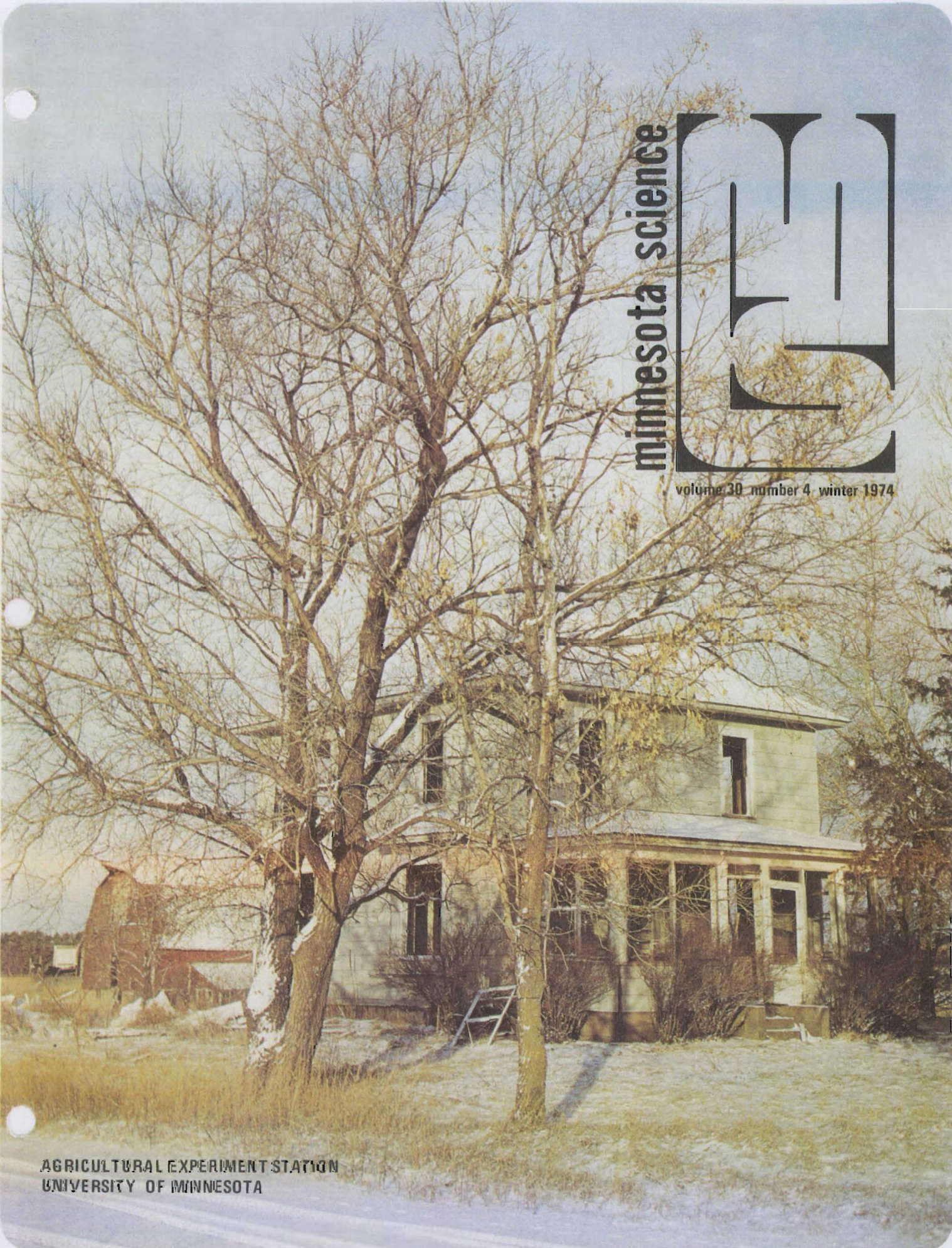


minnesota science



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AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF MINNESOTA



Interview with the Director

Minnesota Science asked the Director of the University of Minnesota Agricultural Experiment Station, Dr. William F. Hueg, Jr. about the world food situation as it relates to recent changes in what is now the Institute of Agriculture, Forestry, and Home Economics (Hueg is the institute's new dean).

Q. *Do you foresee an alleviation of the world food crisis?*

A. The simple equation of population increase times the availability of dollars and the conscious effort of governments around the world to improve the dietary levels of their people would indicate that this is not a short-run situation.

Q. *With the increasing demands for more food, should agribusiness put aside environmental concerns?*

A. No. The high demand for food production domestically and around the world must be accomplished within an environment of energy shortage as far as the fuel, fertilizer, and pesticide inputs, as well as certain constraints through legislation to maintain if not improve the environment at its current levels, are concerned.

Q. *Would large reductions of farm applications of fertilizers and other agricultural chemicals—which require considerable energy—help to offset oil imports and help the national and state economies?*

A. No. The reverse would happen. A recently-completed research program in the Department of Agricultural and Applied Economics indicates that, nationally, each additional dollar spent on pesticide materials returned about \$6 of additional farm output. An additional dollar spent on fertilizer materials returned between \$4 and

\$6 of additional output. On a national basis, a reduction in the use of fertilizer would increase the price of raw agricultural products about one-third. Similarly, a 75 percent reduction in pesticide-use would increase the price of raw agricultural products about 20 percent. Figures of this magnitude not only indicate the impact of the industry but the importance of research which undergirds it.

Q. *Do you—as the new Dean of the Institute of Agriculture, Forestry, and Home Economics—see a new focus for home economics research?*

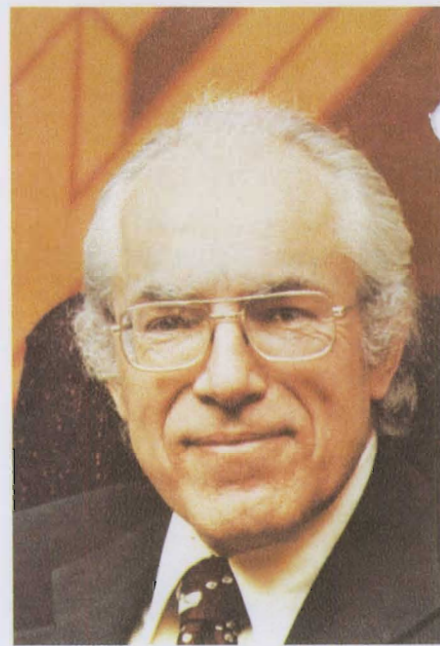
A. There is new focus on the family and the institutions which impinge on the family. Too little study has been done on family structure and action. The College of Home Economics is geared through its Departments of Family Social Science, Textiles and Clothing, and Housing and Design to address itself to these critical areas of society. The move of the Center for Youth Development to the College of Home Economics gives us a greater potential for impact on family development and understanding the multiplicity of factors involved.

