5-1-1992

Farm, Rural Economy, and Policy Implications of Sustainable Agriculture in South Dakota

T. L. Bobbs

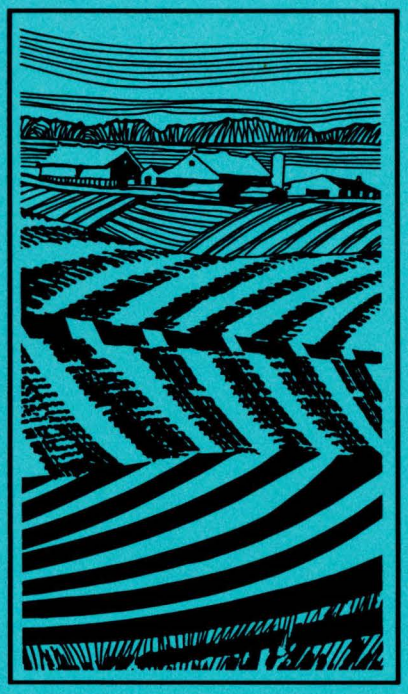
D. C. Taylor

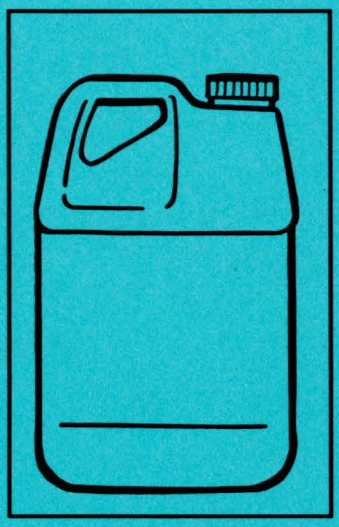
J. D. Smolik

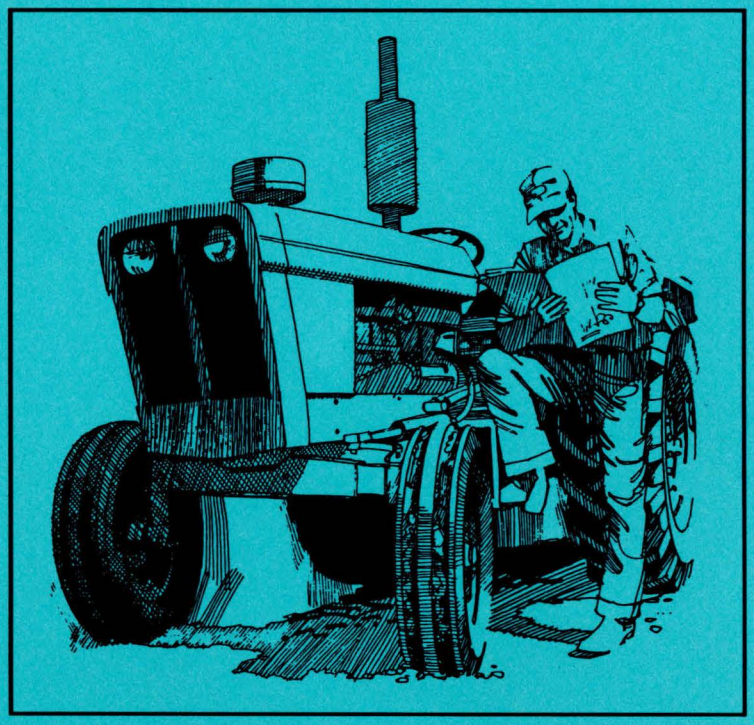
B 713
May 1992

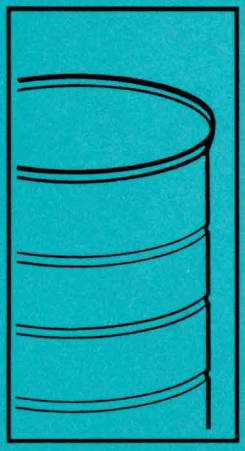
FARM, RURAL ECONOMY, AND POLICY IMPLICATIONS OF SUSTAINABLE AGRICULTURE — IN SOUTH DAKOTA —

