the sunflower processing industry could have 100,000 tons of hulls on hand by 1980 at just two or three sites in Minnesota and North Dakota.

Hulls are presently made into pellets as roughage for cattle, but this is not the long-range answer to the prob-

lem, according to forest products researchers Roland Gertjensen and John Haygreen, and plant pathologist David French. The researchers say a large and expanding international industry is evolving from the growing and processing of sunflowers. A Canadian firm has pressed hulls into 7½-pound logs for fireplace fuel. Using hulls in the production of the chemical furfural, as a landfill material, and as a fuel in sunflower seed processing plants are a few of the ways hulls have been put to use outside this country.

The Minnesota scientists have been experimenting with hulls as a material for particle board. Particle board commonly is used as floor underlayment and in furniture and kitchen cabinets. The particle board they fabricated in their laboratory is made of 50 percent sunflower seed hulls and 50 percent aspen wood flakes. Tests run on the sunflower-aspen board showed it met or exceeded the commercial standard requirements for medium density interior boards with the exception of screw-holding capabilities.

The researchers say it is questionable whether comparing the laboratory-produced board to commercial standards is valid. Whether or not a commercial board made of 50 percent seed hulls would meet the requirements of commercial standards is open to conjecture at this point, they say.

Other possibilities for using sunflower hulls in particle board remain to be explored. If the internal bond of hulls and resin can be improved, the material might be suitable as a core for three-layer plywood. They also say that the effect of resin content, the shape of hulls and aspen flakes, and the possibility of pre-treating hulls to improving bonding quality should be evaluated.

The scientists believe there may be some merit in operating a particle board plant in conjunction with a sunflower processing operation. Present sunflower processing sites are well within range of aspen wood sources of west central Minnesota. One sunflower processing plant can produce nearly 40,000 tons of seed hulls annually. A plant manufacturing particle board containing half hulls and half aspen would consume that amount of hulls as well as 40,000 cords of aspen in a year, they say.

The economic feasibility of the combined operation has yet to be considered, but Minnesota's sunflower processing and wood products industries might make the state a prime location for such a facility, the researchers say.

TWO CUSHION MUMS INTRODUCED

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Minnglow and Minnyellow are the 51st and 52nd varieties of garden chrysanthemums introduced by the University of Minnesota's Department of Horticultural Science. The prefix Minn is used to designate varieties with a cushion type of growth habit introduced by the University. This low-growing series has become quite popular and the new introductions broaden the range of flower colors available.



MINNGLOW (Minnwhite Sport #1) is a uniform, vigorous cushion type that produces a prolific cover of light, lemon-yellow blooms with darker yellow centers. The 2¼-inch flat decorative flowers have good keeping quality and above average frost resistance, even though they are a bit soft. Flowering usually starts in mid-September in the Twin Cities area. When grown in full sun, the plants reach a height of 12-15 inches and a spread of 24 inches. Foliage is clean and a rich green color. Minnglow originated as an induced sport of Minnwhite.



MINNYELLOW (Minnwhite Sport #2) produces rich, lemon-yellow colored, flat decorative flowers on compact cushion type plants. The abundant 2-inch double blossoms hide the clean, green foliage. Bloom in the Twin Cities area usually begins about September 20 (approximately 1 week after Minnglow). Plants grown in full sun reach a height of 10-12 inches and a spread of 20 inches. Once open, the flowers hold up well even though they are a bit soft. Minnyellow originated as an induced sport of Minnwhite.

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