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ALTERNATIVE AGRICULTURE

Federal Incentives and Farmers' Opinions

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Program Evaluation and
Methodology Division

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February 16, 1990

The Honorable E (Kika) de la Garza
Chairman, Committee on Agriculture
House of Representatives

The Honorable George E. Brown, Jr.
Chairman, Subcommittee on Department Operations,
Research, and Foreign Agriculture
Committee on Agriculture
House of Representatives

In response to your letter of November 1, 1988, we are submitting this report entitled Alternative Agriculture: Federal Incentives and Farmers' Opinions. This study identifies and describes key federal farm program incentives and disincentives that can influence farmers' adoption of alternative production methods. Federal farm program components addressed in the study include commodity price and income support, farm credit, and crop insurance programs.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution of it until 30 days from the date of this report. At that time, we will send copies to interested congressional committees and the Department of Agriculture, and we will make copies available to others upon request.

If you have any questions or would like additional information, please call me at (202) 275-1854 or Dr. Michael J. Wargo, Director of Program Evaluation in Physical Systems Areas, at (202) 275-3092. Other major contributors to this report are listed in appendix II.

Eleanor Chelimsky
Assistant Comptroller General

Executive Summary

Purpose

Farming in the United States is highly productive, yet several emerging health, environmental, and economic problems associated with conventional farming practices threaten its sustainability. Concerns about conventional farming have led to interest in alternative farming methods that may lower health risks, protect farm resources, reduce environmental damage, and improve long-term farm profitability and competitiveness. To ensure that farmers have the flexibility to use a variety of management approaches, particularly those that emphasize low-input, sustainable agricultural methods, the House Agriculture Committee and House Subcommittee on Department Operations, Research, and Foreign Agriculture asked GAO to assess how current federal agriculture policies and programs may contribute to, or inhibit, the use of alternative farm production methods.

Background

Conventional agriculture in the United States is characterized by specialized farms that employ intensive cropping systems and rely heavily on synthetic agrichemical inputs to control pests and enhance soil fertility. A basic strategy of alternative agriculture is the reduction in the use of agrichemical inputs, through the use of diverse crop rotations, integrated pest management, mechanical weed control, and other alternative practices.

Few farms currently meet the goals and practices of alternative agriculture. Some studies have suggested that more farmers are not using alternative practices because they believe profits will be lower, greater management skills are required, or information on practical alternatives is lacking. Also, these same studies suggest that government farm policies and programs may contribute to the reluctance of farmers to adopt alternative practices since they significantly influence farm profits, credit, and insurance availability for farmers.

GAO's study focused on three components of the federal agricultural support system—farm commodity price and income support, farm credit, and crop insurance programs. GAO collected, reviewed, and analyzed existing information on alternative farming methods and federal program influences and conducted in-depth interviews with 74 farmers and farm program officials selected from seven different counties across the nation. Because existing information about farm program influences is fairly limited and GAO examined data from only a small, judgmentally selected sample of farmers in a few locations, these findings cannot be generalized to other farmers or farm areas.

Results in Brief

The farmers GAO interviewed believe that greater management requirements, lower yields and profits, increased weed problems, and federal farm program constraints all create barriers to the use of alternative agriculture. While the federal price and income support programs do not impose direct barriers, they provide strong incentives to grow program crops and to specialize in them year after year. Program provisions reinforce farmers' use of high-input conventional practices and make it economically difficult for them to adopt alternative practices. The loss of program benefits that would result from giving up program crop acreage and using it to grow nonprogram crops in a diversified crop rotation system is a key economic disincentive.

GAO also found no direct evidence that farmers are denied access to federal farm credit and crop insurance because of the use of alternative practices. However, these programs do place greater emphasis on conventional farming practices and are less likely to accept the potential of alternative farming practices, particularly those for which economic outcomes are uncertain.

Principal Findings

The literature suggests that there are several farm program incentives and disincentives that influence farm production practices.

The farm programs support crops that tend to require high agrichemical inputs and are associated with high rates of soil erosion. Other less-erosive and less-agrichemical-dependent crops receive little government support. The programs reward farmers for specializing in program crops year after year, resulting in further soil depletion and pest problems, which in turn lead to a greater need for agrichemical inputs. The programs tend to discourage farmers from planting other crops and from using more diversified crop rotations.

By basing program benefits on historical crop production levels, the farm programs encourage farmers to maximize the production of program-supported crops and possibly use greater amounts of conventional inputs to do so. Provisions enacted through the Food Security Act of 1985, however, limit the ability of farmers to increase their program benefits as a result of higher crop production yields. Furthermore, the farm programs provide incentives for farmers to grow program crops on marginal lands that require more intensive production practices. However, conservation compliance legislation enacted by the Food Security Act of 1985 has reduced this influence.

Farmers' Opinions About Program Influences

The farmers GAO interviewed reported that the desire to maintain program crop acreage bases and federal program benefits had a great influence on their planting decisions. They also identified experience with a crop, the availability of markets, and crop prices as having a moderate-to-great influence in their planting decisions. Federal farm programs were relatively more important for farmers specializing in program crops than for farmers planting a more diverse set of crops.

Most of the farmers strongly agreed that the federal farm programs encourage them to grow only program crops and make it difficult to switch crop rotations or grow nonprogram crops. About 60 percent of the farmers reported they had considered planting some other crop but many felt that the farm programs do not provide adequate flexibility to do so without losing valuable crop acreage bases.

Over 90 percent of the farmers believe that participation in the farm commodity programs is the best way for them to reduce economic risks. A majority also reported that planting a diverse number of crops reduces their risks. Less than half the farmers felt that buying crop insurance was an effective way to reduce risk.

Almost all the farmers stated that they intend to continue growing the same crops and using the same farm practices and that the likely outcomes of this would be improved crop yields and farm profits with no expected change in environmental effects. Although research has suggested that conventional agriculture damages the environment and alternative agriculture can reduce such damage, knowledge of these findings is not reflected in the farmers' statements.

Farmers also reported concerns about greater management requirements, yield reductions, increase in weeds, and declining profits as key barriers to the use of alternative agriculture. This suggests that unless research or farm demonstrations convince farmers that these are not problems, movement toward alternative agriculture will be slow, regardless of farm program effects.

Some research studies have shown that under certain conditions alternative agriculture can be profitable. Further research, however, is needed before it is possible to draw firm conclusions. Technical information about workable alternatives that can be substituted for agrichemical inputs is not well developed or applicable to many different farm situations. Research on the use of practical crop rotations that use cover

crops such as legumes or intercropping and other alternative methods that rely less on agrichemical inputs have been largely neglected.

Finally, the farmers overwhelmingly reported that their use of farm practices was not an issue when applying for a loan or taking out crop insurance. However, about one fifth said that lenders suggested they participate in the farm programs.

General Implications

This exploratory study has several important implications:

- To the extent that the federal farm programs make it difficult for farmers to grow other crops and implement more diverse crop rotations, they act as a barrier to the adoption of alternative agriculture. Farmers most specialized in program crops face the strongest disincentives.
- The farm programs have a great influence on crop choice. Crop selection in turn strongly influences the types and amounts of production inputs that are required. Thus, even though the farm programs do not have a strong and direct effect on production methods, they do have a major indirect effect on input use.

The federal farm programs, and particularly the crop acreage base system, will have to be modified if the government wants to facilitate the adoption of alternative agriculture. However, because other factors play an important role, changing the farm programs alone may not be sufficient to bring about any significant increase in the adoption of alternative agriculture. Yet changing the farm programs to provide greater flexibility does seem necessary to offer farmers the opportunity to make production changes and incorporate alternative agriculture practices without suffering undue financial consequences.

Recommendations

GAO makes no recommendations.

Agency Comments

At the request of the Subcommittee, GAO did not seek formal comments on this report. However, a draft was discussed with Department of Agriculture officials and they generally agreed with the findings.

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Abbreviations

ASCS	Agricultural Stabilization and Conservation Service
ATTRA	Appropriate Technology Transfer for Rural Areas
FCIC	Federal Crop Insurance Corporation
FmHA	Farmers Home Administration
GAO	U.S. General Accounting Office
IPM	Integrated pest management
LISA	Low Input Sustainable Agriculture
NRC	National Research Council
USDA	U.S. Department of Agriculture

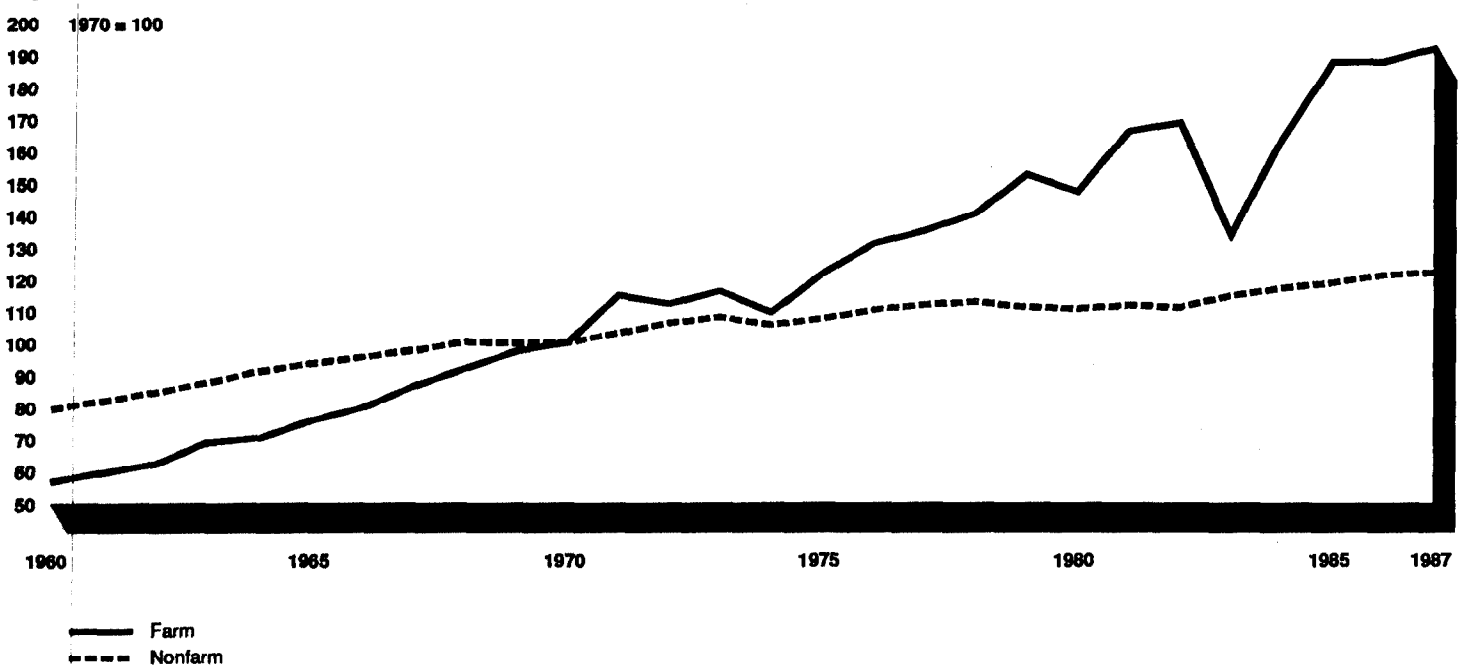
Introduction

Conventional agriculture in the United States can be characterized as consisting of increasingly specialized, mechanized farms that use synthetic fertilizers and pesticides to produce large quantities of food and fiber. Alternative farm systems that rely on diversified crop rotations and reduce the use of nonrenewable inputs are considered by many observers to be healthier, less environmentally harmful, and profitable in the long run. (National Research Council, 1989) Concerned that alternative farm practices are not used as much as they could be, the House Agriculture Committee and House Subcommittee on Department Operations, Research, and Foreign Agriculture asked us to evaluate whether current federal farm policies contribute to or inhibit the use of alternative production practices.

Conventional Agriculture: Description and Concerns

Agriculture in the United States has become increasingly specialized and dependent on agrichemicals in recent decades. Since 1960, productivity has grown much faster in farming than in the nonfarm business sector. (Figure 1.1.) This increased productivity made it possible for total farm output to increase by 45 percent between 1960 and 1987 while the amount of land farmed remained essentially the same. (President of the United States, 1989)

Figure 1.1: Farm and Nonfarm Productivity Index[a]



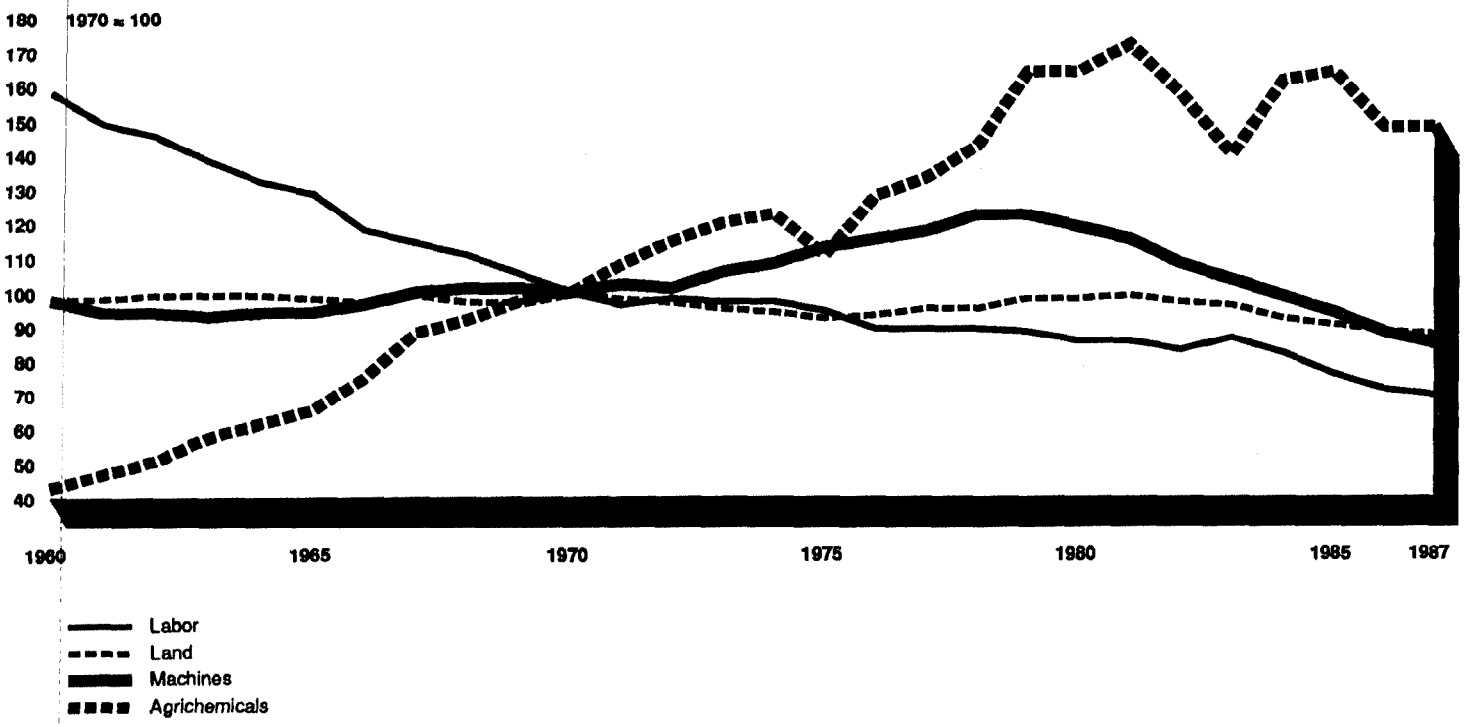
[a]1970 = 100.

Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), tables B-97 and B-46.

The tremendous gains in productivity and output have been accomplished in part by using more agrichemicals and less labor. (Figure 1.2.) Pesticide use on major crops rose from 225 million pounds in 1964 to 558 million pounds in 1982 before dropping to 440 million pounds in 1988.[1] Total use of commercial fertilizers also increased dramatically from 7.5 million tons in 1960 to a high of 23.7 million tons in 1981. Since then, the absolute amount of fertilizer applied has declined to 19.5 million tons; the per acre use has remained fairly stable since the late 1970's for most major crops. (Vroomen, 1989) Farms have also grown steadily bigger and the farm population has steadily declined, continuing patterns that have existed since the mid-1930's. (Figure 1.3.)

[1]Weight is an imperfect measure of pesticide use. As Osteen and Szmedra note, "The decline in insecticide quantity can be attributed to technological advances in the chemical industry heralded by the introduction of insecticides . . . that are applied at much lower rates than the materials they replaced. . . . " Other measures that provide a look at pesticide use over time, however, are not available. (Osteen and Szmedra, 1989, p. 37)

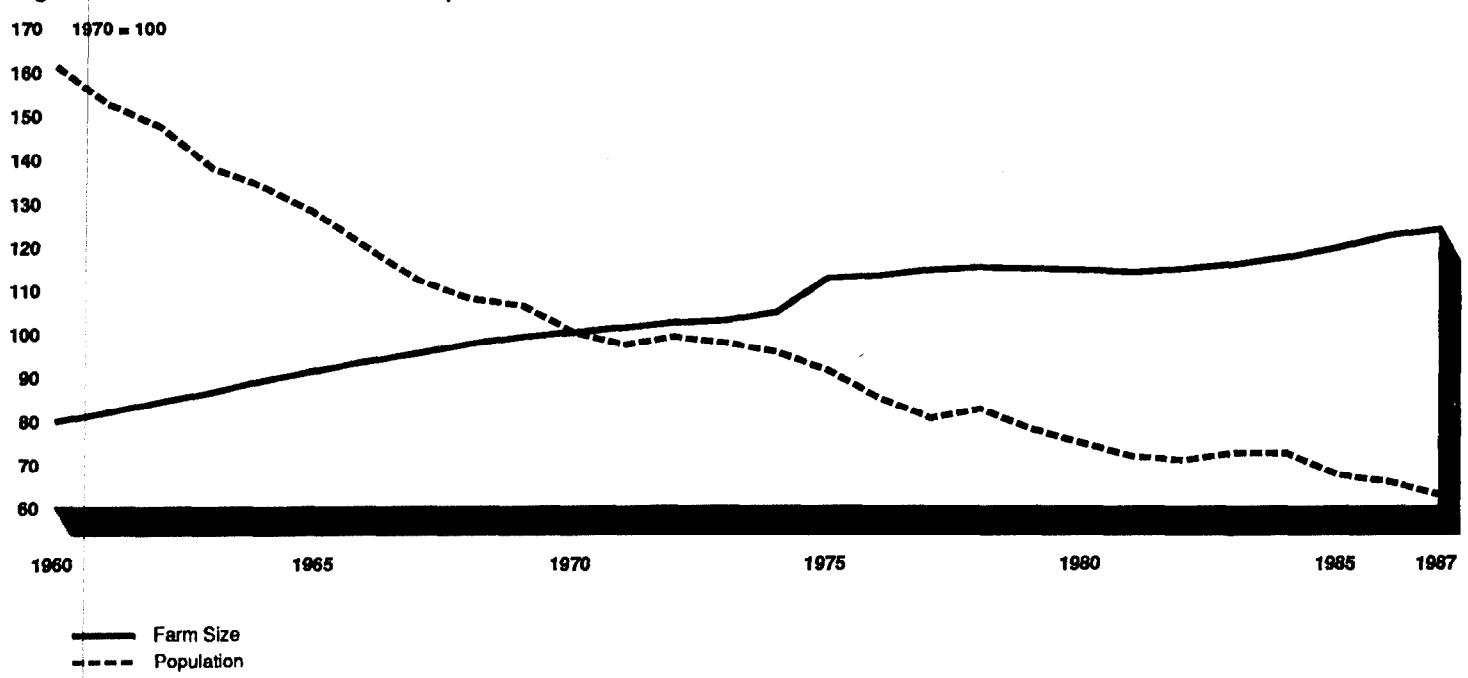
Figure 1.2: Farm Input Index[a]



[a]1970 = 100.

Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), table B-98.

Figure 1.3: Trends in Farm Size and Population[a]

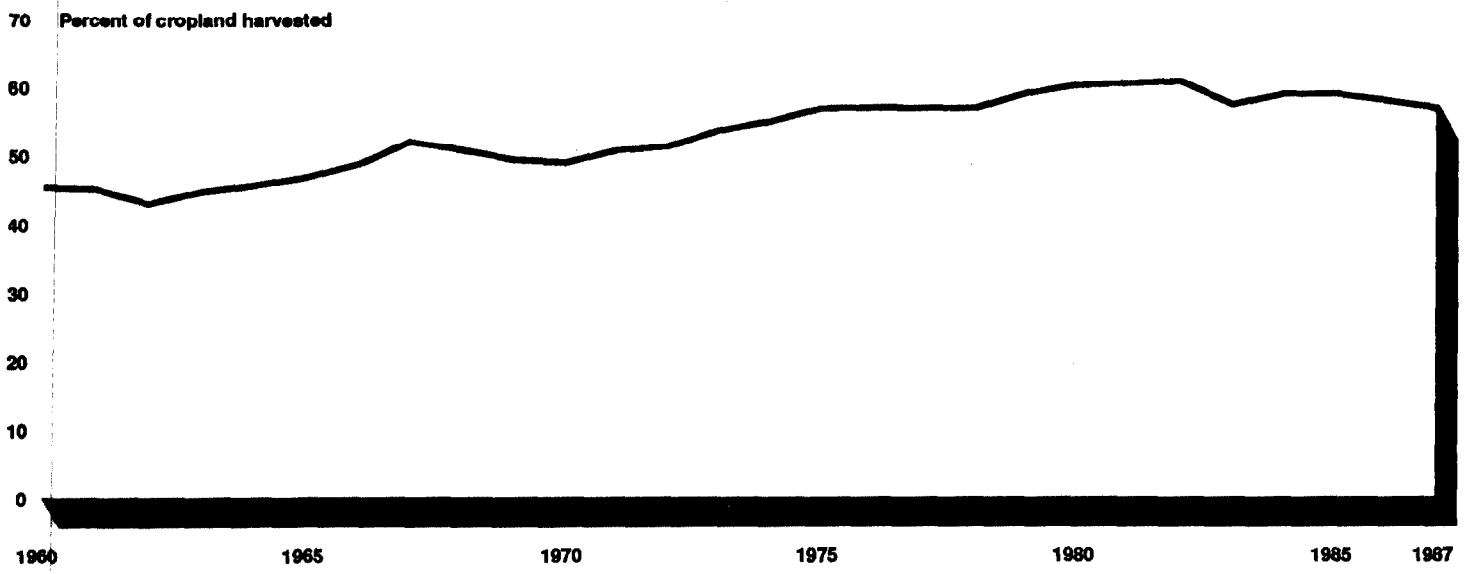


[a]1970 = 100.

Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), table B-98; U.S. Department of Agriculture, Agricultural Statistics 1987 (Washington, D.C.: 1988), table 531, and Agricultural Statistics, 1974 (Washington, D.C.: 1975), table 597.

Farming has also become more specialized: a larger share of the total farm acreage has been planted in a smaller number of crops. Corn, wheat, and soybeans have gradually accounted for a larger share of farm acreage. (Figure 1.4.) Individual farms have also become more specialized. Fewer and fewer farms raise both crops and livestock; more farms concentrate on growing smaller numbers of crops.

Figure 1.4: Specialization in Corn, Soybeans, and Wheat



Source: U.S. Department of Agriculture, Agricultural Statistics 1987 (Washington, D.C.: 1988); U.S. Department of Agriculture, Agricultural Statistics 1974 (Washington, D.C.: 1975).

Conventional agriculture has helped make food in the United States plentiful and relatively inexpensive. Many observers believe, however, that such farming produces health, environmental, and economic problems.

Health Concerns

The use of agrichemicals in conventional agriculture can endanger human health in two ways. Consumers may be exposed to agrichemical residues on the food they eat and the water they drink, while farmers and farm workers face heavier and more direct contamination from handling agrichemicals and working in fields where they have been used.

Food safety was a highly visible issue in 1989. Major news stories and reports appeared and legislative hearings were held concerning the health risks of chemical residues in food.[2] One survey of shoppers in early 1989 showed that 82 percent believed that chemical residues

[2]For example, on March 27, 1989, Time and Newsweek ran cover stories on agrichemicals and food safety; the House Energy and Commerce Committee Subcommittee on Health and the Environment held hearings on legislation concerning pesticides and food safety on May 17 and 31, 1989; the Senate Committee on the Environment and Public Works Subcommittee on Toxic Substances, Environmental Oversight, Research, and Development held hearings on chemicals and food crops on May 15, 1989.

posed a "serious hazard" to the health of consumers.[3] A public opinion poll released in March 1989 showed that 84 percent of Americans said they would buy organically grown food if it was readily available and 49 percent would be willing to pay higher prices for it.[4]

According to the National Research Council (NRC), available data do not show that the pesticide residues consumed in the average diet make a "major contribution to the overall risk of cancer for humans." (National Research Council, 1989, p. 126; 1987; 1982) However, a recent NRC study did find that 30 percent of the insecticides, 50 percent of the herbicides, and 90 percent of the fungicides applied to farm products contain agrichemicals that cause tumors in laboratory animals. (National Research Council, 1987) But it is quite difficult to know precisely how dangerous such agrichemicals are to human health. Extrapolating laboratory results to humans is subject to scientific debate. Little data are available on the actual levels of pesticides present in the human diet. (National Research Council, 1987) The health effects of many active ingredients in pesticides have also not yet been fully assessed, nor have the synergistic effects of chemicals used in common combinations been fully evaluated.[5] Health problems may develop only after long periods of exposure or years after a single contact. (U.S. Environmental Protection Agency, 1988)

Agrichemicals also pose an ongoing threat to the safety of surface and groundwater supplies used for drinking. However, evidence is spotty regarding both the extent of the pollution and its effect on human health. Pesticides have been found in the groundwater of 26 states as the result of normal agricultural practices. (Williams et al., 1988) A U.S. Geological Survey study established that in 474 of 1,663 counties sampled, 25 percent of the wells tested had nitrate-nitrogen amounts above natural levels; 87 of these counties had nitrate-nitrogen levels exceeding EPA's interim standard for nitrate in drinking water. (National Research Council, 1989, p. 105) USDA estimates that 1,437 counties (46 percent of all counties in the United States) contain groundwater susceptible to contamination from agricultural pesticides or fertilizers. (Nielsen and

[3]Survey conducted by the Food Marketing Institute, a supermarket trade group. (Steimel, p. F1.)

[4]This Louis Harris Poll was conducted in November 1988 for Organic Gardening magazine. (Nazario, March 21, 1989, p. B1)

[5]In 1984, an NRC panel estimated that "data to conduct a complete assessment of health effects were publicly available for only 10 percent of the ingredients in pesticide products." (National Research Council, 1989) For studies of the possible synergistic effects of chemicals, see DuBois, 1972.

Lee, 1987) EPA is currently conducting a nationwide survey of pesticides in groundwater, scheduled to be completed in 1990.

If agrichemicals create risks for human health, health concerns can create economic risks for farmers. If an agrichemical is shown to produce unreasonable risks to human health, EPA can ban it. (U.S. Environmental Protection Agency, 1988) If manufacturers believe that an agrichemical is dangerous, they may voluntarily withdraw its federal registration, making certain uses of that chemical illegal.[6] If retailers think that a pesticide is harmful, they may refuse to sell produce treated with it. (Gutfeld, 1989) If consumers suspect that an agrichemical is harmful, purchases of treated crops can fall sharply.[7] Whether food safety concerns are justified or not, farmers who rely on agrichemicals may face a loss of productivity if these chemicals become unavailable for use or a loss of income if they cannot sell products treated with them. Either way, farmers who have become dependent on these agrichemicals are at economic risk.

Agrichemical use may pose a serious health threat to farmers themselves. Frequent exposure from handling certain pesticides raises the risk of cancer. National Cancer Institute studies in Kansas and Nebraska found that farmers exposed to herbicides more than 20 days per year had from three to six times higher risk than nonfarmers of developing non-Hodgkins lymphomas. (Hoar et al., 1986, 1988) Other studies have also found evidence of a link between pesticide use and certain types of cancer among farmers. (Pearce, Smith, and Fisher, 1985; Weisenburger, 1985) Acute and chronic health problems have also been linked to heavy exposure to agrichemicals. (Davies, 1985) No regular surveys or examinations, however, are used to monitor farm-worker exposure to pesticides or the health consequences of this exposure, so it is not possible to accurately estimate the real effect of agrichemical use on farmers' health.

Environmental Concerns

Conventional agriculture has also been blamed for contributing to environmental problems involving soil erosion and water pollution. Each year, between 2.7 and 3.1 billion tons of soil erode from the nation's farmland. (National Research Council, 1986; USDA, 1988a) Much of this

[6]The makers of ethylene bisdithiocarbamate (EBDC) fungicides voluntarily suspended their registration on roughly 50 crops. (Schneider, 1989)

[7]After the intense media coverage of Alar in February 1989, it was estimated that the Washington State Red Delicious apple industry lost $140 million in revenue. (Buxton, 1989, pp. 85-88)

loss is caused by intensive farm production methods and the cultivation of highly erodible lands. Soil erosion poses a threat to the long-term productivity of some farms, because it reduces soil quality and increases the need for fertilizers. (Pimentel, 1987) The actual effect on farm productivity can vary tremendously, however. Farms with deep topsoil can maintain productivity for the forseeable future even with heavy soil loss, while farms with thin soils can lose productivity after only a few years. Estimates of the cost of soil erosion for farms vary widely, ranging from $1 billion to $18 billion per year. (National Research Council, 1989, p. 116)

Agriculture also causes nonfarm damage, since farming is a primary nonpoint source of water pollution.[8] The major sources of agricultural pollution are sediment (from soil erosion) and nutrients (from fertilizers). USDA calculated that agriculture contributes 50 percent of all suspended sediments in surface waters; as much as 1 billion tons of agricultural soil are deposited in waterways every year through erosion. (National Research Council, 1986) From 50 to 70 percent of nutrients in surface water also have been linked to agricultural use. (Phipps and Crosson, 1986) Deposited soil obstructs waterways and fills reservoirs; suspended soil chokes water life, depresses recreational use, and increases water purification costs. Increased nutrient levels promote algae growth, which depletes available oxygen; decreased oxygen limits the population of larger plants and animals. The National Research Council argues that "nutrient loading has had a devastating effect on many lakes, rivers, and bays throughout the country." (National Research Council, 1989, p. 100) The declining fisheries along the Chesapeake Bay illustrate the effect of increased nutrient levels on water quality. (Kahn and Kemp, 1985) As with estimates of damages to farms from soil erosion, calculations of the total economic costs associated with the pollution of surface water by agriculture vary widely, running between $2 billion and $16 billion per year. (National Research Council, 1989)

Farm practices can affect soil erosion and nutrient runoff in several ways, but the net effect of conventional farming on soil erosion is not known. Soil erosion increases with the amount and intensity of plowing and cultivating. The trend toward larger farm equipment has made

[8]Nonpoint-source pollution is diffused pollution resulting from water runoff from urban areas, agriculture, and the like; point-source pollution occurs from a pipe or other discrete sources from factories, wastewater treatment plants, or confined animal feedlots.

traditional soil conservation practices such as contour farming, windbreaks, and terraces more difficult to follow.[9] Furthermore, intensive crop rotations using row crops (such as corn and soybeans) are more erosive than ones including small grains, hay, or other cover crops; for a number of reasons, few conventional farms include these less-erosive crops in their rotations.[10] However, several conventional practices reduce the potential for erosion. Increased reliance on herbicides has "made it possible to control weeds in most of the major crops with little or no disturbance of the soil surface"; widespread use of herbicides has almost certainly reduced erosion and nutrient runoff. In addition, the increased use of fertilizer may have cut erosion rates by promoting faster, heavier plant growth. Both early growth, which protects soil at the beginning of the planting season, and heavy growth, which increases the amount of residue that can be left on the field after harvest, can protect the soil at vulnerable periods. (American Farmland Trust, 1984, pp. 49 and 50) The erosion-reduction benefits that can be derived from increased fertilizer and herbicide use can be negated, however, if such inputs are used to promote intensive row crop production.

Perhaps the main effect of conventional farming on soil erosion concerns not how land is farmed but what land is cultivated. Soil erosion is concentrated: 53 percent of total erosion on cropland occurred on 11 percent of the acres farmed, according to the first reliable, nationally consistent estimates, obtained in 1977. (American Farmland Trust, 1984, p. x) About one fifth of all farmed land is subject to serious damage from erosion. (Clark, Haverkamp, and Chapman, 1985; USDA, 1987b) The best way to conserve soil on highly erodible land is to keep it out of production; some experts believe this can be done without endangering the supply of farm commodities. (American Farmland Trust, 1984, pp. 44 and 45)

Economic Concerns

American agriculture faces many economic challenges. In assessing them, it is important to focus on long-term trends and not just temporary conditions. Farmers typically have good years and bad years.

[9]"Larger equipment is best suited to long, parallel rows; conservation is maximized by farming land to its contours." (American Farmland Trust, 1984, p. 50)

[10]Crop rotations that include hay, forages, and other cover crops are used infrequently, in part because (1) the number of farms raising livestock has fallen dramatically in recent decades, and without livestock, farmers have less need to produce these crops; (2) the increasing availability of affordable synthetic fertilizers has made it less necessary for farmers to rotate crops to enhance soil fertility; (3) fertilizers have made it possible to grow row crops year after year. (American Farmland Trust, 1984, pp. 50-55)

Therefore, one should not place too much emphasis on the latest drought or bumper crop in describing agriculture's economic condition. We have identified several important trends.

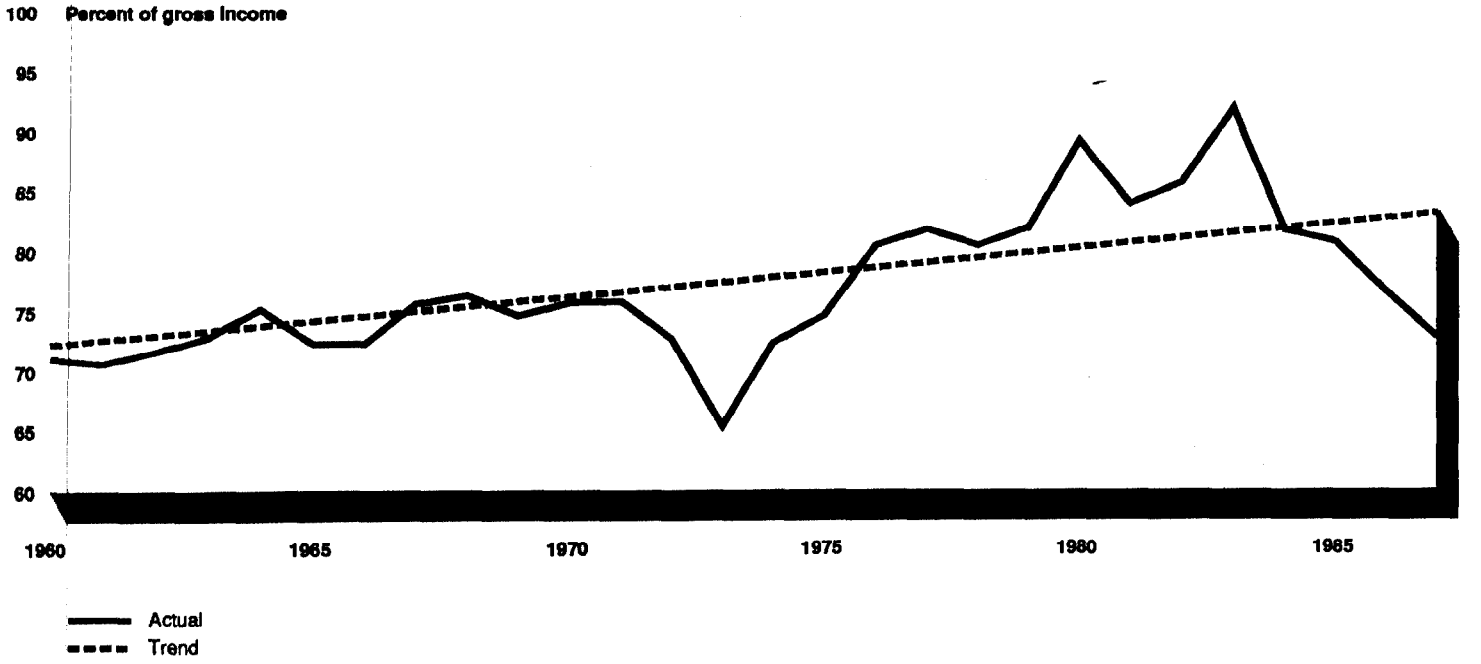
Real net farm income has been falling since 1960, even though gross income has continued to grow. (Figure 1.5.) Thus, despite yearly variations, farming as a whole has become less profitable. Although gross income has grown, more farm revenue has been spent on the costs of production, thus reducing profit margins. (Figure 1.6.) Meanwhile, government spending on farm income stabilization has increased substantially. (Figure 1.7.) The growth in government support to farming has occurred during periods when farm income was both high and low.

Figure 1.5: Gross and Net Farm Income[a]

[a]Trend lines are estimated by regression.

Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), table B-96.

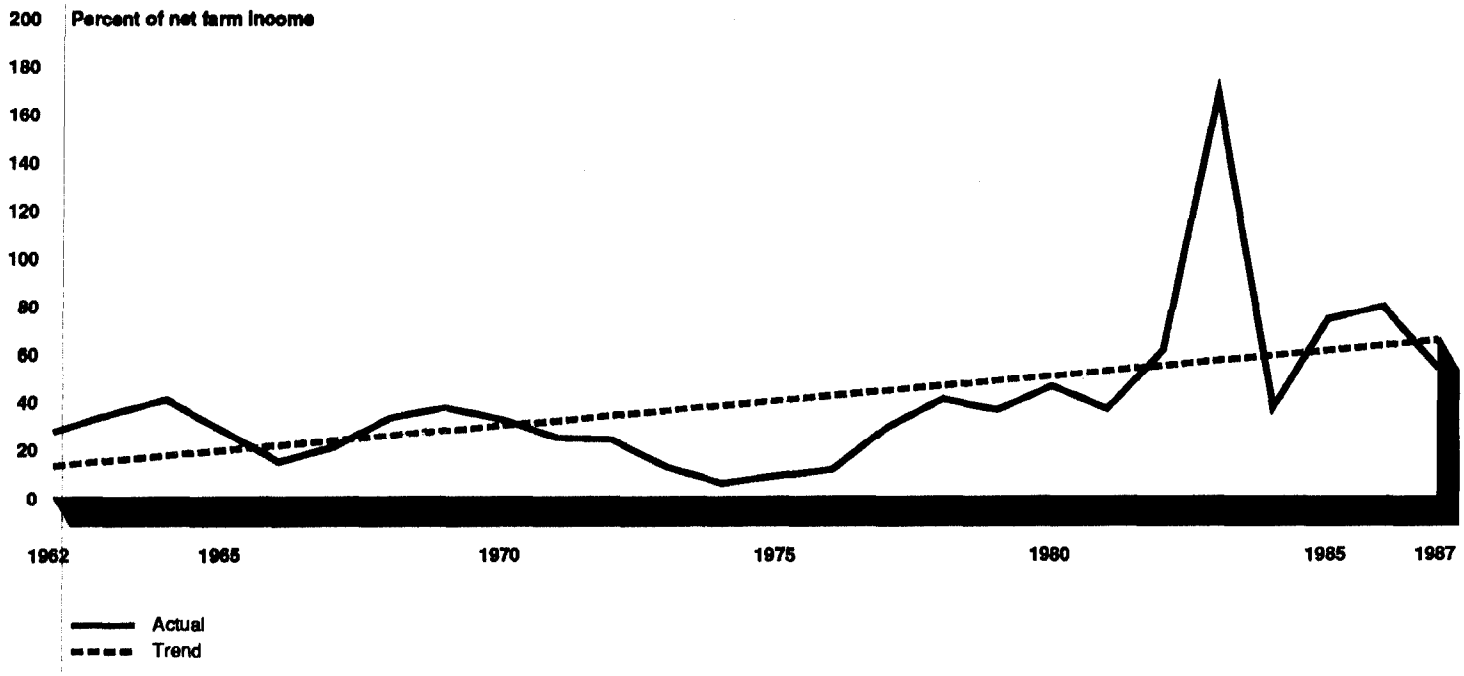
Figure 1.6: Increased Production Expenses[a]



[a]Trend lines are estimated by regression.

Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), table B-96.

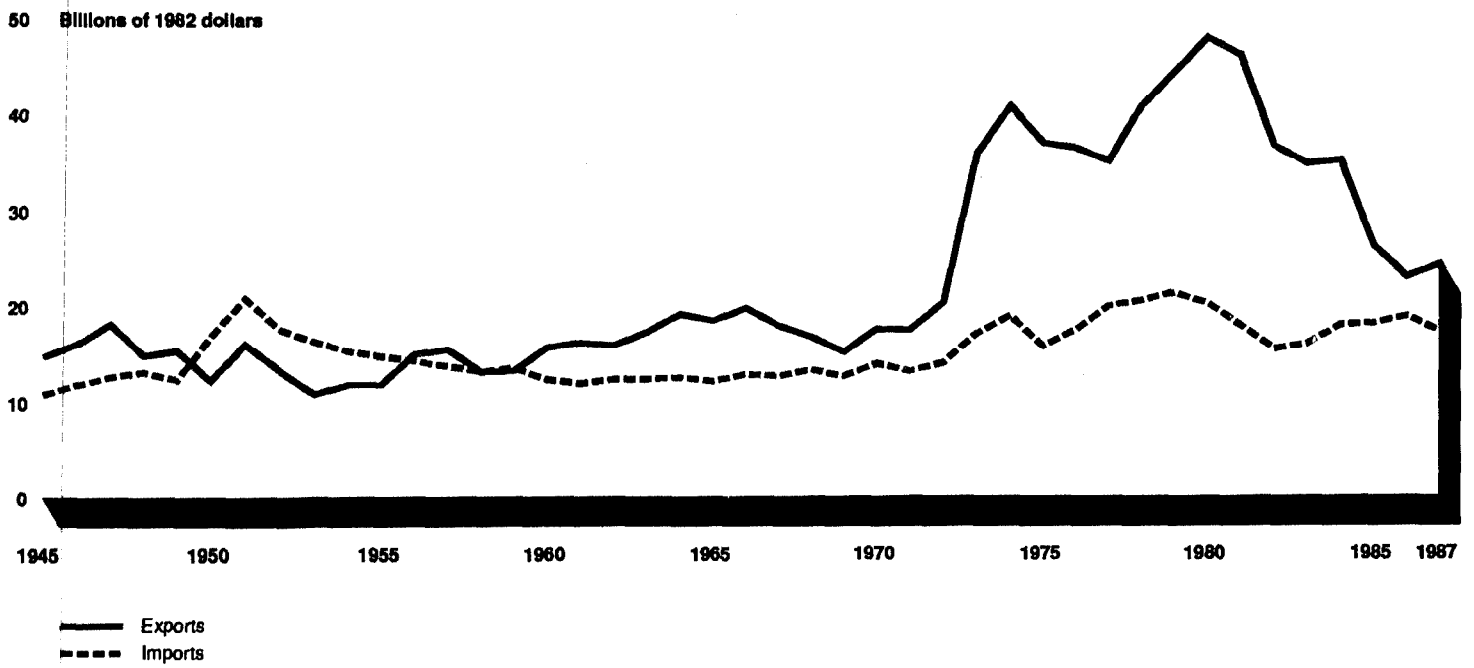
Figure 1.7: Government Outlays for Farm Income Support



Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989), table B-96; Office of Management and Budget, Historical Tables, Budget of the United States Government, FY 1989 (Washington, D.C.: 1989), table 3.3. The Office of Management and Budget divides federal spending on agriculture into two categories: farm income stabilization and agricultural research and services.

Farm exports fell sharply between 1980 and 1986 after a long history of expansion. (Figure 1.8.) Declining exports put additional economic strain on the farm sector. However, it is not clear whether the export slump marks a dramatic break from the historical trend or is a return to it. In 1987, farm exports returned to a long-term growth path, and figures for 1988 indicate a continuation of this path.

Figure 1.8: Farm Exports and Imports



Source: President of the United States, Council of Economic Advisers, Economic Report of the President (Washington, D.C.: 1989).

As shown in figure 1.5, net farm income increased from about $12 billion in 1983 to about $40 billion in 1987. Despite a period of renewed prosperity, however, many farmers still face financial uncertainty. The U.S. Department of Agriculture (USDA) estimated that 33 percent of farm operators were in questionable economic health at the end of 1988, because they had marginal income, marginal solvency, or both. (Table 1.1.)

Table 1.1: Distribution of Farm Operators by Financial Position[a]

Year	Favorable	Marginal income	Marginal solvency	Vulnerable
1988	66.9%	19.5%	8.3%	5.3%
1987	68.1	16.9	10.1	4.9
1986	56.8	21.6	11.7	10.0

[a]As percentage of all farms. Farms with marginal incomes had low levels of debt but negative incomes. Farms with marginal solvency had high debt-asset ratios but positive income. Vulnerable farms had high debt loads and negative income.

Source: USDA, Financial Characteristics of U.S. Farms (Washington, D.C.: U.S. Government Printing Office, January 1, 1989), p. 9.

With the budget deficit problems presently facing the nation, pressure to reduce government support to farmers is likely to increase. Although farm program funding levels have declined since 1986, farm programs are structured such that the government continues to remain vulnerable to increased spending levels when market conditions change. As policymakers implement measures to reduce the federal deficit, farm support programs may become targets for restructuring.

Interest in Alternatives to Conventional Agriculture

The health, environmental, and economic concerns associated with conventional agriculture have led to a growing interest in the development of alternatives that would lower health risks, protect farm resources, reduce adverse environmental effects, and improve long-term farm profitability and competitiveness. Farmers, environmentalists, consumers, and researchers have begun to seek, study, test, adopt, and advocate alternatives to conventional agriculture. Interest in alternatives is partly reflected by the workshops, conferences, and farm demonstrations being conducted around the country.[11] Alternative farming methods are also gaining recognition as an important area of scientific inquiry at several universities and agricultural research centers. Furthermore, information networks have recently been established to provide information about alternatives.[12]

Federal and state governments are also beginning to focus more attention on alternatives. Recent initiatives in a small number of states have established stronger regulations to reduce the effects of some conventional farming practices and to devote more resources to the development of alternatives. Earmarking taxes on agrichemical products for

[11]National conferences sponsored by USDA, the Soil and Water Conservation Society, the Center for Science in the Public Interest, the Institute for Alternative Agriculture, the Freshwater Foundation, and other government and nonprofit organizations were held on the subject in 1988 and 1989. Farm demonstrations and tours of farms using alternatives were conducted in several farm areas across the country. Dick Thompson of Boone, Iowa, a well-known alternative agriculture farmer, has attracted several hundred visitors each year to his farm to learn about the production practices he uses, and the Rodale Research Center in Kutztown, Pennsylvania, attracted over 5,000 visitors interested in alternatives in 1987.

[12]One sourcebook on alternative agriculture research lists 18 universities having programs in research, education, and extension work. (Haney, Krome, and Stevenson, 1986) The Appropriate Technology Transfer for Rural Areas (ATTRA) is a national service begun in 1987 and funded by USDA to collect, analyze, and transfer information on alternative agriculture. In fiscal year 1988, ATTRA responded to over 2,500 requests for information; during the first part of fiscal year 1989, the rate of requests ran more than double the previous year. The University of Missouri at Columbia also started an information network on alternatives for farmers in 1989.

research on alternatives and developing programs to monitor groundwater and promote the use of "best" management practices by farmers are some examples of state efforts.[13]

The Secretary of USDA made a formal statement in support of alternatives early in 1988, saying that USDA encourages research and education programs "that provide farmers with a wide choice of cost effective farming systems including systems that minimize or optimize the use of purchased inputs and that minimize environmental hazards." (USDA, 1988c)

A small program specifically designated to provide research, education, and technical assistance efforts for alternative agriculture was established at the federal level by the Food Security Act of 1985. Although not funded until fiscal year 1988, USDA's Low Input Sustainable Agriculture (LISA) program did provide $3.9 million in 1988 and $4.45 million in 1989. USDA also claims to spend about $100 million on related research. (U.S. Congress, 1988) In addition, USDA initiatives focusing on farm marketing and competitiveness, water quality, and alternative crops are under way.

Objective, Scope, and Methodology

Concerned with ensuring that farmers have the flexibility to use a variety of management approaches, particularly methods that reduce agrichemical inputs, the House Committee on Agriculture and the Subcommittee on Department Operations, Research, and Foreign Agriculture asked us to assess how current federal farm programs and policies may contribute to or inhibit the use of alternative farm production methods. The Committee is aware of the health, environmental, and economic problems that are associated with some conventional farming practices, and it is familiar with the growing interest in alternatives. The Committee believes that if federal policy limits the farmers' ability to use alternative practices, the Congress should begin developing measures to remove these limitations.

Objective

Given the Committee's request, we designed a study to identify and describe the extent to which federal agriculture policies and programs

[13]In 1987, Iowa enacted a major groundwater protection law that created a tax of 75 cents per ton on nitrogen fertilizer, along with pesticide sales and registration fees. Part of the money collected through these measures is used to fund a research program at Iowa State University to study ways of reducing the use of agrichemicals. Wisconsin also has a per ton sales tax on fertilizer and license fees on pesticides, which in part fund a state system to monitor and regulate groundwater supplies.

provide incentives and disincentives to the use of alternative farming practices. Our study is partly exploratory, because alternative agriculture is difficult to define or measure operationally and because little is known about the use of alternative practices in the farm sector. In addition, it is difficult to precisely identify and measure program influences on farm practices, because other factors such as market conditions and management capabilities also influence farm management decisions.

Three research questions guided our analysis. First, What is known about alternative farm practices, particularly their technical utility and economic viability? Second, What incentives do the federal programs create that favor conventional practices, and what barriers do they present to the adoption of alternatives? Third, What do farmers think about the effect of federal farm programs on alternative agriculture?

Scope

We selected the components of the federal farm programs that have major importance for agriculture generally and, in particular, for the economics of farming. We also looked at the federal components that have been identified within the literature as having potentially important implications for the adoption of alternative agriculture. From these criteria, we chose to examine the commodity price and income support, federal farm credit, and federal crop insurance programs.

We narrowed the scope of our study of the commodity price and income support programs to the major commodity cash crops—namely, feed grains, wheat, soybeans, and cotton. These programs make up the bulk of the price and income support system, in terms of both program spending and acreage in production. They are also commodities that have received much of the criticism directed against conventional agriculture. The production of these commodities is generally associated with high agrichemical use, and many of the adverse environmental effects identified with conventional farming involve the production of these commodities. We included the main farm operating and ownership loan programs of the Farmers Home Administration (FmHA) within the federal farm credit system. For crop insurance, we included the Federal Crop Insurance Corporation (FCIC) programs, which subsidize insurance coverage on many different farm commodities.

We decided not to include federal agricultural research and extension, resource conservation, and tax policies in this study. Although the

research and extension system provides essential information and technical assistance to farmers, and although it has been the subject of criticism for failing to focus more on alternative agriculture practices, we chose not to include it, because other evaluation work is currently in progress and because it may be too soon to evaluate the effect of USDA's LISA program and other recent research and education initiatives. While it is important to consider resource conservation—because of the possible effect the conservation compliance provisions of the Food Security Act of 1985 may have on the use of alternative farming practices—many of these provisions are not fully implemented, so it may be more appropriate to evaluate them later. The tax code can influence agricultural practices by favoring certain investments over others. (Benfield, Ward, and Kinsinger, 1987) We did not evaluate tax policies, because any incentives they provide for selecting farm practices are less direct than those provided by the federal farm support programs.

We considered several ways to obtain information on the farm programs and on farmers' opinions about the programs' effect on their farm practices. These ranged from conducting a review and synthesis of existing studies to surveying major farm organizations to polling a nationally representative sample of farmers. We believed it was crucial to obtain information directly from farmers but thought it would have been extremely difficult to accurately collect complex information about alternative agriculture and the influence of federal programs through a mailed questionnaire. Thus, we chose to obtain the information most appropriate for this exploratory study through personal, in-depth interviews with a small number of farmers in selected sites around the country so that terminology and questions could be explained clearly and answers could be given at length.

Methodology

Our study includes a number of evaluation components. To learn more about the characteristics of alternative agriculture and its use, we conducted an information synthesis. (U.S. General Accounting Office, 1983) The synthesis consisted of identifying, collecting, and reviewing available research studies and other relevant literature published over the past 15 to 20 years, as well as interviewing researchers, public interest group representatives, and other experts in the field. We also examined federal agriculture legislation, program regulations, and administrative provisions that pertained to the price and income support, credit, and insurance programs in order to identify program objectives, interactions, and intended effects. Information sources for this assessment included the Food Security Act of 1985 and subsequent farm legislation, sections

of the Code of Federal Regulations, USDA documents, and relevant literature on program operations and effects. We supplemented this work by interviewing officials from USDA's Agricultural Stabilization and Conservation Service, FmHA, FCIC, Extension Service, and Economic Research Service and others knowledgeable about federal agriculture policies and programs. Our final evaluation component was a set of interviews with farmers—in effect, a series of case studies. The purpose was to learn how programs are implemented at the local level and to obtain farmers' views about the influence of farm programs on their farm practices.

Case Study Approach

Our case studies were designed to collect descriptive information from farm officials and farm producers in a judgmentally selected sample of local farm areas. We used several criteria to select local farm areas. We first chose locations concentrated in the major commodity production areas of the country. Within these areas, we identified counties where agriculture was a key part of the economy and where the federal programs were a key part of agriculture, as indicated by farmers' participation and federal farm program spending. In addition, we considered information on farm and farmer-related characteristics in the counties. We also tried to select counties that contained at least some farms devoted to alternative farming. Since only limited information was available on the location of such farms, we could not use this criterion for selecting all county sites. The seven farm counties we selected are listed in table 1.2.

Table 1.2: Study Sites

County	State	Agricultural region
Colquitt	Georgia	Southeast
Robeson	North Carolina	Southeast
McLean	Illinois	Corn Belt
Boone	Iowa	Corn Belt
Cowley	Kansas	Northern plains
Brookings	South Dakota	Northern plains
Dane	Wisconsin	Lake states

In selecting a sample of farmers to interview, we were assisted by state and local extension service officials. We asked extension officials in our selected farm counties to identify farmers who generally own their farms, have farmed for many years, rely on farming for their livelihood, grow program-supported crops, participate in the farm programs, and typically use conventional farming practices. We also asked extension

officials to identify farmers who used or were in the process of developing alternative practices. Of the farmers we chose for our sample, 2 considered themselves organic farmers and 4 others did not use pesticides; 22 farmers indicated that they had reduced their agrichemical use in the past 5 years.

We developed a structured questionnaire for interviewing farmers. We reviewed related surveys of farmers concerning farm production practices, alternative agriculture, and federal farm policies to aid in constructing our questionnaire. We also used information from our review of the literature to develop additional questions. We included questions about the types of farming practices they use (crop rotation, tillage, pest and weed control, and soil fertility practices), their participation in the farm programs (price and income supports, conservation, credit, and insurance), factors that affect their decisions about what crops to plant and practices to use (market conditions, experience with crops, availability of labor and machinery, and farm programs), the extent to which participation in the farm programs influences their crop selection and production practices, and their views about the potential barriers to the use of alternative farming practices. (Several of these questions are highlighted in chapter 4.)

In conducting the seven site visits, we interviewed a total of 74 farmers—from 8 to 13 farmers in each county site. The interviews averaged 1-1/2 hours each and took place with individual farmers at their farms or at the local county extension offices. We also interviewed state and local farm officials, and we obtained reports on farming systems and practices in the area and data and documents on federal farm program provisions and participation. We met with staff from ASCS and FmHA and with Cooperative Extension officials and, in some sites, a few commercial farm lenders, crop insurance agents, and farm management company representatives. We also had discussions with agricultural researchers at nearby land-grant universities about farming practices and the use of alternative agriculture in the state. (Table 1.3.) Our site visits were conducted between April and June 1989.

Table 1.3: Farm Officials We Interviewed

		State officials			County officials			Private officials			
State	County	ASCS	FmHA	CES[a]	ASCS	FmHA	CES[a]	Lender or management company	Insurance	University	Farmers
Georgia	Colquitt	X	X	X	X	X	X	X		X	12
North Carolina	Robeson	X	X	X	X	X	X		X	X	12
Illinois	McLean				X		X	X			13
Iowa	Boone	X			X		X	X			9
Kansas	Cowley	X			X	X	X	X		X	9
South Dakota	Brookings	X	X	X	X	X	X	X	X	X	11
Wisconsin	Dane			X	X		X			X	8

[a]Cooperative Extension Service.

We documented, analyzed, and summarized the information we collected from the site visits. Our findings from the case studies are presented in chapter 4.

Strengths and Limitations

Relatively little evaluation work has been conducted on the extent to which federal policy contributes to or inhibits farmers' adoption of alternative farming practices. Our report should therefore provide information useful for understanding the influence of federal agricultural policies and programs while identifying areas where additional work is warranted.

This report is limited to a review of existing policy and an examination of the data from seven farm counties. We were strongly impressed by the diversity of conditions within and across these seven counties and believe that the findings reflect many points of view. However, the counties we visited were not randomly chosen, and the sample of farmers we interviewed in each site may not represent farmers throughout the country or even throughout the local areas we visited. Our findings therefore cannot be generalized to the nation. However, when these farmers are compared to their peers, they do not appear, collectively, to be unusual regarding farm size, crop types, and management practices. Our case studies, therefore, serve the exploratory function intended: they provide a better basis for developing a more complete evaluation, and they illustrate current concerns among farmers, knowledge of which should be useful for setting policy in this area. Except as noted

above, our work was conducted in accordance with generally accepted government auditing standards.

Characteristics of Alternative Agriculture

In this chapter, we briefly describe what is known about alternative agriculture. We begin by defining the concept of alternative agriculture and then discuss key factors that may limit its adoption by farm producers. Our discussion is based on a review of the existing research literature and information from conferences and meetings about alternative agriculture and interviews with agricultural experts and others familiar with the subject.

Defining Alternative Agriculture

Alternative farming strategies attempt to address the health, environmental, and economic problems associated with conventional agriculture. The most well-known labels for these strategies include alternative, sustainable, low (or reduced) input, organic, and regenerative agriculture. Although these terms do not have precise or identical meanings, they are generally used to identify a broad range of farm practices centered on common farm goals. Detailed definitions of these terms have not been well-developed in the literature. (Lockeretz, 1988)

Goals

For agriculture to be sustainable in the long run as well as the near future, it must balance several goals. The goals commonly identified include

- promoting consumers' and farmers' health,
- maintaining environmental stability,
- enhancing farmers' profitability, and
- producing the agricultural goods that meet society's needs.