Q. *Do you foresee any change in the emphasis of forestry research?*

A. The importance of our land resource—perhaps 1 of the greatest national assets—and its appropriate use for food and fiber production, as well as serving the recreation and development needs of all segments of our society, is critical. The College of Forestry along with the several departments in the College of Agriculture have been addressing themselves to policy development and adequate use of this land resource base. However, more intensive study must be done in cooperation with local communities, the state planning agency, and other groups if we are truly to use this resource to its greatest advantage to service all society.

Q. *How does research of the Minnesota Agricultural Experiment Station keep pace with the needs of Minnesota citizens?*

A. Our program must be undergirded by strong fundamental research which can move quickly into applications. Budget increases would counter the ravages of inflation by strengthening existing programs, while at the same time providing modest program expansion, making it possible for the Minnesota Agricultural Experiment Station to better serve the citizens of our state, region, nation, and the world. Relationships of the research



efforts of the experiment station and the economic development and improved standard of life for all citizens are closely intertwined.

Q. *For such services, and to keep the institute's research program productive and responsive, what kind of request is being made to the 1975 legislature?*

A. We all are aware of the effect of inflation. Research programs have been influenced also. We have lost more than 25 percent of the original purchasing power of the funds appropriated for the current biennium. (See page 14 for the FY 1974 financial statement.)

The regents of the University of Minnesota have approved a budget increase request of \$1,929,400. About two-thirds of this will cover the losses from inflation and the program reductions through retrenchment over the past 4 years. The request will make it possible to make better use of physical facilities already built. It will also make it possible to strengthen programs now existing, but needing additional technician and graduate assistant help.

Although the request is large, it is only a fraction of the income from the important 6 billion dollar agribusiness complex. It is also a very small part of the already large return from 1 research development: Era wheat. Funds appropriated for research return several-fold. Agriculture and related research is 1 of the important engines of the economy.

Q. *How important are increases in state funding?*

A. Before going into the specifics of funding, it is important to establish a

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Cropland loses nutrients as ground water carries them underground into tile lines.

Cutting Nutrient Loss Through Tiles

What happens to fertilizer nutrients after they have been applied to tile-drained soils?

How can a farmer cut down on the amount of nitrogen which escapes from the soil and through tile lines?

University of Minnesota scientists have begun unique field experiments to help answer these questions.

Many studies have shown that nitrogen, and to a much lesser extent phosphorus and potassium, may be lost as water seeps through soils and into tile lines, say UM soil scientists. But until now, few experiments have been conducted which show how much of the applied nutrients may be lost through tile drainage.

"For some time there has been an awareness of the fact that scientists have a very poor handle on what happens to many of our nutrients applied in the field," says Wallace W. Nelson, Superintendent of the UM Southwest Experiment Station at Lamberton.

One of the most important of these nutrients is nitrogen. Nitrate-nitrogen is the form of nitrogen that readily moves through the soil and may be lost into drainage water. Nitrogen is a key nutrient in many fertilizers, of course, but it is also a natural product of decomposition of organic matter. This fact has been put to good use by farmers, perhaps as long as there has been farming. Since nitrogen is

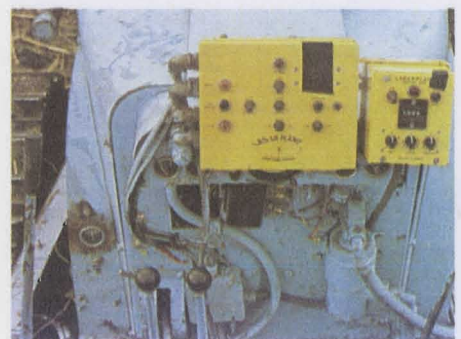
essential for growing plants, any nitrogen loss becomes a problem for the farmer, says the UM scientist.

"Nitrogen loss causes great concern, both from production and environmental standpoints," says Nelson.

"To maintain optimum yields, 20 to 40 percent more nitrogen must be added to many soils than is removed in the corn grain at harvest," says Gyles W. Randall, UM soil scientist at the Southern Experiment Station at Waseca.

"Having to use fertilizer at such high rates in order to maintain yields is not only an inefficient use of a scarce and expensive resource but it also raises questions concerning nitrate contamination of ground and surface waters," says Robert G. Gast, UM soil scientist at Saint Paul.

This laser computer guided the laying of tile.



Some studies indicate that such inefficient uses of nitrogen are due to denitrification in the surface soil with relatively small losses through tile drainage and downward leaching.

When fertilizers are denitrified, the nitrogen escapes into the air as nitrogen gas and other breakdown products.

"There is considerable uncertainty as to the amount of nitrogen losses since most research results have been based on indirect evidence rather than direct measurements of nitrogen losses from tile drains," says Gast.

To help resolve this uncertainty concerning the loss of fertilizer nutrients, University of Minnesota soil scientists from Saint Paul, Lamberton, and Waseca initiated new studies: They set up experiments to accurately measure nitrate concentrations and flow volumes from well-defined land areas.

"In 1972, we established a set of plots referred to as the Nutrient Movement Plots at the Southwest Experiment Station," says Nelson.

"A new approach was used in setting up these plots which I believe makes them the only plots of this type in existence at this time."

Randall describes the unique closed systems used in the plot design at both stations:

"By using the enclosed system, and by channeling all subsurface drainage waters through the collection stations, we can monitor both flow rate and nutrient concentrations as they are influenced by nitrogen application."

The Waseca experiment was set up in 1974, in a manner similar to that of the Lamberton site:

"We want to eliminate outside influences such as lateral movement of soil water from 1 plot to another," points out Randall, "so each plot is encased in polyethylene plastic to a depth of 5 to 6 feet."

A laser-guided bulldozer lays plastic tile.



The scientists designed the 45- by 50-foot plots so that they would accommodate field-sized equipment.

"This design gives 18 rows of corn across the plot," points out Nelson. "We chose the 50-foot length so that a tile line could be placed across 1 end of the plot. This gives us our recommended tile spacing of 90 to 100 feet between tile lines."