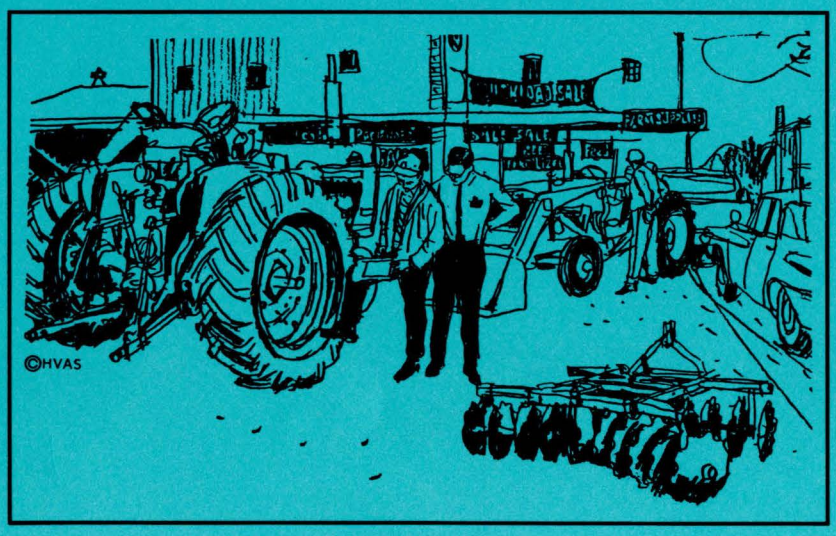
AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE UNIVERSITY
U.S. DEPARTMENT OF AGRICULTURE











Preface

This bulletin is a summary report of an intensive 4-year study of "sustainable agriculture" in South Dakota. Surveys and case studies gave us an understanding of agronomic and economic contrasts between "conventional" and "sustainable" farming systems in different agro-climatic areas of South Dakota.

Special attention was devoted to the effects of alternative farm and environmental policies on the relative profitabilities of different farming systems. Also, the implications of different systems for the economic strength of rural communities were examined.

More detailed articles and reports on the various components of this study are listed in Annex A. The annex contains a brief description of each report, as well as the charges to cover reproduction and postage for readers wishing to obtain copies. Copies of the reports can be obtained by writing to: Sustainable Agriculture
SDSU Econ Department
Box 504A
Brookings SD 57007-0895

Checks made out to the SDSU Economics Department should accompany publication orders.

Several individuals and institutions deserve our sincere appreciation for support given to this study. The SDSU Agricultural Experiment Station and the Northwest Area Foundation (NWAF), based in St. Paul, Minn., provided the essential monetary support for this study. Karl Stauber, vice president-program of the NWAF, was encouraging, flexible, and supportive in numerous ways throughout the study.

We owe special appreciation to several colleagues. David Becker contributed throughout the study, starting with the on-farm interviews. He also did much of the enterprise and whole-farm budgeting for the sustainable farms, and he was deeply involved in the policy analyses. Clarence Mends was responsible for much of the economic analysis with the east-central South Dakota case farms over several years and assisted with the livestock analyses for sustainable farms. John Cole had principal responsibility for developing enterprise and whole-farm budgets for conventional farms; he also collaborated on the rural economy and energy analysis components of the study.

Former graduate students Liong Min Tiong and Indrani Ranasinghe also contributed to the study, Tiong through her analysis of relative risks and Ranasinghe through her examination of farm size and structure issues. Several undergraduate research assistants, including Rod Kappes, Scott Van Der Werff, and Kellie Koehne, also contributed to particular research and education components of this project.

A special note of appreciation is due to Diane Rickerl, who has collaborated with us on other sustainable agriculture studies at SDSU and who has generously provided advice and reviews throughout this study. She, along with Bashir Qasmi, provided constructive reviews of a draft of this bulletin. We also thank Mary Brashier for her editorial support and for helping to guide this report through to publication. Verna Clark's careful and patient typing of several drafts has been greatly appreciated.

Finally, we heartily thank the farmers who cooperated in this study. They completed questionnaires, gave of their time for on-farm interviews, showed us their farming operations, and in many ways provided critical data and insights. We especially thank the Northern Plains Sustainable Agriculture Society (NPSAS), a farmer-based organization, and particularly Fred Kirschenmann, for critical cooperation and involvement in the research, workshop, and conference components of this project.

TLD, DCT, and JDS
May 1992

B 713

FARM, RURAL ECONOMY, AND POLICY IMPLICATIONS OF SUSTAINABLE AGRICULTURE IN SOUTH DAKOTA

Thomas L. Dobbs and Donald C. Taylor,
professors of agricultural economics, and
James D. Smolik,
professor of plant science,
SDSU

Inherent in the term "sustainable" is a long-term point of reference. Sustainable development in a state, region, or country requires private and public decisions within the context of both short-term technical and economic concerns and long-term environmental, economic, and institutional "staying power." In other words, unless decisions result in mankind surviving over the long term—able to live in an environment with (1) nondegrading natural resources, (2) adequate food and incomes to meet the basic needs of all people, and (3) human organizational/political institutions that enable people to live in harmony —an agricultural production system will not be "sustainable."