Whether these goals can be attained simultaneously and whether conventional or alternative farm production methods are best suited to attaining them are empirical questions that have not been conclusively answered. We do not attempt to address these questions in this report. Instead, our purpose is to assess whether existing federal farm programs contribute to or inhibit the use of alternative methods. To answer this question, it is important to differentiate between conventional and alternative practices.

Practices

Alternative practices can best be illustrated by contrasting them in general with conventional practices regarding the four components of farming listed in table 2.1: crop choice, pest and weed control, soil fertility, and soil cultivation.

Table 2.1: Farm Practices

Agricultural component	Conventional practice	Alternative practice
Crop choice	Specialize; plant most profitable crop on same ground year after year	Increase diversity, use multiyear rotations, and develop integrated crop and livestock operations
Pest and weed control	Apply synthetic insecticides, herbicides, and fungicides	Use integrated pest management, natural predators, resistant crops, crop varieties well-suited to agronomic conditions, crop rotations, mechanical cultivation, and intercropping
Soil fertility	Apply synthetic fertilizer, especially nitrogen products such as anhydrous ammonia and urea	Use crop rotations, legumes to fix nitrogen, and livestock manures
Soil cultivation	Cultivate highly prepared seed beds	Maintain protective cover on soil and plow to minimize soil erosion and loss of soil moisture

These practices are distinctly different, although farms often use some blend of conventional and alternative practices. Farms consequently need not necessarily be either conventional or alternative but can be more-or-less conventional or alternative regarding each agricultural component. Farms are usually labeled "conventional" or "alternative" for their main tendencies, not because they fall completely within either category.

Proponents of alternative agriculture contend that farmers can move toward the goal of sustainable agriculture by using fewer nonrenewable inputs such as synthetic fertilizers and pesticides.[1] In particular, they strive to hold agrichemical input use to the lowest feasible level. For example, they believe that using fewer agrichemicals may increase profits by reducing production costs. Reducing agrichemical use can also decrease pollution, thus improving water quality, and it can help restore depleted fields. Less exposure to agrichemicals may ease consumer and farmer health problems and concerns. Furthermore, advocates of alternative agriculture believe that farm productivity can be maintained even with reduced agrichemical use.

Defenders of conventional agriculture generally argue that the farm practices most commonly used today are themselves sustainable. They note that agriculture in the United States is highly productive and provides food and fiber to the public at relatively low cost. Furthermore,

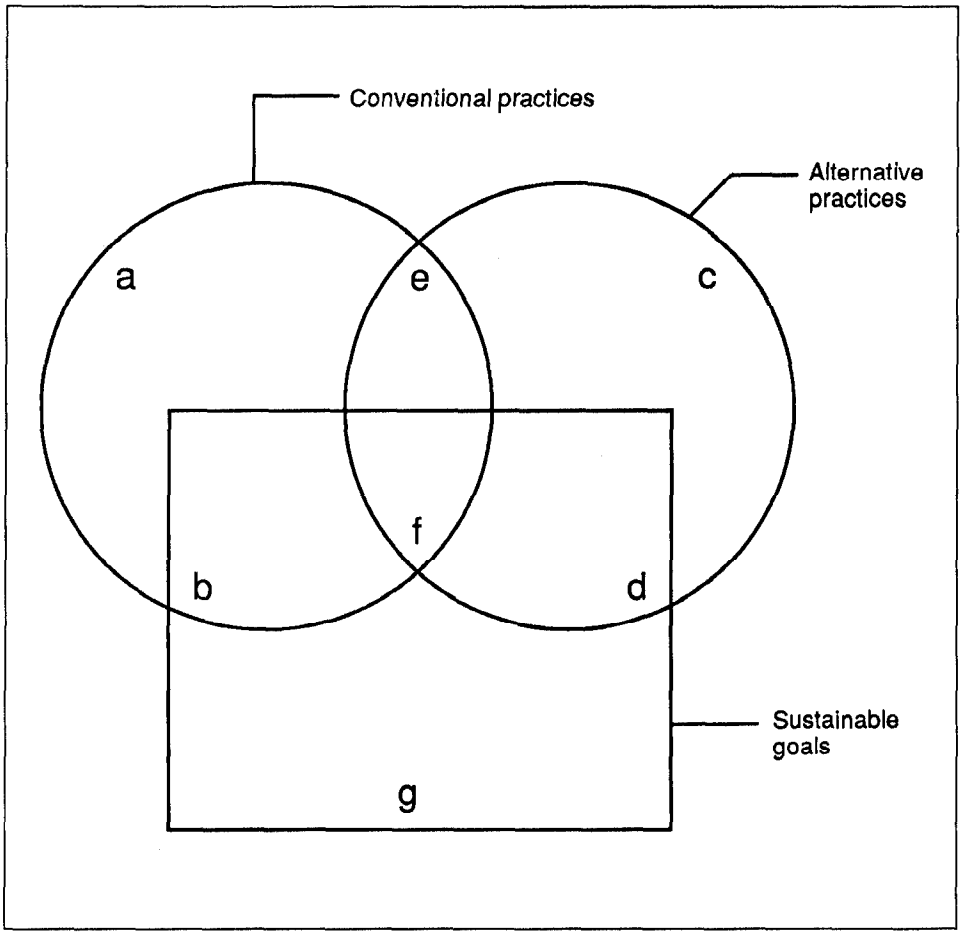
[1]Some proponents of alternative agriculture see reduced nonrenewable input use as a goal in itself, while others view it as a means of achieving the other goals.

although farm incomes fluctuate, they are close to the national average, and net worth per farm family is about four times the national average. (USDA, 1989b) Supporters of conventional agriculture consider environmental problems minor compared to productivity gains, and harmful effects on human health are considered largely unproven and unwarranted. (Butz, 1987)

Conventional and Alternative Agriculture: Convergence and Divergence

To clarify the conceptual relationship between conventional and alternative farming within the context of the goals of sustainable agriculture, it may be helpful to see them as three partially overlapping shapes, as in figure 2.1. One circle shows the entire body of alternative practices, and the other circle shows the conventional practices, while the square represents all the sustainable goals. The lettered sections identify the possible relationships. Much of the debate over conventional and alternative agriculture concerns the practices that actually are sustainable in sections b, d, and f.

Figure 2.1: Conventional, Alternative, and Sustainable Agriculture



[a]Conventional practices that are not sustainable.

[b]Conventional practices that are sustainable.

[c]Alternative practices that are not sustainable.

[d]Alternative practices that are sustainable.

[e]Conventional and alternative practices that are not sustainable.

[f]Conventional and alternative practices that are sustainable.

[g]Sustainable goals that are not met by existing conventional or alternative practices.

Because conventional and alternative farm practices overlap, moving from one to the other may not necessarily require dramatic changes in techniques. For example, using "pest scouting" and carefully targeted applications of pesticides can help control insects and diseases while

reducing the use of agrichemical inputs. Introducing legumes and livestock manure, and following the guidelines of regular soil tests to accurately monitor soil fertility, can enhance fertility and reduce the need for synthetic fertilizers. Broadening crop rotations to include a variety of cash crops, legumes, and hay can also improve soil quality, cut down on erosion, and break insect and disease cycles. Using different cultivation techniques and cover crops to control weeds can limit the need to use herbicides. These are all alternative techniques that lead to significant reductions in agrichemical inputs. Together, these practices may help improve consumers' and farmers' health and lessen the adverse environmental effects while improving farm productivity and profitability.

Barriers to the Adoption of Alternative Agriculture

Even though conventional agriculture presents some health, environmental, and economic problems, only a relatively small number of the farms in the United States are considered to have operations that currently meet the goals and practices of alternative agriculture. Although no accurate data are available on the extent of the use of alternative agriculture, one expert believes that 20,000 to 50,000 farms of a total of 2.2 million farms in the country have stopped using agrichemical inputs or are in transition to farming without them. (Youngberg, 1988) Given the potential benefits that many observers believe can be derived from alternative agriculture, this number seems fairly small.

A larger number of farmers employ one or more alternative agriculture practices in conjunction with their more dominant use of conventional practices. For example, conservation tillage, integrated pest management (IPM), and crop rotation methods are extensively used alternative practices. A survey by the Conservation Technology Information Center reports that conservation tillage practices are used on about one third of the total planted crop acreage in the country. (Conservation Technology Information Center, 1988) IPM, in one form or another, is also used on a relatively large proportion of farm acreage, according to USDA information. (USDA, 1988b; USDA 1987a) For certain crops such as cotton and peanuts, IPM is used on approximately 40 to 50 percent of the planted acreage, while for crops such as wheat and corn, IPM is used on approximately 15 to 20 percent of the planted acreage. Conventional agriculture has not eliminated crop rotation from common use, either. Most farmers still employ some form of crop rotation, although it may consist of intensive rotation of only two alternating crops.

In addition, a significant number of farmers do not use some kinds of agrichemicals because of the types of crops they grow and their favorable growing conditions. A large proportion of wheat producers, for example, do not use herbicides or insecticides on their fields. Herbicides are not used on 39 percent of the total wheat acreage under production and insecticides are not used on 93 percent of the acreage. (Osteen and Szmedra, 1989)

There are several reasons why a larger number of farmers have not adopted alternative production practices that significantly reduce agrichemical use. Farmers may perceive that alternative agricultural practices would lower crop yields and profits while making credit and insurance harder to get. Lack of information, lack of access to information, or simple reluctance to change might also hinder their adoption. Farmers may lack markets for some alternative crops, the financial resources to change farm labor and machinery, or the skills needed for more complex management. Finally, since the federal government's farm policies significantly influence farm profits, credit and insurance availability, and the development and transfer of research information to farmers, these policies may—intentionally or unintentionally—institutionalize the use of conventional methods and contribute to the reluctance of farmers to adopt alternative agricultural practices.

Economic Viability

Alternative agriculture must be profitable if farmers are to accept it. Studies on the economic performance of alternative agriculture, however, are few, methodologically limited, and enterprise-specific. They do not allow us to draw firm conclusions about the general profitability of these farming systems compared to conventional farms.

Only a small number of studies using direct farm comparisons, research test plot data, or simulation models have analyzed the economic characteristics of alternative systems and compared them to conventional farm systems. (Dobbs, Leddy, and Smolik, 1988; Goldstein and Young, 1987; Helmers, Langemeier, and Atwood, 1986; Shearer et al., 1981) Additional information from case studies and surveys of farming operations that use alternative systems are also available and lend support to what is known about the economic performance of these farming systems. (National Research Council, 1989; Duffy, Ginder, and Nicholson, 1988; Taylor, Dobbs, and Smolik, 1989) The vast majority of the literature, however, focuses on a narrow set of alternative agriculture systems—namely, farms that use virtually no agrichemical inputs and are most closely linked to organic farming systems. At least one critic has pointed

out that this is a major shortcoming in the research literature, because farmers are less likely to move all the way to organic farming and more likely to adopt one or more alternative practices that are compatible with their conventional farming systems. (Nowak, 1989)

Several reviewers have criticized the methodological quality of many studies that compare alternative and conventional farming systems, particularly much of the research conducted in the 1970's. Problems such as small sample sizes, poorly matched farm comparison groups, and lack of multiyear data have been noted. (Cacek and Langner, 1986; Crosson and Ekey, 1987; McKinney, 1987) Such problems make it difficult to attribute differences in economic outcomes (production costs and profitability) to the farm methods employed.

The studies conducted in recent years appear to be stronger methodologically, but the findings are highly specific to the farm enterprises analyzed. That is, they are limited to specific crop mixes, rotation systems, agroclimatic conditions, and production practices. Findings are difficult to compare, because different assumptions about market prices, crop yields, and government agricultural policies are used. In addition, many of the findings are weakened because the research does not generally take into account possible uncertainties about weather conditions, variations in crop yields, differences in management skills and labor requirements, and the influence of government policies or market conditions.

Although the available research is limited, evidence is beginning to emerge with respect to the potential profitability of certain alternative farming systems that have completely stopped using agrichemical inputs. One economic characteristic shown in much of the literature is that the production costs of the alternative farming systems studied are usually lower than those of the conventional systems that are compared to them. This difference stems largely from a reduction in agrichemical inputs. Although the alternative systems in these studies appear to require more labor for mechanical cultivation and other alternative pest control measures, the increase is not enough to offset the cost reduction gains arising from the decreased use of agrichemicals.

With respect to crop yields, the literature is more divided. In some studies, yields under alternative farming systems were found to be comparable to those achieved under conventional systems; in other studies, alternative agriculture yields were shown to be lower. Several researchers have noted that during an initial transition or conversion phase, crop yields may be significantly lower for alternative systems because of the

time usually required for reduced chemical cropping systems to become established and effective. (Dabbert and Madden, 1986) After some time, however, yields tend to improve as these systems take hold and mature. In several studies, yields are shown to improve to levels slightly lower, on the order of 5 to 10 percent, than those produced under conventional systems. (Goldstein and Young, 1987; USDA, 1980) Although yields produced in these alternative systems were lower, they did appear to be less variable year to year than the conventional yields studied. (Helmers, Langemeier, and Atwood, 1986) In other literature, however, particularly various case studies of alternative farms, yields were found to be higher than local county averages. (Culik, 1983; National Research Council, 1989)

Evidence based on existing research about the overall profitability of alternative farming systems is inconclusive. Most of the available case study information concerns alternative farms that are profitable. (National Research Council, 1989; Madden, 1988) Many of these farms are profitable in part by reducing input costs and relying on higher prices for their crops. By producing crops without agrichemical inputs, these farmers can often take advantage of higher prices available for organic products.

A few existing comparative studies also show that alternative systems can be profitable under certain situations but less so under other conditions. In a study of two different alternative farming systems in the Northern plains, net income for one system was shown to be 30 percent higher than the conventional system analyzed but 48 percent lower for the other alternative system. (Dobbs, Leddy, and Smolik, 1988) In another study of an alternative farming system in the Northwest, net returns were 21 and 7 percent less compared to the conventional system under high and low yield assumptions. (Goldstein and Young, 1987) The authors of this study, however, noted that when government support prices were subtracted from the farm budget calculation, the alternative systems provided higher net returns. Finally, in another study of experimental farming systems in Nebraska, net returns under alternative crop rotation systems were somewhat lower than those of conventional systems employing intensive crop rotation systems but higher than several other systems involving continuous crops. (Helmers, Langemeier, and Atwood, 1986)

One reason for the difference in profitability in these studies appears to be the difference in market value of the crops produced. The alternative systems in these studies tended to have diversified crop rotations, which

included crops such as alfalfa and small grains. These crops generally have lower market prices than the crops characteristic of conventional systems, such as corn or soybeans.

Since many macroeconomic, microeconomic, environmental, and agronomic factors influence farm profitability, a significant amount of further research will need to be completed before it is possible to make general statements about the relative profitability of alternative and conventional agriculture systems. Farmers will naturally be reluctant to change existing production practices without convincing information regarding profitability. Recent interest in alternative agriculture, however, has led to the start of additional farm economics studies. This increased effort should provide better data to assess the profitability of alternative agriculture systems.

Technical Information on Alternative Agriculture

Reliable information about alternative agriculture practices must be available and readily accessible to farmers if alternative agriculture is to be accepted. Many observers have pointed out, however, that research, education, and technology transfer activities in alternative practices have been lacking. (Edwards, 1987; National Research Council, 1989) These observers stress that agricultural research and education activities during the past 3 decades have focused chiefly on increasing food supplies and farm profits through higher yields. This has led to developments in intensive farming practices and the dominant use of agrichemical inputs. Alternative practices that make use of reduced agrichemical methods have not been studied as extensively and, as a result, are not well developed.

A significant amount of work has been conducted on selected practices that can help reduce agrichemical use and improve resource conservation. IPM, conservation tillage, nutrient management, disease and insect resistant crop types, and more efficient agrichemical application techniques are areas where research and education have taken place. As mentioned earlier, some of these practices are used by a large number of farmers.

Research, however, on the use of practical crop rotations that incorporate cover crops such as legumes or intercropping techniques and various biological and mechanical pest control methods has been largely neglected until recently. (Dahlberg, 1986) Information gaps currently exist with respect to these alternative methods. It is generally known, for example, that certain crop rotations contribute to better crop yields

and help break some pest cycles, but information about the types of crop rotations (crop mix, crop varieties, and rotation sequence) that are best suited to different agroclimatic conditions and farm management situations is not readily available. Also, it is widely recognized that various legumes and other nitrogen-fixing crops can be used to enhance fertility but information about the most effective plants to use is limited.

Several proponents of alternative agriculture have suggested that farmers considering the adoption of alternative practices have difficulty obtaining information about such practices. A small number of surveys have been conducted of farmers who use organic methods to learn what sources of information they have used in deciding upon their farming operations. (Blobaum, 1983; Baker and Smith, 1987) Survey respondents from these studies most often identified fellow farmers, specialized farm magazines and newsletters, farm workshops and conferences, and farm experiments as the most important sources of information. A relatively small number of the respondents said that they relied on land grant university researchers or extension specialists for technical information.

Alternative agriculture researchers often emphasize the importance of applying a systems perspective to the study of alternative practices. That is, they look at a whole farm and the interactions of its various components—crop rotations, cultivation, fertilization, crop protection, and farm economics—rather than just balancing inputs against profits. (Edwards, 1987) As agrichemical inputs are reduced, the interaction of the components within the farm system become more important. Instead of relying on a single component such as pesticides, alternative agriculture places greater emphasis on a diverse set of components such as crop rotations, cultivation, and possibly biological controls to protect crops. Knowledge about the interactions of these components is important for developing effective alternative farm management strategies.

A key criticism of agricultural research is that it has failed to approach farming from a systems perspective. Agricultural research, like many other areas of research, has tended to emphasize specialized subareas within the discipline—agronomy, soil science, entomology, and so on—rather than interdisciplinary work that considers the whole farm. As a result, scientific advances pertaining to individual practices have occurred but advances toward the development of agricultural systems have not. Proponents of alternative agriculture argue that the development of alternative practices can come only from an interdisciplinary approach.

A great deal of technical information on particular alternative practices is currently available but much of it is fragmented and not well integrated or accessible to farm producers. Recent interest among farmers and others has contributed to increased research on different aspects of alternative agriculture. Several farm research projects and demonstrations are under way around the country, funded by USDA's LISA program and other government and nongovernment funding sources. These efforts should increase our knowledge about alternative agriculture.

Summary

Alternative agriculture emphasizes a reduction in agrichemical inputs and greater use of management techniques to conserve farm resources, reduce adverse environmental effects, promote health, and improve profits. A broad range of management practices is emphasized, including the use of diversified crop rotations, conservation tillage, animal manures and nitrogen-fixing crops, and biological pest control techniques. Greater adoption of alternative agriculture is unlikely to occur, however, unless more research can demonstrate its profitability and technical utility. The profitability of alternative agriculture systems has been shown in some cases when compared to conventional systems. Further research is needed to systematically evaluate the costs and benefits of various farm practices so farmers can see the likely trade-offs. Research is also needed to develop a better understanding of the effects of reducing agrichemical inputs and to investigate techniques that may effectively replace them.

In the next chapter, we focus on the role of federal agriculture policy and the incentives and disincentives of existing policy for the adoption of alternative agriculture. Federal policy has traditionally had a strong influence on the agricultural sector by supporting farm income and regulating production. Several proponents of alternative agriculture believe that federal policy has been a key factor influencing crop selection and the use of farm production practices.