The Minnesota scientists applied urea at rates of 0, 100, 200, and 400 pounds of nitrogen fertilizer per acre.

"In addition to these nitrogen rates," says Nelson, "we kept a complete inventory of all materials applied, such as fertilizers, insecticides, corn, and herbicides."

If nitrogen is a currency of the future, and some economists say it is, then the term soil bank takes on new meaning. The Minnesota scientists point out that the amount of nitrogen applied to soils is much less than the amount of nitrogen stored in soils.

"Approximately 8 to 10 thousand pounds of nitrogen, per acre, is tied up in the organic matter of the soil," says

Workers line a University of Minnesota Nutrient Movement Plot with a plastic barrier.



Nelson. "To some extent, of course, this nitrogen can break down and be utilized by plants or released into tile lines."

Rainfall brings another 6 to 10 pounds per acre per year in Minnesota, he says.

"So, even though soils may not have received nitrogen from fertilizers or legumes," says Nelson, "there may still be some release of nitrates into the tile line drainage from organic matter."

This is illustrated by early findings of the UM researchers: During the



A culvert to be used as a water collection pit is placed in a Nutrient Movement Plot.



Workers backfill a UM Nutrient Movement Plot.

first year of their investigation at Lamberton, they found from 10 to 20 parts per million of nitrate in the tile drainage from unfertilized soil. The nitrate levels varied, depending upon the time of drainage.

"Ten or more parts per million of nitrate-nitrogen is not unusual in Minnesota tile drainage," says Randall.

"However, total losses from tile lines at Lamberton, in 1973, were only about 5 pounds of nitrate-nitrogen per acre," says Gast.

This small nitrogen loss, he says, was a result of a low total tile flow during the 1973 season: Only about 1.5 inches of rain water, out of a total annual precipitation of 26 inches, got through to the tile.

What affect does fertilization have on nutrient content of tile drainage?

"Both the flow volume and nitrate concentrations increased in 1974, naturally resulting in significantly greater total nitrogen losses," says Gast. "However, these nitrogen losses were much less than the amount of fertilizer-nitrogen not taken-up in the corn grain."

Nelson adds that, "In 1974, after 1 year of fertilization, the nitrogen losses per acre increased, but not until the amount normally recommended had been greatly exceeded."

What is the total contribution of both fertilization and natural soil processes on the nutrient contents of Minnesota tile-line waters?

The Minnesota preliminary findings show that:

- Moderate fertilizer applications do not appreciably raise nitrogen loss through tile lines.
- Excess fertilizer applications do increase nitrogen losses through tile lines, but not near to the extent previously believed.

Since the Waseca and Lamberton experiment station sites vary in annual rainfall and drainage, the University of Minnesota soil scientists are hopeful they will gain additional information which can be used in making more efficient use of fertilizer materials while minimizing possible burdens on the environment. □

A Losing Battle: Public Right to Knowledge

ROY E. RICKSON
Assistant Professor, rural sociology

People of the United States have lost much of their power to control and solve problems.

Why?

One reason for the loss of power is the impotence of many public voluntary organizations; but also, it is difficult for the public to gain access to vital information.

The public has become increasingly dependent on scientific information needed to deal with problems such as housing, health, food supply, and pollution. However, scientific research akin to industrial production has become highly concentrated and dependent on the resources of a few. Most research funded by the federal government has been for national defense, space exploration, and atomic energy (see graph 1). Corporations invest in research primarily for product development. Consequently, public concerns such as housing, pollution, and environmental deterioration receive little attention.

When deciding how to heal social woes we often assume that wise decisions require scientific knowledge. But too often, the public is unable to get useful scientific knowledge for decisionmaking either because the appropriate research has not been done, or the appropriate knowledge is not available. Critical gaps in knowledge about important public problems are now apparent.

Although the public has given responsibility and authority to scientists and engineers, the public has grown relatively weak in its ability to influence the nature and direction of scientific and engineering research. Instead of problems of the people, the problems which are investigated are the problems which concern the centers of power, such as modern industrial corporations.

Where decisionmaking is in the hands of a few, money is spent on

problems which the few think are important. Concentrations of power in a society is a serious impediment to societal development. Comprehensive development requires:

- An interest, not just in economic production and profit, but also in environmental quality and other publicly-oriented problems.
- A way in which citizens can participate so that their needs can be brought to the public forum.

Knowledge is Power

The US has highly sophisticated knowledge and technology which are geared for industrial production, defense, and space exploration. Yet, the US seems incapable of effectively dealing with other problems which are not directly related to goals of industrial corporations or a few public bureaucracies. We know much about how to produce, but relatively little about how to conserve. When we try to deal with critical problems—such as energy, fertilizer, or food shortages—we typically find that our technological knowledge is highly limited or undeveloped. We have a very difficult time getting useful current information. In this context, knowledge is power—power, as the ability of a person, group, or any social unit to control events so that outcomes favor them. Alternatives for development depend upon knowledge which is communicated, and defined as important. Groups who control knowledge, therefore, control the perception and the realization of alternatives for development.

Organizations: Generators and Gatekeepers of Knowledge

It is in the management of knowledge to meet organizational goals where power lies. Managers, who may also be scientists or

engineers, direct research and coordinate the work of technical specialists to meet problems of production, competition, or other goals. A basic function of the large corporation and agency is the coordination of specialized knowledge to meet their goals. They must create new knowledge as well as extend or develop what is known.

Scientific and engineering subsystems also create and improve technologies. As social structures they create knowledge, gather and store information, and apply it to present circumstances. Ideally, feedback from the environment readily enters the structure and influences decisionmaking. However, when the public has a limited influence, then many public needs are not properly met.

Knowledge for Whom and for What?

Professional scientists and engineers enjoy considerable autonomy, and power, but only so long as their work contributes directly to their organization. Basic research and knowledge maximization—a central goal of the scientific community—is not highly valued by industrial corporations.

Scientific knowledge can be used as a means of conflict, rather than enlightenment. Knowledge can be suppressed, and research design of experiments—and even scientific testimony—manipulated.

The public is best served when scientific information is made public. Large organizations have the resources necessary to sponsor research and contribute greatly to our storehouse of knowledge. However, they also have the capacity to conceal information which conflicts with their main goals.