No one, of course, knows for sure today what approaches in agriculture will prove to be sustainable environmentally, economically, and institutionally over the long term. Nevertheless, research does give us some insights on the prospects for particular systems.

South Dakota State University (SDSU) has been conducting research since the mid-1980s on what has come to be called sustainable agriculture. We have been examining farming systems in which producers adopt management-intensive, holistic system orientations in planning their farms. Such farm managers generally view themselves as allies with nature, rather than as conquerors of nature. In addition to economic survivability, these farmers tend to give high priority to (1) being good stewards of the soil, (2) reducing pollution of ground and surface water, (3) raising chemical residue-free, high quality products, and (4) reducing possible harmful effects of farm chemicals on their families' health.

In practice, such sustainable producers use crop rotations and other natural soil-building and cultural practices to at least partially replace synthetic chemicals (e.g., fertilizers, pesticides). They substitute on-farm produced resources for externally produced, purchased inputs.

There is no universally accepted dividing line between "conventional" and "sustainable" farming systems. We have termed producers to be "sustainable" simply on the basis of their indicating that they make deliberate decisions to substitute the above types of management practices for synthetic chemicals, without reference to the degree to which the substitution takes place. Sustainable producers who use **no** synthetic chemicals are termed "organic."

For the purpose of this report, we term those producers who do not meet this criterion for sustainability as "conventional." We recognize the oversimplification represented by this simple, bipolar classification of farmers. Nevertheless, some classification is necessary if we are to analyze the implications of contrasting farm practices.

Sustainable Agriculture Research at SDSU

As in the rest of the U.S., sustainability issues are receiving major attention in South Dakota. In response to grass-roots initiatives from farmers, SDSU began research on sustainable agriculture in 1984. Initial work of plant scientists involved monitoring "conven-

tional" and "sustainable" farmers' fields in the east-central part of the state. Production practices, soil fertility, yields, pest populations, and other agronomic parameters were measured. Intensive monitoring has continued on one of the conventional farms and on one of the sustainable farms, and agricultural economists have joined the plant scientists in data collection and analysis.

SDSU's sustainable agriculture research was incorporated into agronomy trials at the Northeast Research Station near Watertown, starting in 1985. Long-term trials compare various combinations of crop rotations and cultural practices (conventional, reduced tillage, and alternative or sustainable). Agronomic and economic results of those trials have been and continue to be published in journal articles and other research reports.

The sustainable agriculture research program expanded in 1988 to include a broader perspective on sustainable farming practices across the state. A mail survey of known "sustainable" farmers in South Dakota was conducted that year, and 32 usable responses were returned. A grant received in late 1988 from the Northwest Area Foundation (NWAF), in St. Paul, Minn., helped fund expanded research work with farmers—first through follow-up, on-farm interviews with 22 of the sustainable farmers who responded to the mail survey.

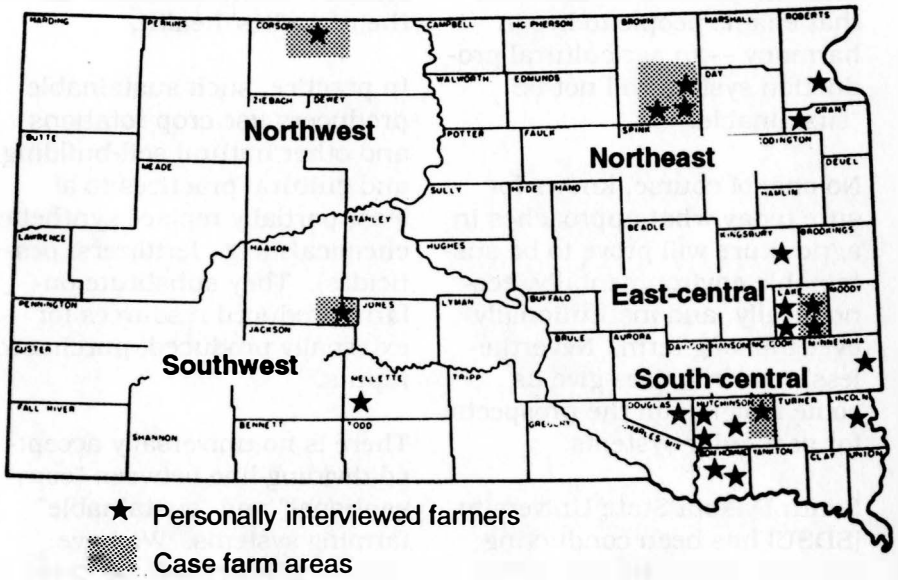
Detailed results of those interviews, related data collection, and subsequent analyses are contained in a series of reports listed in Annex A. The reports cover crop and livestock enterprise practices, participation in federal farm programs, attitudes toward farm policy, profitability of sustainable farming systems in comparison to conventional systems, effects of increased energy prices and of various farm and environmental policy options on relative profitabilities of sustainable and conventional systems, and potential effects of conversions to sustainable farming systems on the economic health of rural communities. This bulletin is an overview of the NWAF-supported study.