The Implications of Federal Farm Programs

In this chapter, we discuss federal agriculture policies and programs that create incentives and disincentives for crop selection and production practices and, thus, have the potential to encourage or discourage the use of alternative farming practices. We emphasize the word "potential" because much of what is known about the relationship between federal programs and farm practices is largely unproven or dependent on specific circumstances. Little empirical research isolates and measures the effect of these incentives. Thus, what follows is more a logical than an empirical analysis; we do, of course, make use of available data.

Farmers' decisions about what crops to plant, how much to plant, and which farm practices to use are influenced in varying degrees by a diverse set of interacting factors, including market prices, government policies, personal preferences, management skills and abilities, past experiences, available financial resources, costs of inputs, and agronomic conditions. Market prices may influence some farmers to change crops in order to increase short-term profits, for example, while other farmers may prefer to continue growing the crops with which they have experience.

The following sections describe the federal farm programs and identify elements in them that can logically be expected to affect the use of alternative agriculture, especially through the incentives or disincentives they may offer, and the extent to which they may limit farmers' flexibility to consider and incorporate alternatives. This discussion is based on our review of existing literature, federal legislation and agency program regulations, and material collected from interviews with USDA program officials and other individuals knowledgeable about the federal agricultural support system. After describing the main features of the farm programs, we consider some of the main criticisms raised by proponents of alternative agriculture.

Federal Farm Commodity Price and Income Support Programs

About 50 percent of the total market value of U.S. agricultural crop and livestock production is included in USDA's price and income support programs. (USDA, 1988b) These programs, administered by the Agricultural Stabilization and Conservation Service, were created during the farm depression of the 1920's and 1930's to address the economic instability and risk associated with farming. They are intended to support commodity prices, improve farmers' incomes, and manage the supply of farm commodities. A combination of authorizing legislation, most recently the Food Security Act of 1985 and amendments, and USDA's discretionary authority govern the programs' scope and structure. A

number of provisions authorized by law can be implemented or approved by USDA, based on certain supply, demand, and other market conditions in the farm sector.

One difficulty in discussing farm price and income support programs is that several provisions are commodity specific. Our discussion in the following section pertains to the general provisions that apply most directly to wheat and feed grains.

How Farm Commodity Programs Work

All farmers growing eligible crops are entitled to participate in the farm programs regardless of income, and most of the acreage in program supported crops has been enrolled in recent years.[1] Between 85 and 95 percent of eligible farmland in 1987 was enrolled in the programs that support wheat, corn, cotton, and rice. (USDA, 1989d) Price support programs ensure participating farmers that they will not have to sell selected commodities for less than an authorized floor price. Income support programs pay participating farmers directly if prices for certain crops fall below an established "target" price. Supply management programs may require farmers who are participating in price and income support programs to reduce their plantings; they also allocate production quotas or provide producer storage payments.

In the price support program, nonrecourse loans are made to farmers who pledge their commodity crop as collateral against the loan. A key purpose behind the use of these loans is to enable farmers to hold on to their crops after harvest and sell them at a later date when market prices might be higher. The loan rate is given in dollars per bushel, ton, or hundredweight and effectively acts as a floor price for each crop. Farmers can either repay the loan by selling their crops when market prices are higher than the loan rate or forfeit their crops to USDA when market prices are lower than the loan rate. The loans are "nonrecourse" because the USDA has no choice but to accept the crop as repayment for the loan, regardless of how low market prices may be. A farmer's total loan for each crop is essentially the loan rate times actual production.

[1]Program-supported commodities include feed grains (corn, grain sorghum, barley, and oats), wheat, soybeans, cotton (upland and extra long staple), tobacco (flue-cured and burley), peanuts, rye, rice, sugar, wool, mohair, honey, and dairy. Our discussion of the commodity programs focuses mainly on the provisions that pertain to corn, wheat, cotton, and soybeans. Historically, program participation rates have tended to go up and down as market prices fluctuate. During periods when market prices are low relative to program support prices, participation rates are high; when market prices improve, program participation rates begin to fall.

The income support program makes "deficiency" payments directly to participating farm producers of wheat, feed grains, cotton, and rice if crop prices fall below the "target" price level set by law. The payment rate is the difference between the target price for the crop and the crop's average market price or government nonrecourse loan rate, whichever is higher. A farmer's total deficiency payment for each crop is calculated by multiplying the payment rate by the farmer's established program yield (measured in bushels, pounds, or hundredweight per acre) by the farmer's permitted program acres (the farmer's total crop acreage base minus land set aside through the acreage reduction program) for that crop.[2]

The producer's acreage base and program yield, which together make up the crop acreage base system, are based on previous, not current, production. The acreage base is the average of the acreage that is planted, or "considered planted," in the program crop during the previous 5 years. Land is "considered planted" if it is taken out of production to comply with program requirements designed to manage supply or if it could not be planted because of extreme weather or other conditions beyond the producer's control. The program yield is the average crop yield for the 5-year period 1981-85, dropping the highest and lowest yields. Before 1986, farmers could increase their program yield by increasing actual yields. Since then, farmers have not been allowed to increase program yields, even if their actual crop yields have continued to grow.[3]

Farmers who participate in commodity programs are required to reduce their planted acreage in order to receive support payments or loans when an acreage reduction program is put into effect by USDA. The land that farmers take out of production to meet acreage reduction program requirements, commonly called "set aside" land, must be put into an approved conserving use or planted in an approved crop.[4] Conserving uses vary by locality but generally involve measures to protect land from weeds and erosion. Common measures include growing grass or

[2]If the payment rate is $1.00 per bushel, a farmer with a program yield of 100 bushels per acre and a permitted base of 100 acres will receive $10,000 in deficiency payments ($1.00 times 100 times 100).

[3]The Congress is considering proposals to remove the freeze on program yield levels. The House passed a bill on June 13, 1989, to allow wheat, feed grains, cotton, rice, and soybean farmers to report annual crop yields.

[4]Technically, land taken out of production through the acreage reduction program is called ACR (acreage conservation reserve) land rather than set-aside land; set-aside land is slightly different. The term "set aside" is commonly used, however.

leaving crop residue on the ground. USDA allows grazing on set-aside acreage during part of the year but not haying except under special circumstances, which involve determining that no adverse economic effects will result from such production. The amount of land that participating farmers must put in set-aside varies yearly, depending on estimated crop supplies. A 10-percent acreage reduction was in effect for the 1989 crop year for wheat and corn, compared to 27.5-percent and 20-percent reductions respectively for each crop in 1988.

Farmers are not allowed to plant more than their base acreage in a program crop as long as they are participating in the farm programs. Farmers may leave the program in a given year to "build" their base, however. A farmer with a 100-acre corn base, for example, could stay out of the program for a year, not collect any support payments, and plant 200 acres of corn. A farmer who planted twice as much corn acreage would increase the corn base to 120 acres the following year, based on the previous 5-year average acreage.

Farmers also have the option to participate in the "0/92" and "50/92" acreage diversion programs. Producers can choose to plant less of a program crop than they are permitted to grow and still receive deficiency payments. In the 0/92 program, wheat and feed grain producers can plant as little as 0 percent of their permitted crop acreage base and receive 92 percent of their expected deficiency payments.[5] Land enrolled in these programs and not planted must be devoted to conserving uses.

The crop acreage base system gives participants limited flexibility to grow other program or nonprogram crops. A farmer growing a program crop cannot plant any other program crop, for example, unless that farmer also has a crop acreage base for that crop (this is called the "cross compliance" provision). Thus, a participating farmer growing corn who plants wheat as well but has no established wheat base stands to lose eligibility for benefits in the corn program. Cross-compliance restrictions do not apply, however, to separate farms operated by the same farmer. Farmers who operate multiple farms have greater flexibility to establish or change crop acreage bases.

Certain program provisions can enable farmers to plant other program or nonprogram crops on their acreage bases without becoming ineligible

[5]The "50/92" program applies to upland cotton and rice producers. These producers can receive 92 percent of their expected deficiency payments for planting as little as 50 percent of their permitted program acreage.

to receive benefits or without having to reduce their crop acreage bases. The actual provisions vary from year to year, and many are implemented at the discretion of the Secretary of USDA. Follow-on legislation to the Food Security Act of 1985 allowed participants for each of the crop years 1986-89 to grow "other nonprogram crops" on a portion of their program crop's permitted acreage without any reduction in that crop's acreage base.[6] In 1989, farmers participating in the wheat, feed grains, cotton, and rice programs were also allowed by the Disaster Assistance Act of 1988 to plant soybeans or sunflowers on 10 to 25 percent of the program crop's permitted acreage without reducing their crop acreage base, and an oats provision allows farmers to substitute oats for a program crop.

Farm Commodity Price and Income Support Program Incentives and Disincentives

Proponents of alternative agriculture contend that federal farm programs encourage the use of conventional farm practices while discouraging the use of alternative farming practices. There are several main criticisms, all involving incentives for farmers to

- grow only a small group of selected program crops,
- grow these program crops year after year instead of planting diverse crop rotations,
- overproduce the program crops by farming more intensively, and
- plant program crops on land best left unfarmed.

The logic underlying these assumptions about program incentives is based on four general observations about farmers' behavior. The first is that farmers seek profits: given two alternatives, alike in other ways, a farmer will normally choose the more profitable one. Second, farmers are averse to risk: given two alternatives, alike in other ways, a farmer will usually choose the less risky one. Third, farmers also prefer to follow routines: given two alternatives, alike in other ways, a farmer will typically choose the one that does not require a change in behavior. Finally, farmers differ in their preferences: given two alternatives, alike

[6]Producers could substitute up to 50 percent of the permitted crop acreage base in a nonprogram crop in 1986 and 1987, 35 percent in 1988, and 20 percent in 1989, the last year the provision was in effect. The Secretary also has legislative authority to allow the planting of another set of nonprogram crops called "approved" nonprogram crops. These include sweet sorghum, guar, sesame, safflower, sunflower, castor beans, mustard seed, crambe, plantago ovato, flaxseed, triticale, rye, commodities grown for experimental use, and commodities for which no substantial domestic production or markets exist but that could be used to make industrial raw materials that are being imported. In approving these crops, the Secretary must determine that their production will not have an adverse effect on the cost of price support programs or farm income. The Secretary has not yet chosen to approve the planting of these nonprogram crops.

in every way, two farmers may make different choices. These observations suggest that it is not always possible to precisely predict the effect of a farm program on farmers' behavior. Programs that increase the profits farmers seek may require other changes in behavior that they may resist. However, if a farm program provides strong and consistent incentives for farmers to develop routines that increase profits and reduce risks, then the likelihood that the program will influence farmers' behavior is increased.

1. Incentives to grow only a small group of selected crops. The farm programs support the production of only 16 specified commodities, and they support these commodities to varying degrees. Many other commodities produced in this country, such as vegetables, fruits, and livestock, receive no direct government support.[7] By providing support for selected crops through crop price and income support protection, programs offer incentives to farmers to devote more resources (land, capital, and so on) to the production of supported crops compared to nonsupported crops. The lack of government support for other crops may discourage farmers from planting them.

Many observers have noted that program commodity crops, and especially those given higher levels of support, have tended to displace nonprogram crops, or program crops receiving less support, in areas where the crops could be substituted for one another. In parts of the country best suited to growing grain crops, selected program grains have come to dominate other grains (nonprogram grains and program grains receiving less support). As shown in figure 3.1, the proportion of total acreage devoted to three of the most important program crops (corn, soybeans, and wheat) has increased relative to acreage in other crops.[8] Oats, as shown in figure 3.2, have declined substantially in importance as a cash grain crop, although recent concern about the health risks associated with cholesterol has contributed to an increase in oats consumption since the mid-1980's. The farm programs alone have not been responsible for the changes in crop acreage uses. The displacement of oats by corn and soybeans, for example, occurred in part because prices for corn

[7]Some analysts note that farmers can receive indirect support. If farm programs encourage farmers to grow program-supported crops, market prices of nonprogram crops will tend to rise because more acres are planted in program crops and fewer in nonprogram crops. Also, if program support subsidizes the overproduction of feed grains, nonsubsidized cattle growers still benefit by access to cheaper feed.

[8]Soybeans, however, have received historically less government support compared to corn and wheat. Much of the growth in soybean acreage is largely attributed to expanding markets and improved market prices.

and soybeans were better and corn and soybean yields improved faster than those of oats.

Figure 3.1: Specialization in Corn, Wheat, and Soybeans

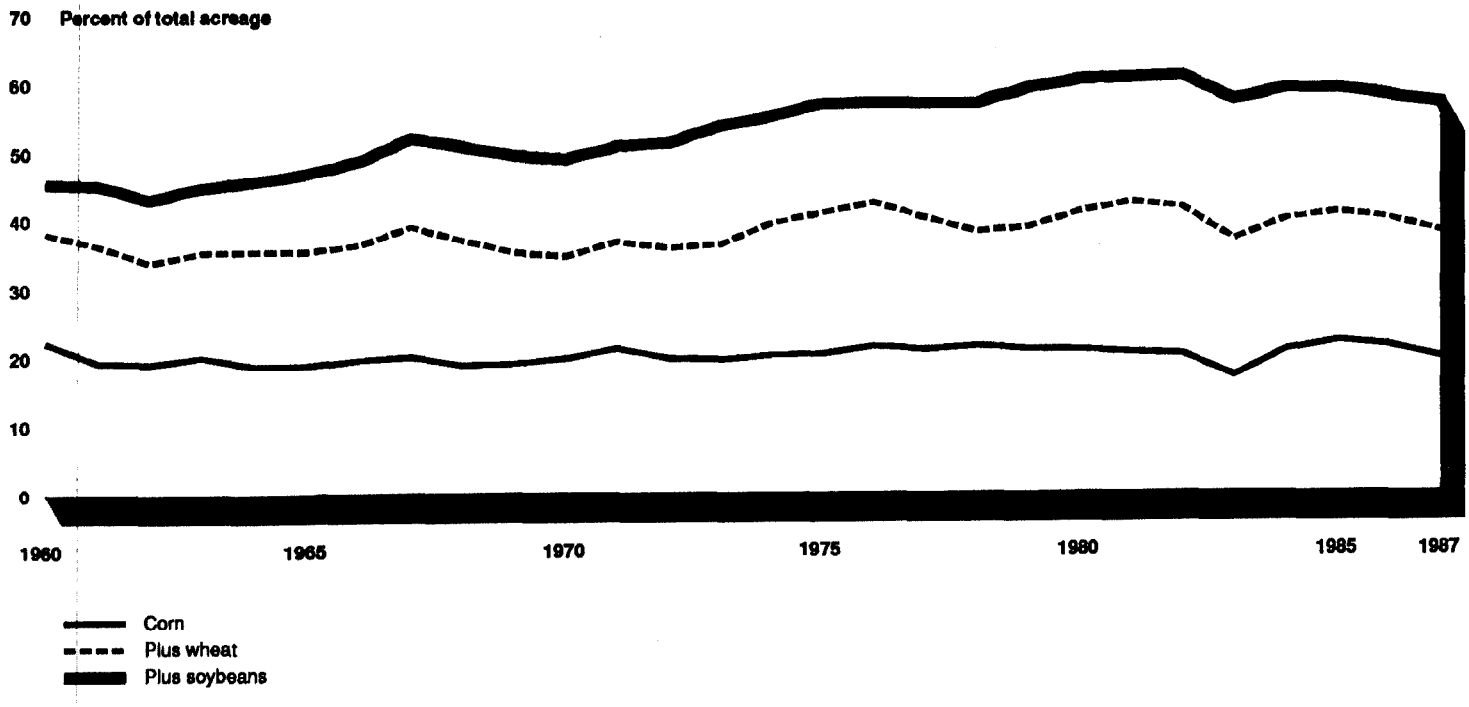
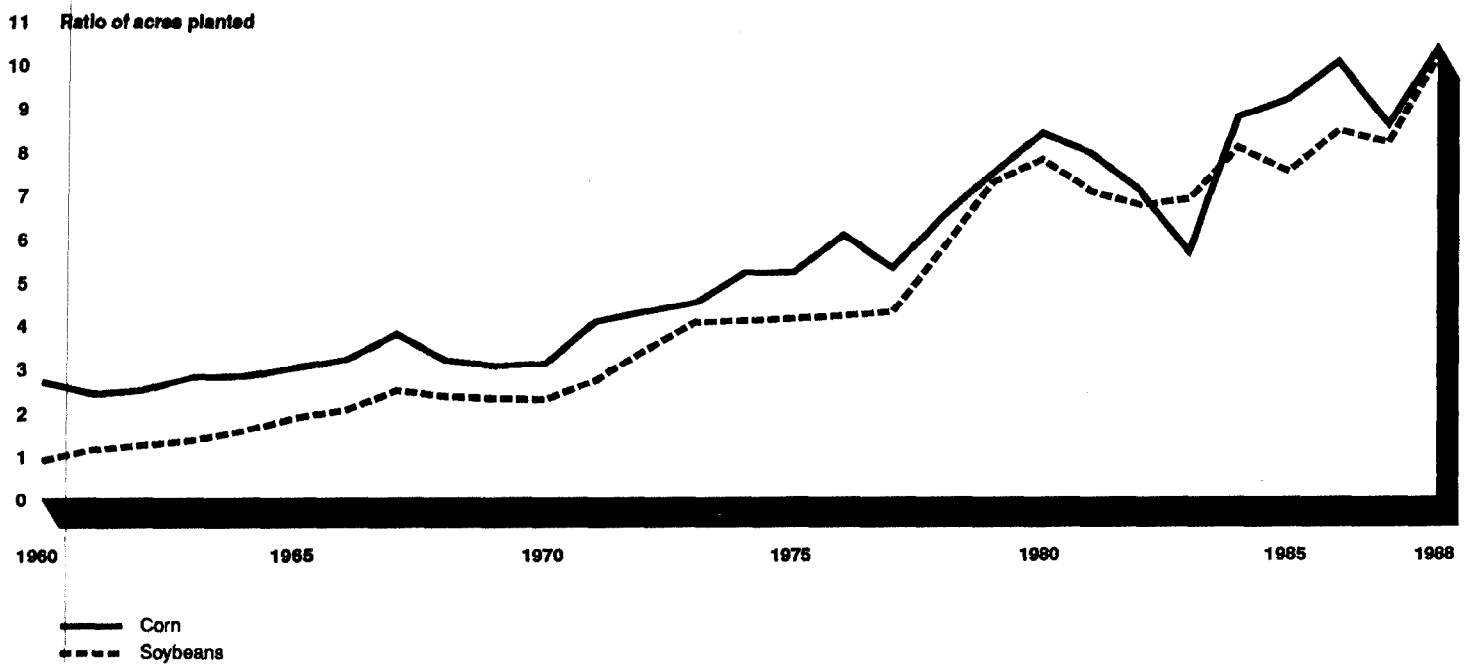


Figure 3.2: Displacement of Oats by Corn and Soybeans



Several analysts have noted that some program crops are heavy agrichemical users.[9] Less-agrichemical-dependent crops receive smaller amounts of or no direct government support. Agrichemical use on four of the largest program-supported crops (corn, wheat, cotton, and soybeans) is extensive. About 65 percent of all commercial nitrogen fertilizer use is directed toward these crops, as is a large proportion of pesticides. (Vroomen, 1989; Osteen and Szmedra, 1989) As shown in table 3.1, fertilizers, herbicides, and insecticides are applied to a high percentage of the acreage planted in these crops. Herbicides, for example, are applied to more than 95 percent of all the corn, cotton, and soybean acreage, and synthetic fertilizer is applied to almost all the corn acreage and about 80 percent of the wheat and cotton acreages.

[9]Many nonprogram crops such as vegetables and fruits also rely heavily on agrichemical inputs, although the acreage of these crops is considerably smaller than that of the program crops.