Some experts are pressured to fashion their testimony to meet either their company's, or another group's, goals. Some professional associations closely related to given industries censor research and publication of topics which are considered detrimental to their industries.

When the scientist is an employee, organizations are sorely tempted to fashion his or her role in a way which reduces the scientist's capacity to contribute to the public knowledge by means of such techniques as:

- *Advocacy*, or taking a position and active involvement with the political strategy of an organization.
- *Legitimizing*, or the sanctioning of ideas or courses of action initiated or proposed by others.

- *Technical decisionmaking*, which includes either research or the implementation of policies already defined as needed by the official order.
- *Idea-initiation*, which entails the introduction of relatively new ideas for consideration or action.
- *Administrative decisionmaking*, a role that is part of the official decisionmaking hierarchy.
- *Professional consulting*, which entails providing advice and information for others in the system without becoming identified with 1 particular alternative.

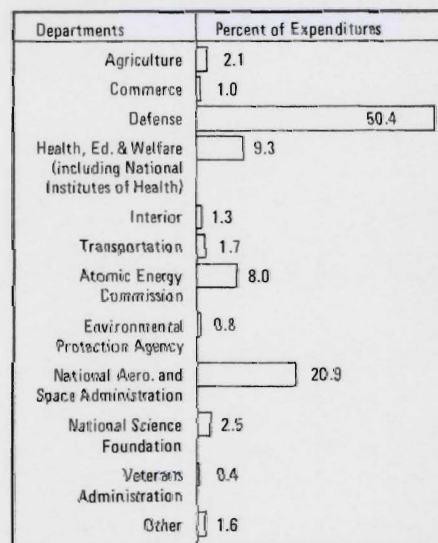
Consulting is one of the most autonomous of those roles yet portrayed:

Ideas of the professional consultant are usually used only to the extent that his contribution fits with established policies. Seldom is the consultant called in before there is the recognition of an occasion for a decision.

Advocates, legitimators, and technical decision-makers can easily find themselves in situations where there is pressure to reveal less than the whole truth about a problem on which they are working. A scientist who occupies an administrative position can suffer special pain: He has the power to innovate; yet he must be concerned with the overall needs of his or her employers. The idea-initiator is comparatively free from these constraints, but lacks the power to innovate.

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Graph 1. Federal Expenditures for US Research and Development by Agency for the Year 1972*



* Federal expenditures for US development and research by agency for 1972 from The Statistical Abstracts of the United States, 1974.

Improving Agriculture and the Environment

Can we have high levels of industrial and agricultural production and, at the same time, increase environmental quality and human health?

These are vital questions for our time and are basic to understanding the direction which our future development is likely to take. Of most importance is that we begin to think about a variety of problems and how efforts to deal with 1 condition can relate to efforts to resolve the other.

In a time when we desperately need to increase world food supply we must not dismiss efforts to maintain and improve environmental quality. The time is past when we can sacrifice environmental quality for the sake of industrial or agricultural production. Although we tend to think of the goals of environmental quality and production as contradictory, evidence is mounting that they are closely linked. This is particularly true of water use and water quality.

There is concern that water contaminated by certain chemicals used in agriculture cannot be used for irrigating other crops, and that chemicals like those found in some pesticides (DDT, chlorodane, malathion, and parathion) are injurious to human health. Research on conservation of water and improvement of its quality is important for industry and agriculture. Minnesota can ill afford to neglect its relatively clean air and water.

Experts at the recent World Food Conference, in Rome, warned that the efforts to expand world food production depend on whether we can find new sources of water and improve conservation of water already available. Lester Brown, an economist and adviser to the conference said, "In the near future, the lack of fresh water rather than of land may be the principal constraint on efforts to expand world food output."

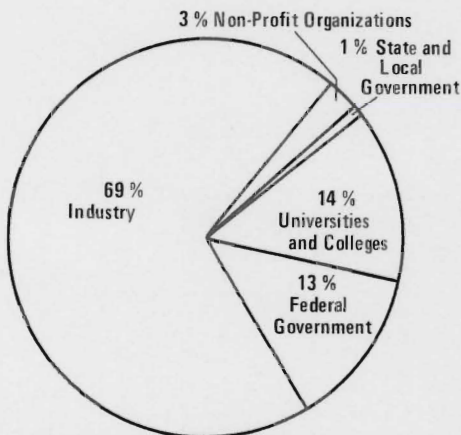
Our society has become increasingly dependent on science and scientific research to handle its problems. At the same time, scientists and other technical experts have become increasingly dependent on the resources of a few very large and powerful industries and government agencies. The goals of these organizations direct most of the research work in the US (see graph 2). About 70 percent of the engineers and

30 percent of the natural scientists are employed by the largest US industrial corporations. The US Department of Defense, in 1972, spent 50 percent of the total federal expenditures for research in that year. Agriculture's share was about 2.2 percent and even less was allocated to problems of environmental quality. Research in agriculture was primarily directed toward increasing yields with much less concern for analyses of agricultural practices to reduce pollution. Consequently, environmental problems received relatively little attention even with the environmental movement.

Production-oriented research teams that are in manufacturing and agriculture have not until recently investigated the affects of production-oriented measures on environmental quality. This is as true of product development and pest control as it is of atomic energy research. It is curious that we continue to pay so much more attention to production than to conservation, because it is becoming clear that conservation of water, land, and air is necessary for production. We are beginning to discover, however, that production and environmental quality are not polar opposites, but related to each other. We cannot plan for rapid increases in food supplies, for example, unless we have ample supplies of good water. The world's problem is how to get enough water of acceptable quality or to improve bodies of water already contaminated.

Minnesota's continuing challenge is to preserve its water quality. The

Graph 2. Percentage Distribution of Natural Scientists and Engineers Employed in the US*



*Approximate percentages of the scientists and engineers in research and development in 1970.

relationship of environmental quality to industrial production is an important part of the answer. The link of environmental quality to food production is a mutually vital link. The picture is further complicated when we understand that, with respect to water, industrial manufacturing is the leading US source of controllable man-made pollutants. The second-ranking pollutant is domestic waste, and the third is urban and agricultural runoff. Compared to agricultural or urban wastes, industrial wastes are often more toxic and potentially more injurious to plants and animals when the pollutants are deposited in water supplies.