Locations of the 22 farms on which personal interviews were conducted are shown in Figure 1. Detailed economic analyses of the crop systems were conducted for 12 of the 22 farms, and economic analyses of the livestock systems also were conducted for the nine of those 12 farms which have livestock.

For purposes of **policy** and **rural economy** analyses, five of the 22 farms were used as case studies. The five farms represent sustainable systems in different agro-climatic areas within South Dakota (shown in Figure 1): south-central, east-central, northeast, northwest, and southwest. These five "sustainable" farms are compared with five "conventional" farms, one of which (in the east-central area) is an actual operating farm and four of which are "synthetic." The east-central conventional and sustainable (actual operating) case farms are the ones noted previously for which SDSU has been collecting data since the mid-1980s.

For areas of the state in which we did not have actual operating conventional farms as "controls," a variety of information sources was used to construct hypothetical ("synthetic") conventional farms to compare with the actual sustainable farms. Agricultural census data, Cooperative Extension and Soil Conservation Service reports, and interviews with

Fig 1. Locations, by region, of the 22 personally interviewed sustainable farmers and of case farm areas.



knowledgable individuals ("key informants") were among the information sources used.

In the final stages of the NWAF-supported study, panels of sustainable and conventional farmers, Extension agents, and other key informants were interviewed in each of the five agro-climatic areas. Prior to the panel interviews, we identified the major apparent contrasts in crop rotations and tillage and other cultural practices between sustainable and conventional farming systems in each agro-climatic area. A questionnaire was developed, for each region, in which the apparent contrasts were described. Respondents could agree or disagree with each stated contrasting crop management practice and could give their views on the primary constraints keeping more farmers from adopting sustainable practices.

Production Management Practices: Sustainable Farmers Compared to Conventional Farmers

Crops

These results are based on the collective results from the 32 mail survey questionnaires, the 22 personal interviews, the 12 whole-farm economic analyses, and the various panel responses.

They show four main contrasts between sustainable and conventional crop management practices. Sustainable farmers (1) follow more diversified cropping patterns than conventional farmers; (2) frequently use sweet clover and sometimes forage sudan as green manure crops on summer fallow/set-aside land, rather than leaving the land in unprotected (black) fallow; (3) substitute harvested legumes, green manures, crop residues, and livestock manure for purchased fertilizers; and (4) substitute crop rotations, mechanical tillage, and other cultural practices for chemical methods of weed control. Each management practice is briefly discussed.

Crop mixes. The greater diversity on sustainable farms broadly includes several non-program crops (a diversity of small grains, legumes, and forage sudan) to partially replace the row crops (corn and soybeans) and/or wheat that are the center of cropping systems on most conventional farms. These diversified cropping patterns are built around strategically designed crop rotations.

Virtually all the sustainable crop rotations studied have at least one small grain (most commonly wheat and oats, followed in order of importance by rye, millet, barley, and buckwheat). About three fourths of the rotations contain at least one row crop (soybeans or corn)[1], and about two thirds have at least one forage legume (alfalfa or sweet clover). The number of years that alfalfa is harvested, after the establishment year, ranges from 1 to 7, with 4 to 5 most common. Two east-central farmers harvest alfalfa for only 1 year. Their rationale is to realize a maximum of nitrogen fixation and weed control benefits and a minimum of soil moisture loss from alfalfa.[2]

Summer fallowing is a common component of southwest, northwest, and northeast crop rotations. Fallowing intensities commonly range from once per 2 years to once per 5 years, with the fallowing interval tending to be shorter in the west than in the northeast.[3] About three fifths of the sustainable farmers who summer fallow plant cover crops on the fallowed land. Sweet clover is most common, followed by forage sudan.