Table 3.1: Crop Acres Receiving Agrichemicals in 1988

Agrichemical	Corn	Wheat	Cotton	Soybeans
Fertilizer	97%	83%	80%	32%
Herbicide	96	53	95	96
Insecticide	35	4	61	8

Source: U.S. Department of Agriculture, Agricultural Resources: Situation and Outlook Report, Economic Research Service, AR-13 (Washington, D.C.: U.S. Government Printing Office, 1989); C. Osteen and P. Szmedra, Agricultural Pesticide Use Trends and Policy Issues, AER 622 (Washington, D.C.: USDA Economic Research Service, September 1989).

Several program crops are also linked with high levels of soil erosion. Cotton and soybeans are considered to be highly erosive crops, corn is moderately erosive, and wheat is less erosive. (Reichelderfer and Phipps, 1988) Several nonsupported crops including legumes are less erosive as well. The conservation compliance features of the Food Security Act of 1985, which require farmers with highly erodible land to develop conservation compliance plans as a condition for receiving crop support benefits, are expected to help reduce soil erosion through the use of alternative farm practices. The expanded use of conservation tillage methods as a conservation compliance strategy to reduce soil erosion, however, has been subject to controversy. Although reduction in soil erosion is generally associated with reduced tillage, another consequence can be the need to increase herbicide use to control weeds.[10]

2. Incentives to grow program crops year after year rather than rotating crops. The farm programs have provided incentives for farmers to grow the same crop continuously or, where agronomic conditions prohibit farmers from growing the same crop continuously, to grow these crops in intensive rotations. In particular years, federal programs have made profits for supported commodity crops less risky. One way that the farm programs reduce risk for farmers is by guaranteeing them deficiency payments. Program deficiency payments are independent of what a farmer actually produces in a given year, since payments are based on past rather than current production. If, for example, a farmer's yield is reduced because of drought conditions, the farmer receives the same deficiency payments, regardless. The farm programs also can reduce the price risk for farmers because, as market prices fall, deficiency payments increase.

Farm programs also make commodity crops less risky, not only in any given year but also in terms of expectations. This discourages farmers

[10]Although it is conventional wisdom that conservation tillage increases herbicide use, this has not been proven. For a summary of the debate and literature, see Osteen and Szmedra, 1989, pp. 29-36.

from leaving the program, even when other crops look more profitable.[11] Because crop programs on the average increase the profitability of commodity crops and make them less risky, farmers tend to grow them as a matter of routine, a routine that is difficult to break. Again, because of the crop acreage base system, farmers have a substantial investment in expected returns from these crops. The limited flexibility that farmers have with the crop acreage base system also makes it difficult for farmers to make short-term crop changes.

The incentives to grow program crops can lead to greater crop specialization and less diversification in crop mix. But planting the same crops can increase pest and disease pressures and further deplete soil quality, whereas diversified crop rotations can help break pest cycles and improve soil conditions. As a consequence of these problems associated with continuous crop production practices, farmers tend to become more dependent on agrichemical inputs to maintain production.

3. Incentives to overproduce program crops through intensive farming. The incentives to produce program crops may result not only in more total land in the production of program crops but also in increased production per acre of these crops. The incentives to boost per acre production stem from three program features: deficiency payments, loan payments, and acreage set-asides. Deficiency payments are based on historical program yields, so if farmers raise their program yields, they get higher payments every year into the future. Loan payments are made on current actual yields, so raising production gives the farmer greater payments in that one year only. Set-asides force farmers to take land out of production; to maintain net income, they may farm the remaining land more intensively. All three program features may lead to a greater use of agrichemical inputs than in the absence of these programs.

Before 1986, farmers could raise their program yields by increasing their production. This ability to increase program yields by maximizing actual yields may have caused greater agrichemical use than would

[11]The economic tradeoffs involved in switching from corn to soybeans were estimated in a recent study by USDA's Economic Research Service. Although market prices for soybeans increased significantly in recent years in proportion to corn prices, to a point where soybean prices were almost three times higher than corn prices in 1988, it was estimated that price increases for soybeans were probably not enough to offset the long-term net returns that could be gained from staying with the corn program. (Glauber, 1988)

have occurred in the absence of this program.[12] This incentive was significantly reduced by the 1985 Food Security Act, which placed a cap on program yields. But because the Congress may reverse this policy, as the farmers are aware, the farmers have some continued inducements to boost their actual yields.

The loan rates may induce farmers to increase production in any given year. According to economic theory, farmers will apply inputs to boost production to the point where the marginal costs of doing so equal the marginal returns to be gained. It has generally been assumed that whenever the loan rate is above the market price, marginal returns are raised and farmers have incentives to apply more agrichemicals. (National Research Council, 1989, pp. 70-71) But the accuracy of this assumption depends on actual economic and agronomic conditions, and it has not been empirically proven.

Acreage reduction programs could also contribute to the intensity with which land is farmed. Acreage reduction programs are designed to reduce crop production levels by reducing the total acreage planted with program crops. However, when acreage reduction programs are used, permitted acreage may be farmed more intensively to make up for the production lost from idled acreage. Farmers who have less land under production may be able to concentrate greater available resources (machinery and operating capital) toward increasing production. Again, it is not clear that farmers actually do apply extra inputs to their planted acres when they are required to put land into the set-aside program.

4. Incentives to plant program crops on land best left unfarmed. Program support may have encouraged farmers in the past to bring marginal lands into production. That is, lands on which it would be less economically feasible to produce commodities in the absence of government support, such as wetlands or land susceptible to high rates of erosion, are planted with program crops. Cultivation of such marginal land often requires more intensive production methods. The result of this may be a greater total amount of land under production in program crops—crops for which excess supplies already exist.

Recent changes in agricultural legislation may help reduce the incentive to bring additional marginal land into production. The sodbuster and

[12]Though "the theoretical basis for this incentive is clear," the empirical evidence is not. (Young, forthcoming; Young, 1988; Daberkow and Reichelderfer, 1988)

swampbuster conservation compliance provisions created by the Food Security Act of 1985 restrict farmers' opportunities to cultivate fragile lands in the future. Placing land in the Conservation Reserve Program also reduces the total acreage under production.

Farm Credit and Crop Insurance Programs

In this section, we describe USDA's Farmers Home Administration and Federal Crop Insurance Corporation programs and discuss the ways in which these programs can encourage or discourage the use of alternative farming practices.

How Farm Credit and Crop Insurance Programs Work

Many farmers use credit to finance operating expenses and long-term investments in land or machinery. FmHA makes loans directly to farmers and guarantees loans from other sources. It is a "lender of last resort" because it grants credit to farmers who would otherwise be unable to obtain financing at reasonable rates and terms. FmHA loans are intended to serve as a temporary source of credit to help farmers start a farming operation or to strengthen an existing farm operation. FmHA loan terms are more favorable than those available from commercial lending sources. FmHA held about $26 billion in outstanding loans, or about 16 percent of the total outstanding farm debt, in 1987.

FmHA loans are available through several programs authorized by the Consolidated Farm and Rural Development Act of 1961 and amendments. The major loan programs include farm ownership loans to enable certain farmers to buy, improve, or expand farm enterprises; operating loans to pay for the purchase of seed, pesticides, and farm machinery; and emergency disaster loans to help farmers recover from production or physical losses caused by natural disasters. In fiscal year 1987, operating loans made up about $2.5 billion and ownership loans constituted about $0.4 billion of the $3.1 billion in new FmHA farmer program loans.

Farmers must meet certain criteria, such as having sufficient farming experience or training and being unable to obtain adequate credit elsewhere, to qualify for an FmHA loan. Applicants are required to provide detailed information on farm assets and liabilities, crop and livestock production and sales, operating expenses, and key management practices employed on the farm. Loan approval is then based on FmHA's determination of the cash flow expected from an applicant's farm and the applicant's overall ability to repay the loan.

Federal Crop Insurance Corporation

USDA's Federal Crop Insurance Corporation was created more than 50 years ago to provide farmers with limited crop insurance protection against unavoidable losses from events such as adverse weather and pests or diseases. The Federal Crop Insurance Act of 1980 expanded the FCIC program into a nationwide program offering subsidized coverage in nearly all agricultural counties on some 50 different crops. A key intent of the act was to make crop insurance the primary federal disaster relief program for farmers. Crop insurance was intended not to protect farmers' expected profits but, rather, to provide a reasonable level of protection against loss on some portion of their crops' market value.

FCIC relies heavily on the private sector for selling insurance to farmers. The most widely used system involves "reinsured" commercial companies, which sell and service FCIC insurance in their own company names. Under this arrangement, FCIC is responsible for the major portion of the costs resulting from insurance claim losses and administrative expenses. Although program participation rates have gradually increased over time, only one fourth of the eligible planted acreage was insured by the FCIC program in 1988.[13] During the 1980's, FCIC operated at a net loss. Total crop loss indemnities paid out to farmers were more than $1 billion higher than the premiums collected through the sale of insurance.

Farmers who purchase crop insurance can select one of three different coverage levels and one of three different price options. Coverage is available on 50, 65, or 75 percent of a farmer's historical average crop yield. Price options are based on different percentages of a crop's estimated market price. If a farmer, for example, has a 100 bushel per acre average corn production yield and chooses the 65-percent program coverage level, FCIC will guarantee coverage of 65 bushels per acre of corn. If an insurable loss occurs and the farmer's actual production of corn drops to 25 bushels per acre, FCIC will pay the farmer for the difference, 40 bushels per acre. The price level that the farmer signs up for determines the amount of payment per acre. If, for example, the farmer selected a price of $2.00 per bushel, then the total FCIC payment would equal $80.00 (40 bushels times $2.00) per acre.

Insurance premiums are calculated by multiplying the number of acres to be insured by the level of production coverage selected by the crop price selected by an actuarially established premium rate. The premium rate on specific crops takes into account crop production risks by county

[13]Farmers can also purchase private crop hail insurance from a number of different commercial insurers.

location. Local production yields, farming practices, agronomic conditions, and past insurable losses all factor in to risk determinations.

Farm Credit and Crop Insurance Program Influences

Proponents of alternative agriculture claim that farm credit and insurance opportunities are limited for farmers who use alternative farming practices. The basis for this assertion is that farm lenders and insurers are more likely to place greater emphasis on the use of conventional farm practices and are less likely to invest in or provide protection for alternative practices. Credit lenders concerned about an applicant's expected cash flow and ability to repay a loan often require detailed information on past crop production yields and farm management input practices. An applicant who does not have a well-established production history or does not use generally accepted conventional farm practices may be considered a higher lending risk, thus requiring more stringent loan terms.

Similarly, farm practices may play a role in the way crop insurance premium rates are structured and insurance claims are settled. The crop insurance program does not insure any crop acreage if the farming practices being used are not in accordance with the farming practices used to establish the premium rates. And the farm practices considered in establishing premium rates tend to be those associated with conventional farming. Furthermore, the program will not insure against any loss resulting from the failure to use recognized "good" farming practices.

Proponents of alternative agriculture also claim that credit lending policies work against the adoption of alternative practices because many lenders can require that applicants participate in the farm commodity programs as a condition for loan approval. Therefore, farmers wanting to switch from program crops to alternative crops may find it harder to qualify for a loan. For producers of alternative crops, the availability of crop insurance can also be a limiting factor. Although FCIC insurance is available on more than 40 different crops, insurance on these crops is not available in every county and, for many other crops, federal crop insurance is not available at all.

Farm lenders and insurers are concerned about risks. Lenders want a reasonable assurance that loans will be repaid and insurers want to be able to predict outcomes so that premiums can be properly priced to account for risks. Lenders and insurers rely on some knowledge base (for example, historical evidence or available technical information) about farming systems to establish loan-making terms and insurance

rates. Alternatives for which there may be no reliable information available may be regarded as risky by lenders and insurers. Although advocates of sustainable agriculture may say that growing alternative crops or adopting low-input production practices can lead to economic and environmental benefits, the data available on these outcomes are inconclusive.

In interviewing FmHA officials, we found that "key" farm management practices are formally identified for each county. The practices identified are based on generally accepted farm practices used in the area. For individual crops, particular types of fertilizer, pesticides, and herbicides are included as well as recommended application rates. Officials said that these management practices are used mainly as a guide in reviewing loan applications and not as strict criteria for approving loans.

Summary

There are no statutory or regulatory barriers in the farm commodity programs that prevent farmers from incorporating alternative practices. However, the incentives to participate in the commodity price and income programs are strong. The loss of financial benefits derived from participation in the programs is a major economic disincentive that farmers must consider in making any changes that involve growing alternative crops, switching to nonprogram crops, or using low-input production practices, which might result in reduced crop yields. Farmers who have been continuously growing corn, for example, stand to lose significant government support payments, over the short and long run, if they convert to an alternative multiyear rotation that might include corn, soybeans, alfalfa, and meadow. In such a multiyear crop rotation, a farmer may receive government payments for corn on only 25 percent of the acreage, whereas in a continuous corn operation, program payments are provided on all the acreage.

The literature we reviewed indicates that a number of program mechanisms can create incentives and disincentives for crop selection and production practices for some farmers. Farm commodity program provisions can encourage farmers to specialize in the production of program-supported crops and discourage the use of more diversified cropping systems. In the following chapter, we present information from our case study interviews with farmers to examine the effects of these farm program incentives on their behavior.

Farmers' Opinions

In this chapter, we summarize the information we collected from our seven site visits to selected counties in Georgia, Illinois, Iowa, Kansas, North Carolina, South Dakota, and Wisconsin. We completed interviews with a judgmentally selected sample of 74 farmers and met with various farm program, extension service, and other farm-program-related officials. In the first section, we describe the farms we visited. In the following sections, we present summary information on the farmers' opinions regarding factors related to planting decisions, ways to reduce farm risk, the sustainability of their farms, and their assessment of barriers to alternative production practices.

The survey results are presented to help answer three questions: (1) What are these farmers' opinions about the issues? (2) How strongly do they feel about particular issues? (3) Are there differences of opinion among different types of farmers? The tables in this chapter present data concerning the farmers' opinions. The statistical tests we used to assess the answers to the latter two questions, and the data from these tests, appear in appendix I. Throughout this chapter, when we say that, for example, a factor is important, or that differences do exist between categories of farmers, we mean that we are at least 90-percent certain of these conclusions, given appropriate statistical tests. If we state that factors may be important, or differences may exist, this indicates that statistical tests do not give us at least 90-percent confidence in the results.

Description of Farms

The farms in our sample tend to be fairly large, the median farm having 885 acres. Farm size varies from a median of 430 acres in Wisconsin to about 1,825 acres in Kansas. The farms generally grow the major crops found in the different agricultural production areas represented. About two thirds of the farms supplement their income with livestock.

The farmers in Illinois, Iowa, and Kansas have the least-diversified farms with respect to the number and types of crops grown and have the farms most heavily concentrated in the farm program crops. The Illinois and Iowa farmers have 90 and 98 percent of their cropland planted in corn and soybeans, with somewhat more devoted to soybeans. In Kansas, wheat accounts for almost 70 percent of cropland. Farmers in Georgia and North Carolina also plant corn and soybeans but in addition grow sizable acreages of cotton, tobacco, wheat, peanuts, or vegetables. In Wisconsin, the farmers we interviewed are primarily dairy farmers growing corn and hay for feed. The farmers in South Dakota generally grow corn, soybeans, wheat, oats, and hay.

We found that the farmers employ a large number of farm practices to prepare fields, fertilize soils, and control pests and weeds. Their practices are for the most part those generally associated with conventional farming and with the common practices used locally. Almost all the farmers we interviewed said they recognize the agronomic benefits derived from rotating crops into different fields and that they use some form of a crop rotation system on at least some of their land. Crop rotations vary from simple and short ones with two crops alternated every other year to complex ones, with four or more crops, lasting a number of years. Many farmers plant the same crop year after year on some portion of their land in addition to using crop rotations on other parts of their farms. In general, our farmers do not follow a rigid schedule for rotating their crops.

The farmers in our sample take a variety of steps to enhance the fertility of their soil but rely primarily on commercial fertilizer. Anhydrous nitrogen is the most common fertilizer, used by about 75 percent of the farmers we interviewed. While no farmer relies on livestock manure as a sole source of fertilizer, many do intermittently spread manure on their fields to supplement the synthetic fertilizer. About half the farmers indicated that they grow some cover crops or other nitrogen-fixing crops, which are used to enhance soil fertility.

In preparing their fields for planting, the farmers use several techniques to till the soil.[1] The farmers noted that their tillage practices are influenced by the type of crop they are planting and the quality of the land. About 65 percent of the farmers claimed to use conservation tillage practices, including no-till and contour farming on some portion of their cropland.[2]

The farmers in our sample use a broad range of practices to control weeds, insects, and plant diseases. Herbicides, insecticides, and fungicides are commonly used. Farmers differ in their application methods. Some farmers said they do not use any agrichemicals on certain crops such as small grains, while others noted that they use pesticides in anticipation of pest problems. Many other farmers indicated the number

[1]About 84 percent of the farmers said they use a disk, 68 percent a chisel plow, and 57 percent a moldboard plow on some portion of their crop fields.

[2]Conservation tillage systems must leave certain amounts of crop residue on the ground to help prevent erosion. For a precise definition, see USDA, 1989d. Estimates of conservation tillage use vary greatly, because farmers may say they are practicing it if they are using certain equipment, regardless of how much crop residue they actually leave on the ground. (Bull, 1989, p. 36)

of applications depends on the severity of the pest problem. Most farmers spread their agrichemicals over the entire field, although many also apply them directly to the crop rows. More than half the farmers said they use some form of integrated pest management on their crops.[3] For the most part, the type of IPM these farmers use involves regularly scouting their fields for pests before applying control measures. The farmers also employ cultivation methods to control weeds and rely on crop rotation to help break pest cycles. To a lesser degree, they spray pesticides and herbicides only on infested areas, adjust planting dates, or use organic pesticides.

Although we visited a variety of different farms, they may usefully be divided into two main groups: "specialized" and "diversified" farms. We defined specialized farms as those that have a high percentage of their farmland concentrated in a small number of commodity crops, while diversified farms grow greater numbers of crops in relatively smaller portions. As with conventional and alternative farms, there is no absolute distinction between specialized and diversified farms; rather, our definition divides a continuum into two categories.[4]

Dividing the responses into specialized and diversified farm categories gives us the ability to examine the influence of the federal farm programs on farmers' behavior in an interesting and important way. As we have seen, proponents of alternative agriculture claim that the federal farm programs provide incentives for farmers to become and remain highly specialized in program crops and that such specialization leads farmers to choose farm practices that are not sustainable. By distinguishing between relatively specialized and diversified farms, we can examine such claims. For example, did the specialized farmers in our sample behave differently from the diversified ones? Did the diversified farmers believe that the farm programs encouraged them to specialize in program crops? Did the specialized farmers think that the farm programs provided them incentives to remain specialized?

[3]"IPM is a pest control strategy based on the determination of an economic threshold that indicates when a pest population is approaching the level at which control measures are necessary to prevent a decline in net returns—that is, when the predicted value of the impending crop damage exceeds the cost of controlling the pest. . . . In practice, however, IPM is generally based on scouting fields to determine pest or disease populations or infestation levels, more precise timing and application of pesticides derived from scouting, better knowledge of consequences of various levels of pest and predator populations, rotations, and more precise timing of planting." (National Research Council, 1989, pp. 208-9)

[4]The specialized farmers planted an average of 59 percent of their cropland in their main commodity crop, 92 percent in two crops, and 96 percent in three crops. The comparable numbers for diversified farmers are 38, 58, and 68 percent.