We have a particularly knotty problem as we begin to realize that industrial manufacturing, agricultural production, and environmental quality cannot be neatly separated. These goals have equal merit and should be considered in any model of social and economic development. This considerably complicates our planning; for without these considerations we run the risk of creating greater problems than we have. We must have a conception of the interdependence of quality and production before we plan. We certainly must understand the difference between single and multipurpose planning and development.

Multipurpose planning should be a basic part of any state or national effort. Assuming that power plants exist simply to produce power, factories to produce goods and profit, dams to store water, pesticides to kill pests, and highways to move automobiles, are typical examples of assumptions used in single-purpose planning. Multipurpose planning requires, however, considerations of the relationships of production, environmental quality, and health.

Even though we must increase agricultural productivity, we must be very careful how we do it. To use production technology with no concern for its side effects is to repeat mistakes which are largely responsible for present problems. Environmental quality is a factor relating industrial and agricultural production. Neglecting quality can, in the long run, impede production. Clearly, agricultural and environmental research and knowledge cannot be tied to a single set of goals if this nation's problems are to be reasonably met. □

Women's Changing Sex Roles

DIEDRE NAGY

Instructor
Department of Information
and Agricultural Journalism

Woman is the homemaker and child care provider.

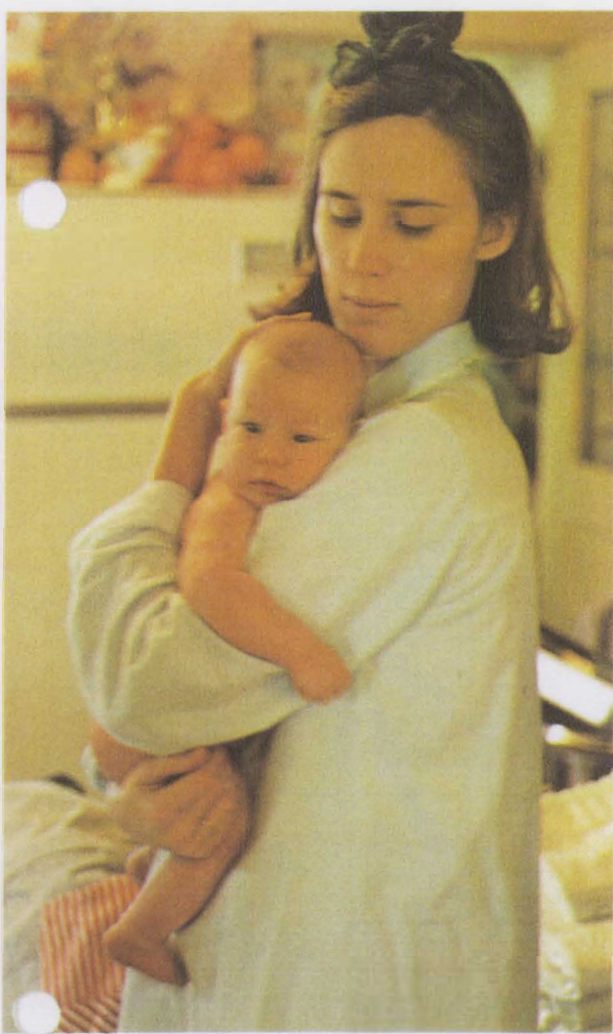
Man is the breadwinner and warrior.

These traditional ideas of sex roles are coming under attack from women's movement activists who claim the roles are myths used to justify discrimination against women. Differences of roles—based on sex—may no longer be necessary to insure human survival in many modern cultures, yet job and role differentiation based on sex has been common to all societies, according to Paul C. Rosenblatt and Michael R. Cunningham of University of Minnesota's family social science department in the College of Home Economics.

Most researchers in the sex-role field are American or European males with varying biases, caution Rosenblatt and Cunningham who believe they have confirmed the existence of certain cross-cultural consistencies in sex roles across the globe.

What similarities could exist in cultures as diverse as African tribes and industrialized United States?

Physical strength differences that favor a division of labor between the sexes and the linkage of females to child care are among the similarities



A mother holds her second baby.



After bass and pike, this young woman starts on a dawn trip to a fishing spot on the Mississippi River at Red Wing, Minn.

which Rosenblatt and Cunningham open to question:

"In every society there is some division of labor by sex," says Rosenblatt. "Such differentiation by sex can be seen to have functional utility. People who are dependent upon each other are more closely bound together."

What seems essential in a family, or other social unit, is not that males do one thing and females do another but that different people do different things, point out the UM scientists.

Child Care Causes Differences in Sex Roles

In nearly all societies child care is predominantly a task for women and is one of the most basic sex roles, say the Minnesota researchers. Although normal pregnancies and deliveries pose few restrictions on the kinds of work women can perform, most mothers in most societies nurse their babies. Of course, to breast-feed, mothers must stay near home or transport a child to the work site, unless wet nurses are used.

"As long as a woman nurses, it seems much more convenient for her to stay near the child than for the

child to travel with her," says Cunningham.

A typical woman might, because of nursing, experience 8 years of reduced mobility, say the social scientists. This has been a powerful factor in producing sex-role differences between the sexes. A nursing mother's limited mobility has reduced the ease with which she can do most fishing, hunting, herding, long-distance trading and war-making; so these activities typically have been done by men.

Safe alternative sources of protein, such as pasteurized cows milk, are among important developments which allow mothers to leave their babies and little children at prolonged intervals of time.

But even after they are weaned, children naturally have restricted their mother's mobility. Children in primitive cultures do not enter school at age 5, or 6, as they do in most modern countries. The tasks of supervising both younger children and older children most often fall to women.

Sex and Strength

Physical strength differences between men and women may be given

more credit for sex-role differentiation than is realistic, say the Minnesota scientists.

"Work that is most frequently done by males includes tasks requiring strength," says Rosenblatt. "Men also do almost all the fowling, fishing, and butchering, as well as the collecting of honey. Women generally fetch water, often in containers big enough to require great strength."

Rather than strength, it is the mobility and the ability to withstand the interruptions necessary for child care which seem to be the keys to sex-role-related tasks, say the Minnesota social scientists.

Leaders in the women's movement in the US who complain that the sexes are afforded unequal status are supported by conclusions in the Rosenblatt and Cunningham survey of cross-cultural research of sex roles.

"Around the world it seems to be very much the case that men have higher public status than women," conclude the UM researchers. "Men typically are the formally-recognized heads of domestic groups and are more prominent in religious and judicial activities. Where men and women have access to desirable things, women seem to get less than men."



Nurses help a mother as she leaves the hospital with her first baby. Prepared baby foods, such as the bottle of "formula" which she holds, have helped to liberate new mothers. Farmers -- especially dairy farmers -- have played an essential role in women's liberation.



An editor, left, and a secretary discuss the format of an agricultural brochure which they are creating.



A Minnesota assistant in home economics uses hand-puppets to teach nutrition.



A home economics assistant helps needy families to stretch their budgets.

Compared to men, women have less access to alternative sex partners and less opportunity to live close to their kin, say Rosenblatt and Cunningham. Many more societies allow men to have more than one wife than allow the reverse.

But women may interact and compete primarily with other women, and men with men, so that in many societies women may not perceive themselves as of lower status or feel exploited, because of the balance of rewards to each sex. In fact, women may ordinarily accept a system in which their own public status is linked to the status of the males in their lives. Of course, this very fact is held in contempt by activists in the women's movement.

Traditional Power of Women

Even in societies where men have much more power and status than women, say the Minnesota scientists, women seem able to hold their own on the domestic scene. Division of labor and separation of the sexes give women spheres of authority within which they have considerable control. In some societies women also have power over men in their ability to do things that could publicly dishonor men. Women have their control of sexual relations and their influence on children and kin.

Domestically, the balance scale weighing men against women is more

nearly equal than a casual look at many cultures would suggest, say Rosenblatt and Cunningham:

"We can expect males in many societies to take advantage of their greater strength, or ability, in fighting. Both sexes exploit the dependence of one spouse on the other spouse's work, sexuality, and kin relations. Women exploit their relations with children."

Women's Changing Roles

Women's traditional roles are changing in some societies. Rosenblatt and Cunningham cite factors such as increased educational opportunities, increased income, containerized baby feeding, effective birth control and labor-saving inventions as reasons for recent shifts in women's roles.

They conclude: "Women's status may seem low from a Euro-American point of view. But even where women's status and power seem quite low, they still have a great deal of leverage in domestic relations. *

"Perhaps the crucial sex differences are men's aggressiveness and women's roles in childbearing and child care. Any sex-role revolution must deal with these, though the plasticity of the sexes seems quite enough to allow for sex-role revolution of almost any sort." □

* Results of this review are scheduled to be published in 1975 in *Explorations in Sex Differences*, J. Archer and B. B. Lloyd, editors, Harvester Press of Sussex, England, publisher.

continued from page 7

To Create Change, People Must Gain Knowledge

The public must know "what is" before it can begin to deal with "what should be."

It is through the contribution of modern science that we now know more about nature than we did in the past. The public, however, knows less than it needs to know for effective citizen input into decisionmaking.

When an issue reaches the public forum and groups are participating in the issue, knowledge comes out which might not otherwise be revealed. A recent UM study of Minnesota communities faced with serious environmental problems showed this. The public was more knowledgeable about issues in communities high in conflict than in communities where there was relatively little conflict. Also, as community members became more involved in the issue, their knowledge increased. They knew about all sides of the issue.

Local conflict and controversy can be a major factor in educating local citizens about issues and stimulating their involvement. The same logic can be applied to societies. It has been the conflicts between industries, agencies, and conservation groups that has allowed the knowledge we have about the extent of pollution and possible solutions to pollution. In this sense, knowledge distribution depends upon the distribution of power. Knowledge itself becomes an adjunct to power if a group is organized so that it can develop and use selected knowledge. When issues can be handled as they arise, rather than ignored or submerged for a long period of time, then conflict and participation tends to bring our problems to light rather than to create divisions and blocks in communication. This, of course, requires a sharing of power among groups in a community or society. Pollution did not become an issue until environmental groups were of sufficient strength to bring the nature of the conditions to the public and influence government action.

Scientists, as professionals, have the responsibility of defining reality as they see it no matter whose biases may be threatened. Organizations employing scientists have the responsibility to allow their scientists to freely communicate knowledge vital to public needs. It is in this way that the public learns, societies develop, and democracies survive. □



Highways, so vital to today's transportation, have taken up millions of acres of land while giving easy access to the countryside.

Good Farm Land: Under Threat

JOHN M. SPERBECK
Associate Professor
Department of Information
and Agricultural Journalism

Good farmland is becoming a high-priced endangered species of the land market.

Farmland prices tend to spiral upward as non-farmers buy land for inflation hedges and tax shelters.

Urban areas encroach upon farmland. Single-family houses and high-rise buildings virtually rob croplands. For example, in one case, a house was built in the middle of a corn field. The house was ready to move into before the crop could be harvested.

Much more than buildings threaten farmland. But most of these threats have in common one factor: Higher prices.

Ribbons of concrete highways—which doom soil to suffocating darkness—do more than take up millions of acres of land. Highways, as well as skyways, give urbanites easy access to nearly any pasture or stream. Few fields are completely safe from becoming high-priced construction sites, or from being bid up by non-farmers.

Land-use has become the number one environmental issue, according to William F. Hueg, Jr., deputy vice president for agriculture, forestry, and home economics at the University of Minnesota:

"Land is our greatest national asset, but we still don't have a good national or state policy on land-use.

"Land-use problems must be solved if we're to meet demands for domestic and world food production in the remainder of this century."

Agreeing with Hueg is Russell W. Peterson, chairman of the US Council on Environmental Quality:

"... The debate over land-use policies has become a major issue throughout America."

Stalemate and continuation of land-use policies that everyone agrees are unsatisfactory are too prevalent, says Peterson.

"National land-use legislation is essential and should be a top priority," he says.

Even though farm land is being used for non-farm purposes, there is much potential farm land not being farmed.

Although prime agricultural land is not to be squandered, the US Department of Agriculture's director of agricultural economics, Don Paarlberg, pointed out that the world is not yet farming even half the cropland that could be cultivated:



A graveyard of junked automobiles surrounds a barn and fills farmland on this plot south of Rochester.

A distant farm appears to be a last foothold against the advance of modern houses.



Businesses and houses compete for land.

"About 3.4 billion acres are being cultivated out of a possible 7.8 billion," Paarlberg said in a recent statement before the Department Operations Subcommittee, Committee on Agriculture of the US House of Representatives.

"This total acreage includes only the land getting enough rainfall so a crop could be made, and only the land within 50 miles of a possible means of transportation."

However, the land not now farmed is less productive than land now in use, pointed out Paarlberg.