Factors Influencing Planting Decisions

Each year, farmers must decide what crops, and how many acres of them, they will plant. These decisions are among the most important ones a farmer makes. The choice of crops and livestock heavily influences the kinds and quantities of inputs that will be used to control weeds, insects, diseases, and soil fertility. The choice has a large effect on the farm's profitability. Consequently, these decisions are tremendously important for the farm's economic outcomes and environmental effects.

In this section, we focus on the factors that influence planting decisions as revealed in our farmers' interviews. Although we consider a broad array of influences, we are particularly interested in the effect of the federal farm programs. To examine this influence, we asked farmers: "To what degree did the following factors affect your decision about what crops to plant this year?" We listed 10 possible factors that we had selected from the literature. The farmers could rate them between 1 and 5, with 1 representing "no influence" and 5 signifying a "large influence." In table 4.1, we present averages for specialized and diversified farmers, as well as a summary of all the farmers together.

Table 4.1: Factors Influencing Planting Decisions[a]

	Farmers interviewed		
Factor	**All**	**Specialized**	**Diversified**
Desire to keep crop acreage base	4.09	4.26	3.91
Experience with the crop	4.00	3.60	4.48
Availability of markets	3.78	3.46	4.12
Farm program benefits	3.76	3.77	3.74
Need to rotate crops	3.76	3.80	3.72
Crop prices	3.74	3.37	4.08
Availability of equipment	3.26	3.03	3.49
Availability of labor	2.87	2.63	3.11
Need to produce feed	2.83	2.63	3.03
Conservation compliance	2.55	2.29	2.85

[a]1 = no influence; 3 = moderate influence; 5 = large influence.

Because planting decisions are such an important influence on input use, we examine this table in depth. First, we highlight the factors that appear to be the most influential, and then we note the differences between specialized and diversified farmers.

Federal farm programs are among the most important factors influencing planting decisions. On the average, farmers responded that the federal farm programs have a moderate-to-large influence on their planting

decisions. Both "the desire to keep my crop acreage base" and the "farm program benefits" were important. (See appendix I.)

Federal farm programs are not the only important factors: other factors are also influential. Although the farmers think the federal farm programs have a great deal of influence on their planting decisions, they also believe that other factors are quite important. Overall, the average scores for 6 of the 10 factors indicated that they have a moderate-to-large influence on planting decisions. (See appendix I.)

The desire to maintain the crop acreage base may be the most important influence on farmers' decisions.[5] Crop prices, markets, and the amount of federal program benefits a farmer receives change every year. The farmer is unable to control prices, markets, or benefit levels. Crop acreage bases, however, are both durable and controllable. Since crop acreage bases are actually tied to the land, they can permanently enhance its value and the farmer's income.[6] The crop acreage base seems to be like the farmer's home: the price cannot be controlled by the owner, but the condition can be.

Specialized and diversified farmers may be influenced by different factors in making their planting decisions. When comparing the two farm categories, it appears that diversified farmers give greater weight to experience, markets, and prices in determining what to plant. Specialized farmers are less influenced by prices or markets. Specialized and diversified farmers do not differ in their assessment that the farm programs are important. (See appendix I.)

Specialized farmers may be more influenced than the diversified farmers by the federal farm programs. The specialized farmers gave the "desire to maintain my crop acreage base" a higher score than any other response. The average score the diversified farmers gave for "desire to maintain my crop acreage base" was lower than the ones indicating the "experience with the crop," "availability of markets," or "crop prices." (See appendix I.)

In general, the farmers indicated that they prefer to continue planting what they have planted in the past, and those crops for which markets

[5]In our statistical analysis of these responses, this factor had the highest reported probability, and it is not significantly correlated with the other factors.

[6]The expected benefits from the crop acreage base are capitalized into the value of the land. (Strange, 1988, pp. 196-98)

are available, but that they are also influenced by federal farm programs. This has important implications for the effect farm programs may have on planting decisions. Farmers may be reluctant to discontinue growing crops that they have substantial experience with, even if federal programs change. Farmers who do stop growing a crop may be hesitant then to grow it again. To the extent that the farm programs continuously provide signals to grow a limited number of specific commodity crops, they are likely to discourage farmers from growing other crops. Although changes in the farm programs may quickly change the amount of each program crop farmers grow, farmers are less likely to quickly change the crops they actually grow.

The farmers noted often that they want, and try, to use crop rotation. This can point to a clear conflict, though, with their desire to maintain their crop acreage base, if by maintaining their base they must alter their rotation or by following their rotation they must reduce their base.

Ways to Reduce Farm Risk

Farming is a risky business. To stay in business, farmers must find ways to reduce their risks. The strategies they choose for cutting risks can influence their choice of farming practices. In table 4.2, we present the farmers' opinions about various risk-management strategies.

Table 4.2: Ways to Reduce Farm Risk[a]

	All		Specialized		Diversified	
Response	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Enter farm programs	65	6	33	2	32	4
Diversify with crops	57	14	24	11	33	3
Diversify with livestock	43	28	19	16	24	12
Buy crop insurance	31	40	20	15	11	25
Use "extra" fertilizer	11	60	2	33	9	27
Use "extra" pesticide	5	66	2	33	3	33

[a]Numbers are numbers of respondents.

Farm Programs

More farmers think that participating in the federal farm programs is a better way for them to reduce the economic risks that they face than any other factor. When given a list of six possible ways to reduce risks, they overwhelmingly chose "entering the farm programs to get at least a fixed minimum price" for their crops as a good way; the specialized farmers were not different from the diversified farmers in this respect. (See appendix I.) In follow-up comments, many farmers said they considered farm program support to be economically essential to them as a

condition for growing the crops covered by the programs. According to them, producing these crops outside the programs, and then competing with farmers who received program support, would have been very difficult during the mid-1980's.

Crop Diversification

This was the second most popular factor. More diversified farmers than specialized farmers preferred to cut their risks by planting a variety of crops. (See appendix I.) This may not seem surprising, but it is important. Farm management specialists have long advocated diversification as a way to reduce risk. But these data suggest that farmers who are specialized are less likely to think they need to diversify in order to lessen their uncertainties. Within the diversified farm category, about the same number of farmers think that program participation and crop diversification are good ways to cut risk. Among the specialized farmers, however, a substantially greater number think that program participation, rather than crop diversification, is a good way to reduce risk.

Livestock Diversification

The third most common way for reducing risk that the farmers in our sample cited was to diversify a farm by adding livestock. Diversified farmers did not agree with this position more than specialized farmers. (See appendix I.)

Federal Crop Insurance

Overall, fewer than half the farmers believe that buying crop insurance is a good way to reduce their business risks. However, a majority of specialized farmers said they thought it is; this was significantly more than the number of diversified farmers who agreed. (See appendix I.)

Use of "Extra" Fertilizer and Pesticides

Some observers have suggested that farmers may use greater amounts of fertilizers and pesticides than are objectively necessary to produce optimal crop yields. (Nowak, 1989) However, as table 4.2 shows, few farmers said that applying "extra" fertilizer or pesticides to their crops was a good way to reduce their risks. This indicates that these farmers are applying the amount of agrichemicals that they perceive to be necessary to achieve their yield goals. It is not surprising that farmers and outside observers disagree on this point. However, whatever the objective conditions, unless farmers believe that they are overapplying agrichemicals, it is unlikely that they will voluntarily reduce their use of them unless convincing evidence to do so is provided.

Influence of the Farm Programs on Farmers' Behavior

In the previous sections, we saw that the federal farm programs are considered to be very important for farmers' planting decisions and risk-reduction strategies. We also noted that the federal programs are not the only factor influencing planting decisions or risk reduction. The farmers' decisions are influenced by their experiences with a crop, the availability of markets, crop prices, and other considerations. Risk reduction involves crop and livestock diversification and purchasing crop insurance as well as enrolling in the federal farm programs.

In this section, we focus more explicitly on the influence of the federal farm programs on farmers' behavior. Instead of asking farmers "Do these factors influence this behavior?" as we did in the section on planting decisions, here we asked farmers "Does this factor influence these behaviors?" Because we saw that a variety of factors influence planting decisions, it should not be assumed that the farm programs are the only influence on these other behaviors. Still, it is important to examine the effect the farm programs do have.

We asked the farmers two kinds of questions about the effect of the federal farm programs. The first was phrased as a personal one: "Does participating in the farm program encourage you to ————————?" The second was stated more generally: "Does participating in the farm program make it (easier, harder) to ————————?" In both cases, we read the farmers a list of choices. The farmers could choose from the following list of responses: strongly agree (1), agree (2), no effect (3), disagree (4), and strongly disagree (5). Their responses are summarized in tables 4.3 and 4.4. The main results can be summarized as follows.

Table 4.3: "Does Participating in the Farm Program Encourage You to ————————?"[a]

Behavior	All	Specialized	Diversified
Grow only program crops	2.18	2.14	2.22
Specialize in one crop	3.22	3.00	3.43
Get crop insurance	3.31	3.00	3.63
Use more fertilizer	3.33	3.23	3.43
Use more herbicide	3.43	3.31	3.54
Grow best crop rotation	3.44	3.74	3.16
Expand farm size	3.51	3.63	3.41
Produce higher yields	3.60	3.60	3.59
Use more pesticides	3.63	3.51	3.73
Raise crops and livestock	3.69	3.63	3.75
Borrow more	3.94	3.86	4.03

[a]Farmers were asked whether participation in the farm program encouraged them to engage in the behaviors listed. Responses ranged from 1 = strongly agree through 3 = no effect to 5 = strongly disagree.

Table 4.4: "Does Participating in the Farm Program Make It ————————?"[a]

Behavior	All	Specialized	Diversified
Difficult to switch rotations	1.94	1.63	2.25
Easier to get credit	2.17	2.31	2.03
Tough to grow nonprogram crops	2.41	2.00	2.81
Tough to raise crops or livestock	3.13	3.09	3.17
Easier to grow one crop	3.30	3.06	3.53
Important to expand	3.43	3.40	3.46
More important to get insurance	3.51	3.51	3.50
Less important to use fertilizer	3.77	3.86	3.69
Less important to use pesticide	3.90	3.88	3.91
Less important to use herbicide	3.97	4.03	3.92

[a]Farmers were asked whether participation in the farm program made these behaviors likely. Responses ranged from 1 = strongly agree through 3 = no effect to 5 = strongly disagree.

The farmers agreed that participating in the farm program encourages them to grow only program crops and makes it difficult to switch crop rotations, somewhat tough to grow nonprogram crops, and easier to get credit. (See appendix I.) While the farmers believe that the farm programs encourage them to specialize in program crops, they do not necessarily believe that the programs encourage them to specialize in a single program crop:

- The farm programs do not encourage the farmers to use more agrichemicals, nor do they make it less important to use them.

- The farm programs do not encourage farmers to raise both crops and livestock, nor do they make it tougher to raise both.
- Overall, there are few differences between the specialized and diversified farmers.

The data do not allow us to conclude that the specialized and diversified farmers have systematically different opinions about these farm program influences. (See appendix I.) They may differ on individual factors, however. In particular, the specialized farmers agreed more consistently than the diversified farmers that the farm programs make it difficult to switch crop rotations and grow nonprogram crops. Diversified farmers are ambivalent about whether the farm programs encourage them to grow their best crop rotations, but the specialized farmers tend to view the farm programs as being more of a disincentive. (See appendix I.)

The farmers disagreed that participating in the farm programs encourages them to produce higher yields than they otherwise would. We did ask farmers how their actual crop yields compared with their program-established crop yields in order to learn whether they might have leveled off production since program yields were frozen by the Food Security Act of 1985. Almost 90 percent of the farmers said that their actual yields were higher by anywhere from 5 percent to 50 percent. In follow-up comments, some farmers felt that program yields should more closely reflect their actual yields. The farmers said that for the most part they try to produce the best crop yield possible, regardless of program influence.

In subsequent questions, we asked farmers whether they had considered planting some other crops and, if so, what crops. Fifty-seven percent responded that they had considered planting other crops. Twenty-nine farmers stated that they were interested in adding either more acreage of their existing crop mix or more of some other program-supported crop such as oats and soybeans. Twelve farmers said that they had considered growing some other nonprogram crop. A variety of reasons were given for not wanting to plant other crops, including the weather, the lack of markets, and the lack of flexibility in the farm programs.

We also asked the farmers if they would consider growing some other crop if their existing program crop acreage base were protected. In response, 75 percent of the farmers said they would. Several farmers stated that the farm programs should provide more flexibility to enable them to switch crops and expand rotations while still maintaining crop

bases intact. About one fourth of the farmers in our sample said they had signed up for USDA's soybean and sunflower program, which allows farmers to plant a limited amount of these crops on a crop acreage base without any loss of base acres.

Farmers' responses about planting other crops may have important implications with respect to any proposed program changes that provide farmers with flexibility to plant different crops. The farmers we talked with showed a strong interest in having greater flexibility in their planting decisions, but much of the interest was directed toward other program crops and not necessarily alternative crops. Allowing farmers to plant other program crops would certainly improve farm diversity and perhaps profit, but there is some question as to whether or not such flexibility would lead to significant changes in production methods and improvements in resource conservation or reductions in farm-related environmental effects.

The farmers believed that participating in the farm programs makes it easier for them to borrow money but does not encourage them to borrow more. Some observers have noted that it is easier to obtain credit if one is in the program, because lenders are more certain of the farmers' cash flow. A few farmers noted that the programs themselves are a source of credit: advance deficiency payments can be used to cover early planting expenses.

The farmers disagreed mildly that the farm programs encourage them to buy crop insurance or make it more important to get insurance. A majority of the farmers (58 percent) we interviewed were currently insured. Some pointed out, however, that they were required by law to buy crop insurance because they received disaster benefits following the severe drought of 1988. Several farmers were critical of the current crop insurance program and believe it is not cost effective. These farmers said that insurance coverage is insufficient to cover their crop production levels and that the cost of premiums is too high. A number have chosen to insure selected crops, usually the ones with a high cash value such as corn, tobacco, or peanuts.

Farmers' Opinions About Sustainability

Most analyses of farm sustainability that we reviewed take an outsider's view: sustainability is assessed according to the analyst's criteria. In this section, we let the farmers speak for themselves, by asking them what they think about their farms' prospects.

Most farmers we interviewed were optimistic. When asked whether they intended to continue planting their current crop rotation into the foreseeable future, fully 97 percent said "Yes." We then asked them about the effects of continuing to use this rotation on their agrichemical use, farm environment, and farm economics. The farmers could choose from the following list of responses: greatly increase (1), increase (2), no change (3), decrease (4), and greatly decrease (5). Again, most farmers were fairly confident about the future, as table 4.5 shows. (See also appendix I.)

Table 4.5: Effects of Continuing Current Crop Rotation[a]

Effect	All	Specialized	Diversified
Inputs			
Herbicide	3.11	3.11	3.11
Pesticide	3.11	3.20	3.03
Fertilizer	2.96	3.00	2.92
Environment			
Erosion	3.23	3.40	3.06
Weed problems	3.13	3.11	3.14
Water quality	3.06	3.00	3.12
Pest problems	3.01	3.00	3.03
Soil fertility	2.63	2.66	2.60
Economics			
Profits	2.61	2.65	2.57
Crop yields	2.31	2.29	2.34

[a]Effects ranged from 1 = large increase through 3 = no change to 5 = large decrease.

Most farmers expect the future to be similar to the present. In particular, the farmers do not think they would use more agrichemical inputs, nor do they think that their water quality and pest or weed problems will change. Although on the average they see the other factors as changing, the changes they expected were modest.

The farmers are in general slightly optimistic about their input use, environmental effects, and business prospects. The farmers on the average said that their crop yields and profits would increase if they continued planting their current crop rotation; the farmers said they thought that these would increase more than any other factors. The farmers believe their soil fertility will increase and soil erosion will decline.

Some qualifications should be made to these results, however. First, the farm economy in general was improving when these interviews were

conducted; this economic upswing may have biased the responses for the other questions. In addition, these farmers themselves had weathered the economic problems of the mid-1980's. Finally, we believe that the farmers tended to say what they hoped would happen rather than what they thought would happen. Still, the responses demonstrate that the farmers are not terribly concerned that their operations will require more agrichemicals, damage the environment, or become unprofitable.

Barriers to the Adoption of Alternative Practices

In this section, we discuss what the farmers themselves identified as barriers to the adoption of alternative agriculture. We read the farmers the following statement,

"Currently, many people are talking about the viability of alternative farming operations which, for example, use diversified crop rotation systems and rely less on pesticides and fertilizers. What do you see as the main barriers farmers face in adopting these alternative farm practices?"

Then we presented them a list of potential barriers. We asked them whether they strongly agreed (1), agreed (2), felt neutral (3), disagreed (4), or strongly disagreed (5) with each factor. Their responses are summarized in table 4.6.

Table 4.6: Barriers to the Adoption of Alternative Agriculture[a]

Potential barrier	All	Specialized	Diversified
Greater management is required	1.61	1.63	1.59
Yields may decline	1.66	1.56	1.76
Weeds may increase	1.76	1.86	1.66
Profits may decline	1.89	1.80	1.97
Farm labor is unavailable	1.89	2.06	1.71
Need to maintain crop acreage base	1.90	1.80	2.00
Workload may increase	1.96	2.09	1.82
Current system works well	1.99	2.09	1.88
Lack of information	2.11	2.14	2.09
Loans are more difficult to get	2.13	2.23	2.03
Loss of federal benefits	2.39	2.54	2.24
Markets are not available	2.43	2.40	2.46
Rotations are not allowed in program	2.49	2.23	2.74
Livestock will be needed	2.53	2.26	2.80
Alternative techniques are not allowed on rental land	2.87	2.47	3.26
Crop insurance may be more difficult to get	2.77	2.94	2.60
No vacations will be possible	2.91	3.34	2.45
Neighbors "won't understand"	3.27	3.29	3.26

[a]Barriers ranged from 1= strongly agree through 3 = feel neutral to 5 = strongly disagree

Farmers see a great many barriers to the adoption of alternative agriculture. Of the 18 potential barriers we listed, 14 were thought to be significant barriers. (See appendix I.) The first 10 factors in particular seemed to provide the largest barriers. Again, it is not possible to precisely rank these factors in order of importance because many of them are correlated.[7]

The federal farm programs provide significant barriers to alternative agriculture. "Need to maintain crop acreage base," "loss of federal benefits," and "crop rotations not allowed in the farm programs" all pose significant barriers. The crop acreage base factor seems likely to be the most important of these.

Many barriers to alternative agriculture are not directly related to the federal farm programs. In particular, farmers believe that adopting alternative agriculture practices may require greater management skills and cause greater weed problems, lower yields, and lower profits. The

[7]For example, management is positively correlated with yields, crop acreage base, and loans at the .01 level in a two-tailed test.

lack of farm labor, and the opinion that their workload may increase, also appears to discourage farmers from embracing alternative practices.

Specialized and diversified farmers do not appear to differ in the barriers they see. (See appendix I.) The farmers stressed that many alternative practices might be technically feasible on their farms but that for a variety of reasons they are impractical. For example, several farmers expressed an interest in using livestock manure to enhance soil fertility but said that the lack of an available supply was a major constraint and to a lesser degree, given that supplies existed, the costs of accurately measuring and applying the manure would be too high. A number of farmers also said that legume crops had been used many years ago to enhance soil fertility but they could not be used effectively now. Using legumes is more costly and time consuming than using commercial fertilizer, they said, and also means losing a cash crop.

Several farmers also gave specific examples concerning their reluctance to adopt alternatives. Peanut and tobacco farmers in the Southeast, for example, said that past disease problems required clean fields before planting. According to these farmers, this meant that alternative practices involving the use of legumes or conservation tillage are not practical. A number of other farmers claimed that reduced prices for lower-quality crops also limit their ability to use alternative practices. A few cotton and soybean producers, for example, said that weeds mixed in with a harvested crop would lower the quality of the crop and the expected price they could obtain in the market.