"But new technology rather than new acreage is the real growing point for agriculture," said Paarlberg. "The modernization of agriculture means that the sheer volume of land assumes declining importance while use of man-made inputs becomes instrumental."

Cities Affect Farmland Values

"No part of rural America today is outside the zone of urban influence on land values," says Philip M. Raup, agricultural and applied economist at the University of Minnesota.

"Fast air and road travel translate urban demands for rural lands into a leapfrog pattern that can impinge on the most remote and isolated places."

The demand for space has acquired a high priority for consumers in an affluent, urbanized society, says Raup. The market incorporates these urban demands into the value structure of rural lands far in advance of any real need of land for rural expansion.

"A few random sales of farm land at residential-lot prices bids up the price-expectations of all farm land owners in a wide area, even though their lands may be years and miles away from any realistic opportunity to sell at these prices," points out the UM scientist.

"These higher levels of rural land prices are built into the farm capital, tax, and debt structures. The next generation then must take over an agricultural plant that is over-capitalized by any test based on net earnings. In this way we've generated an inflated structure of rural land values."

Some rural property owners derive satisfaction from land value increases even when they had no relation to

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perspective from which the requests for increase were made. Minnesota ranks fifth in cash farm income when compared to other states in the nation. About 35 percent of the economic wealth of the state is generated from agribusiness. About 28 to 30 percent of the employment is provided by this industry and approximately 23 to 25 percent of the personal income is generated from this industry. The products of about 1 in 4 of our crop acres are exported. We have 25 million acres of prime agricultural land devoted to field crop production (corn, soybeans, wheat, oats, barley, and alfalfa). The strength of our agricultural industry is based on a strong livestock-crop economy. Each is dependent on the other with a fair segment of crop production being available for export. We believe that more of the commodity should be processed in Minnesota to benefit from the multiplier-effect of the processing of raw materials. Essentially, all of the departments within the College of Agriculture as well as the program in the College of Veterinary Medicine address themselves to this important industry.

In recent years the legislature has responded generously to the requests of the institute in providing excellent facilities to carry out the teaching, research, and extension programs. Built into all of these requests was implicit the understanding of not only continued but increased program support as the facilities came on line. The program increase as presented

should provide the program needs in the space provided through the excellent building program. This is especially true in the areas of the muscle biology and meats program, the food science program, the plant sciences as represented by agronomy and plant genetics, horticultural science, and plant pathology. If the state is to get the full benefit from the funds already expended for construction of these excellent facilities, then the program requests are modest indeed.

The present fund surplus of the state treasury, in major part, has been generated from the increased farm output of the last 2 years coupled with very favorable prices for raw agricultural products. If this industry is to maintain its level of productivity, it is essential that public dollars be plowed back into research programs such as described in this request.

To this point we have discussed the need for increase. Research is an investment, not a cost. An expenditure of \$300,000 developed Era, a hard red spring wheat, grown on 45 percent (900,000 acres) of the wheat acreage in 1973 and 65 percent (1,600,000 acres) in 1974. The average yield over other varieties is 5 bushels per acre which resulted in over \$26 million more income to farmers in 1973, and nearly \$40 million more income to farmers in 1974. This meant that an additional \$20 million was realized in communities' and the state's economy. It also meant 270 million more loaves of bread in 1973 and a potential of 460 million more loaves in 1974. □

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land productivity or farming profits, continues Raup. But such land price increases have contributed to a false sense of well-being, to an inflated net-worth account, and to borrowing on a scale that could only be justified by liquidated values and not by earnings.

"In an era in which enlightened credit policy calls for a shift away from emphasis on the junk value of collateral and toward more stress on management ability and earnings potentials," says Raup "we have a land value structure that propels farmers powerfully in the opposite direction. Farmers are encouraged and forced to bring these inflated land values into their capital accounts, with results that can ultimately be disastrous, not only for farmers but for the nation."

This nation's property tax system has invited "misuse as a guide to land-planning decisions," says Raup. "Property tax policies can't be judged independently of income tax policies, particularly those policies that affect taxation of capital gains."

The differential tax policy, intended to preserve agricultural land, invites nullification by the way we treat capital gains, he says.

"As long as a lower property tax burden creates a potential for an increased capital gain upon sale of the property, we can expect ultimate failure of use-value assessments as a device to protect and preserve agricultural land," says the UIM economist.

A Call for Land Judgements

Some land is highly productive only with heavy expenditure of fertilizer, petroleum fuels, and agricultural chemicals, says Raup. We need a "conservation of energy" classification system for judging lands to help protect rural lands and open space.

"We're beginning to realize that land productivity which depends heavily on energy inputs from fossil fuels is inferior to an equal level of output derived without making heavy demands on stocks of exhaustible resources," says the Minnesota researcher.

This classification scheme could be a variation of the land-use capability classification system established by the Soil Conservation Service. Under the SCS classes, top grades of agricultural land are those that need little or no application of soil-conserving practices such as contour plowing and strip cropping.

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FINANCIAL STATEMENT MINNESOTA AGRICULTURAL EXPERIMENT STATION

Research Fund Expenditures
Year Ended June 30, 1974

Expenditures by Source	Percent	Amount
Federal Funds	12.4	\$ 1,744,339
State Appropriations	67.1	9,475,285
Gifts and Grants	7.5	1,053,115
Fees, Sales, Miscellaneous	13.0	1,829,238
Total	100.0	\$14,101,977
Expenditures by Object Classification		
Personal Services	68.9	\$ 9,710,036
Travel	1.8	249,823
Equipment, Lands, Structures	4.7	671,854
Supplies and Expense	24.6	3,470,164
Total	100.0	\$14,101,977
Expenditures by Location		
University of Minnesota-St. Paul	83.0	\$11,701,326
Branch Stations—within Minnesota	17.0	2,400,651
Total	100.0	\$14,101,977



Science Notes

FARM OPERATORS: STAY LOOSE

A University of Minnesota agricultural economist gives this advice to farm operators:

"To survive they must stay loose and be prepared to live with further general price inflation and sharp farm product price fluctuations that are completely unpredictable," says Willard W. Cochrane, agricultural economist at the University of Minnesota.

"To do this, I suggest:

"—Hold your debt position to the very minimum.

"—Maintain a large cash reserve—stay liquid.

"—And watch out for a major product price decline in the next 2 to 4 years when we happen to hit good crop weather all around the world in the same year."

BLUEBERRY RESEARCH FOR MINNESOTA

The first intermediate-size blueberry bush may be available for commercial and home use within 4 or 5 years if UM horticultural scientists have their way.

In about 5 years pick-your-own blueberries may be a growing industry in northern Minnesota, says Cecil Stushnoff, Minnesota horticulturist. Much the same as pick-your-own strawberry enterprises, already found in Minnesota, consumers would go into the fields, pick the berries, pay for their haul and take them home. The large flavorful berries produced by the intermediate-size bush developed by University of Minnesota researchers would be particularly attractive to consumers.

The intermediate-size blueberry bush is unique, says Stushnoff: The intermediate-size blueberry bush is the right size for Minnesota with its -25 degree and colder winters that seriously damage the taller bushes that can be grown successfully in more moderate climates of the United States. The low, wild blueberry bushes native to Minnesota do not produce as abundant or as large fruit for the fresh-fruit industry as what has been found to

date on the intermediate bushes at the university's Sand Plain Experimental Field, Elk River, and North Central Experiment Station, Grand Rapids.

HOLSTEINS TAKE TO POTATO SCRAPS

Potato wastes can be good for growing dairy animals. But preservation of potato-processing wastes, until fed, is essential in maintaining a high-quality feed for livestock, say George D. Marx and Eugene C. Miller of the Northwest Experiment Station at Crookston.

Waste potatoes include the cull potatoes unsuitable for human consumption, peelings, off-flavor French fries and potato chips, and other residues from the processing of potato flakes and instant potato mixes.

Chaff—or combine wastes—used to mix with the potatoes to lower the moisture, is a feed that is normally wasted in the field, say the UM researchers. The chaff was obtained when harvesting oats and wheat and consisted primarily of leaves, light kernels that normally blow over the sieves, some straw, and weed seeds.

The Minnesota scientists' findings include that:

- No problem was experienced in getting Holsteins to eat potato waste mixtures. However, animals should start on feed gradually to avoid upsetting the rumen flora.
- Potato waste-chaff mixture was an excellent feed particularly from the standpoint of cost advantage. In the UM trial, the performance of potato-wastelage-fed cattle was equal to the performance of cattle fed low-moisture alfalfa silage.
- Animals made satisfactory gains on potato waste, and carcass characteristics on dairy-beef animals were similar to control animals.
- Potato waste can be used as a substitute for part of the forage or grain fed to growing dairy-beef animals.
- Dried potato meal supplemented with urea proved to be equal to dry barley as a concentrate feed in this study when fed at 8 pounds per day per animal.

- Potato meal has a cost advantage compared to small grains in today's market and is an economical feed if the price does not exceed barley price on an equal dry-matter basis.
- Utilization of potato wastes for feed can eliminate a substantial pollution problem in the potato industry.

BURNED FOREST RECOVERS QUICKLY

David F. Grigal of UM's Department of Soil Science and John G. McColl of UM's Department of Ecology and Behavioral Biology studied the effects of a 1971 fire which burned 15,000 acres of virgin coniferous forest in northeastern Minnesota's Boundary Waters Canoe Area and found that by autumn of the same year the burned area had rapidly revegetated both by seeding and through root sprouts.

"Although the death of vegetation led to changes in the pathways and rates of nutrient cycling, it does not appear that this fire irreversibly disrupted these mechanisms . . .," says Grigal.

In other words, the fire did not permanently halt natural processes. Litter continued to fall and decompose, and plant growth did not cease.

LEGUMES SAVE FUEL

Pasture fertility and maintenance is perhaps the most neglected segment of American agriculture. Research on the development of legumes for interseeding in pastures and forage crops could lead to reduced synthetic nitrogen needs and improved pasture and forage quality and production. For example, an annual application of 100 pounds of nitrogen fertilizer per acre is often recommended by Minnesota agronomists and soil scientists. On a million acres of Minnesota pasture 150 thousand tons of ammonium nitrate would be needed. Yearly manufacture of the fertilizer would require the equivalent 370 thousand tons of coal.



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How do we preserve prime agricultural land?

The place to begin is by re-examining a long-standing policy of subsidies to suburbs, recreational areas, and rural non-farm residences which have insured rapid expansion of urban land-uses onto prime agricultural land, says the Minnesota economist.

What are these policies which have generated an urban explosion at the expense of prime agricultural land?

Taxes which finance highways—mainly fuel and tire taxes—are based on a linear function of distance traveled, says Raup. If one vehicle travels twice as far in a year as another, it generates twice as much motor vehicle revenue tax.

"But cost of these highways is a non-linear function," points out Raup. "In other words, upgrading a 2-lane highway to 4 lanes more than doubles its cost. And to build an 8-lane highway much more than doubles it again. So what we get is new road construction to relieve congestion in the suburban areas surrounding large cities.

"In the past, rural people have supported this tax; but it doesn't help them. You have to move to large towns to get the full benefit of these highway taxes."

Housing Policies Blamed

Housing policies exercise a powerful stimulus for single-family detached homes that require substantial areas of land, says Raup.



Decisions on land-use become difficult when the choices are between living space and crop space.

The GI Bill of Rights gave preferred status to borrowers who sought to build single-family homes.

Savings and loan association policies have encouraged single-family homes, until recently.

Transfer of risk from initial lenders to the federal government was made possible by the Federal National Mortgage Association.

These policies added a still more indirect but massive subsidy to those home builders whose demand for shelter included a maximum demand for associated land, says the U of M economist.

"Income tax policy creates an unintended but very large subsidy for those who choose to build in the suburbs," points out Raup. "By permitting interest deductions on borrowed funds in computing tax liability we give added purchasing power to those in higher income brackets who can afford to buy space as well as housing."

Preferential tax on capital gains in the higher income brackets are much below the rate at which wages and salaries are taxed, says Raup. This has led to speculation in farmland by high-income urban dwellers who are seeking a tax shelter. It drives up the price of farmland out of proportion to its value for agricultural purposes.

Tax exempt municipal bonds are also of particular benefit to suburbs, he says. Approved bond issues typically arise in developing areas. However, it has been difficult to secure voter approval of such bonds in central cities or older suburbs.

Changing these land-use policies will not be easy since large and powerful vested interest groups benefit from them, points out the University of Minnesota economist.

"The time for re-examination is ripe," he says. "These policies were never planned—they just grew. But now their growth threatens to become cancerous." □

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