Obtaining Credit and Crop Insurance

In our interviews with farmers, we asked them if, when they applied for a loan or purchased insurance, lenders and insurers inquired about their farm practices and participation in the farm commodity programs. Slightly over 80 percent of the farmers in our sample said they had applied for a farm mortgage or operating loan in the last 5 years from a commercial bank, FmHA, or another credit source. A summary of the responses to our farm credit questions is given in table 4.7.

Table 4.7: Farm Credit

Question	Percent answering "yes"
"Did the loan officer ask you about your ————?"	
USDA farm program participation	47%
Program payments	36
Pesticide use	11
Herbicide use	11
Fertilizer use	11
Tillage practices	11
"Did the loan officer suggest that you should ————?"	
Participate in the farm programs	18%
Change your pesticide use	3
Change your herbicide use	2
Change your fertilizer use	2
Change your tillage practices	2

These data suggest that lenders are concerned more about farmers' financial condition and their ability to repay a loan and less about their choice of farm management practices. However, because the government has been an increasingly important source of income for farmers, participation in the programs has almost certainly become more important for farmers repaying loans. Eighteen percent of the farmers said that lenders recommended they participate in the programs in order to qualify for a loan. We also asked our farmers if they were aware of any other local farmers who had trouble borrowing because of the type of farm practices they used or because they wanted to switch some of their cropland from a program crop to a nonprogram crop. Only about 5 percent of our respondents said they knew of any such cases.

About 70 percent of the farmers we interviewed had purchased crop insurance at some time in the past and about 58 percent were currently insured with FCIC. The farmers overwhelmingly said that farm practices and commodity program participation are not a consideration when applying for crop insurance or in settling insurance claims.

To the extent that farmers are in reasonably sound financial condition and make regular loan repayments, it may not be surprising that lenders

show only modest interest in their farming practices. For farmers considered to be higher credit risks, lenders may devote greater attention to management practices.

Summary

In this chapter, we provided detailed information on a number of topics from our interviews with farmers. Several key points are worth summarizing, and it is important to note that these points correspond to the findings presented in chapter 3.

- Farmers viewed federal farm programs, particularly the crop acreage bases, to be important in their planting decisions. This was even more apparent for our group of specialized farms. Other factors such as experience with the crop, market availability, and crop prices were important as well.
- Farmers believed that entering the farm programs and, to a lesser degree, diversifying with crops were good strategies for reducing farm-related risks.
- Participating in the farm programs encourages farmers to grow only program crops while making it difficult to switch crops or grow non-program crops. The farmers did not show that the programs had much influence on other farm practices.
- The vast majority of the farmers expected to continue with their existing farm operations and expected no change in input use or in the environmental quality on their farms, but they did expect some improvement in farm economics.
- The farmers identified many barriers to the adoption of alternative agriculture. The federal farm programs created important restraints, but there were also a number of barriers that are not directly related to these programs.

The implications of these findings will be discussed in the next chapter.

Summary

Agriculture in the United States is highly productive. Food supplies are abundant and available to consumers at relatively low prices compared to prices in other countries. Fewer than half as many farms today farm about the same amount of land and produce roughly twice as much output per acre as farmers did in the 1940's. Gains in productivity have been made possible largely as a result of farm specialization and the development and increased use of agrichemical inputs and other technological innovations.

In spite of these achievements, several health, environmental, and economic problems face conventional agriculture today. Concern is growing among consumers that harmful residues from agrichemicals are appearing in the food they eat and the water they drink. At the same time, many observers believe that the soil erosion and water pollution caused by current agricultural practices are depleting valuable natural resources. Furthermore, the long-term profitability and competitiveness of farming has come into question as the farming sector struggles to rebound from a period of financial stress, reduced export market share, and high government farm spending.

Farm Programs

Concerns about conventional agriculture have led to interest in a broad range of farming practices, collectively called alternative agriculture, that attempt to reduce agrichemical use while maintaining productivity and profitability. Although a large number of farmers in the United States use one or more alternative practices as part of their conventional farming systems, a relatively small number of farmers have significantly or completely reduced their use of agrichemical inputs. Some observers have suggested that more farmers have not reduced agrichemical inputs because they lack information about workable alternatives, they lack the management skills needed for such reductions, or they think profits will be lower. Because the government plays such a major role in farm research, extension, price setting, and income support, the reluctance of farmers to adopt alternative agriculture has been attributed in part to the USDA's programs. This report has focused mainly on the effects of government programs on conventional and alternative agriculture.

In our review of the literature, we found limited information about the technical utility and economic viability of alternative agriculture systems. Research gaps exist concerning the effects of reducing agrichemical inputs. Alternative techniques to replace agrichemical inputs and other conventional practices are often not well developed or are not

available for different farm situations. Farmers who use alternative practices generally tend to obtain information from other farmers, specialized farm magazines, workshops, and farm experiments rather than from extension specialists or land grant university researchers. Only a few methodologically sound studies are available comparing conventional and alternative agriculture systems. These research studies show that alternative agriculture systems are, under certain conditions, as profitable as conventional agriculture. More research is needed, however, before conclusive statements can be made about the relative profitability of these farming systems.

In chapter 3, we presented the arguments typically raised by proponents of alternative agriculture that the federal farm support system has encouraged the use of intensive farm production practices and discouraged the use of alternatives. These criticisms suggest that federal farm programs provide incentives for farmers to

- grow only program crops;
- grow the same program crops year after year, instead of planting diverse crop rotations;
- overproduce program crops; and
- plant program crops on land better left unfarmed.

These incentives, in turn, may lead to even more intensive farming methods and particularly the reliance on agrichemical inputs. In the remainder of this chapter, we will use the farmers' responses from our case study to further consider these program criticisms.

Farmers' Opinions

Our interviews support the claims that there are incentives to grow only program crops and to grow the same program crops year after year. The farmers agreed that participating in the farm programs encouraged them to grow only program crops and to keep growing them year after year. The farmers also agreed that participating in the farm programs makes it difficult for them to grow nonprogram crops and difficult to switch crop rotations. The desire to maintain their program crop acreage base and receive farm program benefits both influenced the farmers' decisions about what crops to plant. In addition, more farmers thought that a better way to reduce economic risk was to participate in the farm programs rather than diversifying the selection of crops they grew or purchasing crop insurance.

The importance of the program crop acreage base system and its influence on crop choice is demonstrated in several ways. First, the full benefits of the crop programs are available to those who maintain their crop acreage base. Maintaining crop acreage base generally means that the farmer must plant the same program crop year after year. But even if a farmer decides to leave the program, it seems likely, at least for the farmers we interviewed, that the program crops will continue to be grown: experience with a crop was the other most important influence on the farmers' planting decisions. Second, growing program crops is less risky for farmers because the programs provide an available market and a guaranteed minimum price. The farmers in our survey indicated that the availability of markets and crop prices are also major influences on their crop choice.

To preserve their crop acreage base, however, farmers do not always have to plant the program crop on the same field every year. The ability to maintain a crop acreage base depends both on farm and program characteristics. In 1989, several program features allowed farmers to maintain a crop acreage base while planting other crops (for example, provisions allowing oats and soybeans to be planted in the 1989 program) or keep the land idle (for example in set-aside or 0/92). The farmers we interviewed showed a strong interest in being able to use such flexibility in the programs, at least to the extent that they could grow other program crops. The degree to which farmers can rotate crops and preserve their base also depends on farm characteristics such as the mixture of crops currently grown. For example, if a farmer has a specialized crop system of one or two crops with no rotation, the program crops must be planted on each field every year in order to preserve the entire base. The crop acreage base system does not allow a farmer to expand into a more diverse rotation without losing program benefits. But if a farmer already has a diversified crop rotation, the base system does not prevent that farmer from maintaining that rotation.

We found no evidence in our interviews to support the claim that program target prices, loan rates, or set-asides increased production or led to further cultivation of marginal lands. The farmers did not believe they were given incentives to overproduce program crops through more intensive farming or to plant program crops on land best left unfarmed. The farmers in general responded that the farm programs did not influence their use of agrichemicals or other farm production methods. The farmers did not believe that they either increased or decreased fertilizer or pesticide applications because of their participation in the farm programs. This finding corresponds with the reduced program yield levels

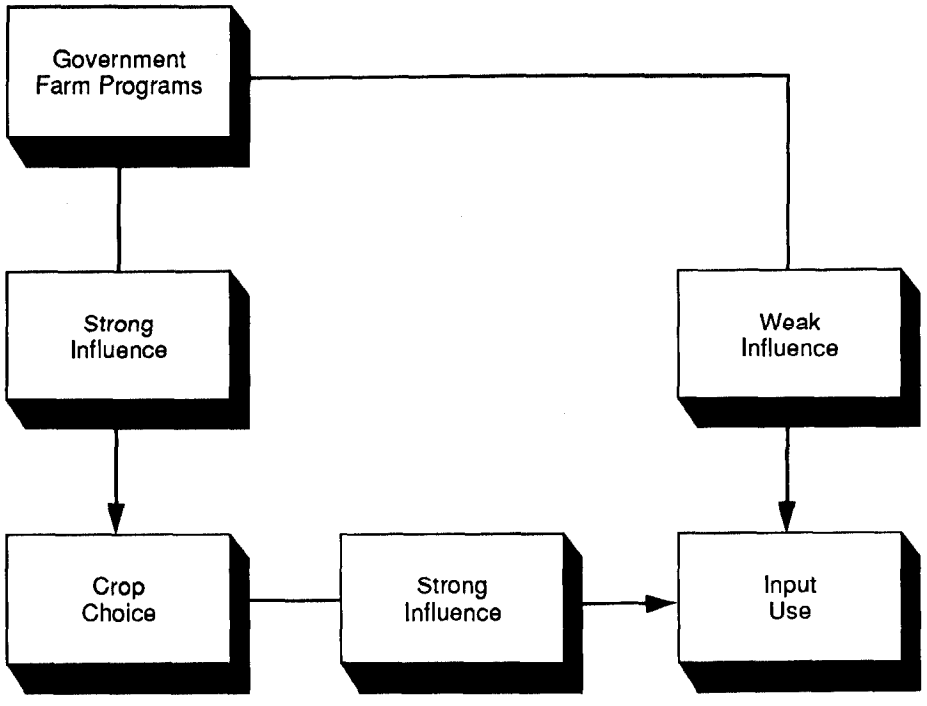
established through the 1985 Food Security Act. Most farmers indicated that they wanted to grow as much of each crop as they could and that this desire for high yields was not affected by the farm programs. There was no suggestion that they increased or decreased their agrichemical use in response to changes in program requirements.

Three important implications can be drawn from the results of our study. First, to the extent that federal farm programs make it difficult for participating farmers to grow other crops and implement diverse crop rotations, they act as a barrier to alternative agriculture. Diversified crop rotations are a key element of alternative agriculture, yet the farm programs provide strong incentives for farmers to specialize in the production of program crops. The farm programs make it difficult for farmers to switch to nonprogram or other program crops because of the loss of financial benefits that would be involved in changing crop choices.

Second, the farmers most specialized in growing program crops are the ones facing the strongest disincentives. The responses of the farmers who were already highly specialized in program crops suggest that they felt "locked in" to the programs: they were encouraged to grow only program crops, they found it difficult to grow nonprogram crops, and they thought it was problematic to switch crop rotations, even though they believed that the farm programs did not encourage them to grow their best rotation. In contrast, the farmers who were currently more diversified found the programs to be less restrictive, though they also agreed that the farm programs did provide disincentives to grow nonprogram crops or switch crop rotations.

Third, the federal farm programs have little direct influence on farmers' behavior, with the exception of crop choice. This exception is critically important for alternative agriculture, however. Most farm practices, including input use, are heavily influenced by crop choice. Once the decision is made to plant a certain mix of crops, the types and amounts of inputs needed to produce any given quantity of those crops are sharply defined. Even though the farm programs do not have a strong and direct effect on the use of inputs, by influencing crop choice the federal farm programs do have a major indirect influence on agrichemical use. (Figure 5.1.)

Figure 5.1: Input Use as a Function of Crop Choice



Conclusion

If the federal government wants to encourage farmers to adopt alternative agricultural practices, it will need to change its farm programs. To give farmers greater flexibility to grow diverse crop rotations, the crop acreage base system in particular will need to be modified. A different farm program may not alone be sufficient to bring a widespread adoption of alternative agriculture, however. Although the farm programs appear to have a strong influence on farmers' planting decisions and subsequently on their choice of production methods, other factors play an important role as well.

Farmers may be reluctant to change until the technical knowledge and managerial skills to implement alternative agriculture are demonstrated and, given our review of the literature and our farmers' responses, we believe such information is not generally available. Market forces may also still provide incentives to apply large amounts of agrichemicals on highly specialized farms. Changing the crop acreage base system by itself will not alone transform these circumstances, but it is a prerequisite if a major move to alternative agriculture is desired. Providing greater flexibility in the programs to allow farmers the opportunity to

make production changes will be an important step toward increasing the use of alternative agriculture methods.

Farmer Survey Statistical Data

In this appendix, we provide the statistical measures we used to analyze the farmer survey data presented in chapter 4.

First, we calculated a summary statistic (such as an average or a sum) for each set of questions and for each category of farmers. Then we identified the responses (or "factors") that were important to the farmers. We did this for each question by conducting analysis-of-variance tests on a model using all factors jointly for each group of farmers—all, specialized, and diversified farmers.[1] Any factor with a univariate statistic significant at the .01 level for at least one farmer category remained in the model; all other factors were dropped from further estimations. We then reestimated the model. The univariate statistics for each factor, as well as the F statistic for the model, are presented in the first three columns of the tables in this appendix.

The F statistic for the model, located near the bottom of each column, shows how likely it is that one or more of the individual responses in that column are important; in general, the larger the number, the greater the likelihood that at least some of the factors are important. However, since our sample of farmers was not randomly selected and assigned, we are not using the probabilities that we computed to test statistical significance. The reported probabilities, though, can be interpreted as indicators of the importance of factors cited by the farmers.

The univariate statistics within the columns suggest how probable it is that a particular response is important if considered in isolation; the larger this statistic, the higher the probability. We denote important factors (that is, those with univariate statistics that exceed the 90-percent level) with an asterisk.

A further caution must be given. If all the factors were uncorrelated, the univariate F statistics would show their true probability, and they could be ranked in order of importance by the magnitude of these statistics. (Tabachnick and Fidell, 1983, pp. 253-57) However, some of the factors are correlated. As Tabachnick and Fidell note, "Although several procedures are available for assessing the importance of [such correlated factors] and interpreting the pattern of results, there is a certain ambiguity associated with the use of each." Consequently, the F statistics should

[1]For all tables except I.2, we used the program MANOVA on SPSS to estimate multivariate and univariate test statistics; all such statistics have been transformed to F statistics. For table I.2, we used the program NPAR to estimate all statistics; chi-square statistics are used for univariate tests and Cochran Q's are used for multivariate tests.

serve only as a rough guide in evaluating the significance of individual factors or ranking them in importance.

We also tested whether the specialized and diversified farmers were systematically different. The F statistic for this general test, near the bottom of column 4 in the tables, indicates the probability that there are at least some real differences between the categories; the univariate statistics within the column suggest which individual factors may distinguish the categories.

Table I.1: Planting Decisions[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Desire to keep crop acreage base	69*	49*	23*	1.4
Experience with the crop	54*	6.9*	111*	8.2*
Farm program benefits	33*	19*	14*	0
Availability of markets	28*	3.2*	44*	4.2*
Need to rotate crops	23*	16*	8.4*	0.2
Crop prices	19*	2.4	24*	4.2*
Approximate F for model	29	16	27	2.1
Probability of F: p is greater than	0	0	0	0.07
Number of respondents	68	35	33	68

[a]See table 4.1. Numbers within cells are the univariate F statistics for those factors.

*Significant at the 90-percent level.

Table I.2: Farm Risk[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Agree				
Enter farm programs	49*	27*	22*	0.2
Diversify with crops	26*	4.8*	25*	4.6*
Diversify with livestock	3.2*	0.3	4.0*	0.7
Buy crop insurance	1.1	0.7	5.4*	4.1*
Disagree				
Use "extra" fertilizer	34*	27*	9*	3.7*
Use "extra" pesticide	52*	27*	25*	0
Cochran Q for model	154	82	84	[b]
Probability of Q: p is greater than	0	0	0	
Number of respondents	71	35	36	71

[a]See table 4.2. Numbers within cells are the univariate Chi-square statistics for those factors.

[b]Not estimable.

*Significant at the 90-percent level.

Table I.3: Farm Program Participation, Personal Encouragement[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Agree				
Grow only program crops	23*	12*	11*	0
Disagree				
Buy crop insurance	3.7*	0	8.4*	3.7*
Use more herbicide	9.2*	2.1	8.4*	0.9
Grow best crop rotation	8.8*	14*	0.7	2.8*
Expand farm size	10*	8.1*	3.1	0.3
Produce higher yields	15*	7.1*	7.9*	0
Use more pesticides	21*	5.7*	17*	0.9
Raise crops and livestock	22*	12*	10*	0.1
Borrow more	49*	16*	42*	0.5
Approximate F for model	11	4.8	11	1.1
Probability of F: p greater than	0	0	0	0.4
Number of respondents	69	35	34	69

[a]See table 4.3. Numbers within cells are the univariate F statistics for those factors.

*Significant at the 90-percent level.

Table I.4: Farm Program Participation, General Encouragement[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Agree				
Difficult to switch rotations	56*	62*	11*	4.4*
Easier to get credit	30*	9*	24*	0.9
Tough to grow nonprogram crops	11*	18*	0.5	4.7*
Disagree				
More important to get insurance	13*	8*	5.7*	0
Less important to use fertilizer	40*	30*	13*	0.3
Less important to use pesticide	51*	26*	24*	0
Less important to use herbicide	69*	41*	29*	0.1
Approximate F for model	23	12	10	1.3
Probability of F: p greater than	0	0	0	0.25
Number of respondents	70	35	35	70

[a]See table 4.4. Numbers within cells are the univariate F statistics for those factors.

*Significant at the 90-percent level.

Table I.5: Farm Sustainability[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Environmental effect				
Erosion	19*	12*	7*	0
Soil fertility	8.2*	8.2*	1.9	0.5
Economics				
Profits	15*	5.4*	9.8*	0.2
Crop yields	56*	29*	26*	0.2
Approximate F for model	14	9	6	0.3
Probability of F: p greater than	0	0	0	0.88
Number of respondents	68	34	34	68

[a]See table 4.5. Numbers within cells are the univariate F statistics for those factors.

*Significant at the 90-percent level.

Table I.6: Barriers[a]

Factor	Is the factor significant for All	Specialized	Diversified	Do specialized and diversified farms differ?
Greater management is required	102*	57*	45*	0
Yields may decline	123*	104*	39*	0.6
Weeds may increase	99*	35*	69*	2.0
Profits may decline	50*	36*	17*	0.2
Need to maintain crop acreage base	63*	64*	17*	0.8
Farm labor is unavailable	73*	26*	50*	1.7
Current system works well	55*	30*	25*	0.5
Workload may increase	57*	22*	35*	1.9
Loans more difficult to get	30*	13*	17*	0.4
Lack of information	38*	17*	21*	0.3
Loss of federal benefits	13*	3.3*	11*	1.3
Markets are not available	11*	9*	3.4*	0.1
Crop rotations are not allowed in farm program	10*	17*	0.8	3.0*
Livestock will be needed for manure	6*	12*	0.1	3.2*
Approximate F for model	16	12	11	1.2
Probability of F: p greater than	0	0	0	0.29
Number of respondents	65	34	31	65

[a]See table 4.6. Numbers within cells are the univariate F statistics for those factors.

*Significant at the 90-percent level.

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