The primary rationale for greater crop diversification on sustainable farms is the strategic role of crop rotations in enhancing soil fertility and controlling pests. Sustainable farmers believe that these benefits compensate economically, over the duration of their crop rotations, for the relatively low annual returns from many small grains and the annual

[1] Row crops are almost totally limited to farms east of the Missouri River.

[2] Also, because soybeans are less moisture-demanding than corn, these two farmers follow alfalfa with soybeans rather than with corn.

[3] Two farmers (one in the south-central region and one in the west) rest all of their owned land every 7th year, however.

net losses from green manure crops. In addition, wider crop diversification enables a more uniform distribution over the year of the labor demands for various enterprises. Some sustainable farmers also emphasize that the lesser per-acre labor requirement for their small grains allows them added time for attention to more demanding row crops.

A variety of factors appear to hold back more widespread crop diversification in South Dakota. Many conventional farmers question the economic viability of "low value" small grains (especially in relation to soybeans) and green manure crops, particularly with current federal farm program provisions. Additional concerns include perceived (1) less drought tolerance and less crop residues for several non-program crops than for wheat; (2) inadequate machinery inventories to undertake cultural operations for a wider array of crops; (3) difficulties in successfully establishing forage legumes; (4) price risk in selling forages; (5) inadequate facilities to store a wider array of crops; and (6) inadequately developed markets for non-program crops.[4] Some conventional farmers also question the wisdom of trying to spread their managerial talents over too many farm enterprises.

Summer fallow/set-aside land management practices.[5] Sustainable farmers often use sweet clover and sometimes forage sudan as a green manure crop on summer fallow/set-aside land, rather than following the more general practice of leaving the land in unprotected fallow.[6] This includes farmers in western South Dakota where annual growing-season precipitation averages less than 15 inches. They feel that the positive impacts on soil fertility, soil moisture retention, and weed competition of the green manure crop more than counterbalance economically the draw-down on soil moisture which results from a green manure crop on summer fallow/set-aside land.

Conventional farmers tend to be skeptical about the wisdom of planting green manure crops on summer fallow/set-aside land. They place more weight on the disadvantages of green manuring than their sustainable counterparts do. In addition to soil moisture draw-down from a growing crop on idled land, they generally believe that it costs more to grow than to buy nitrogen. They are further concerned about perceived (1) additional time and cost for establishing and maintaining a cover crop vs. maintaining unprotected fallow; (2) difficulties in being able to successfully establish a green manure crop on idled land; (3) complications of having to make prior-year decisions about which fields are to be placed in set-aside, so that the cover crop can be seeded; (4) difficulties in being able to effectively kill sweet clover the year following fallow; and (5) complications in subsequent year seeding because of possible inadequate decay of cover crop residue.

Soil fertility enhancement. Contrasting approaches to maintain and enhance soil fertility—revolving around the presence in soil of elemental nutrients, organic matter, and tilth—constitute a central point in the sustainable-conventional farming controversy. [7]

Sustainable farmers rank their most important sources of on-farm produced soil fertility in the following order: harvested legumes, green manure crops, crop residues, and livestock manure.

Conventional farmers emphasize that they are applying less

---

4 Sustainable farmers point out, however, the existence of special "organic" markets for several non-program crops.

5 Summer fallowing is much more common in the northeast, northwest, and southwest regions than in either the south- or east-central regions. Farmers who participate in federal farm programs throughout the state, however, have set-aside acres.

6 In the northeast, however, some conventional farmers have traditionally planted strips of flax on summer fallowed land, rather than leave the land entirely black. In recent, rather droughty years, some farmers in the south- and east-central areas of the state have planted crops such as forage sorghum and millet on their set-aside land--for use as potential livestock feed if there would be a drought declaration by the USDA or for feed after the end of the 5-month ASCS haying and grazing restriction period.

7 While sustainable farmers throughout the state tend to substitute on-farm produced soil fertility sources for purchased soil fertility sources, in recent droughty years, neither sustainable nor conventional farmers west of the Missouri River have very commonly used much synthetic chemical fertilizer.

purchased fertilizer now than formerly. They stress their use of soil testing and applying "only as much fertilizer as is needed and when it is needed." They are concerned that further reductions in chemical fertilizer use will reduce yields and profits. These views are partly based on their belief that it is cheaper to obtain nutrients from synthetic than natural sources.

Additional constraints to conventional farmers substituting more on-farm sources for purchased sources to meet soil fertility needs are perceived (1) inevitable losses of soil phosphorus and potassium, no matter how much on-farm nutrient recycling takes place; (2) incapacity to produce adequate quantities of on-farm soil nutrients to meet total nutrient demands of crops; (3) difficulty in being able to satisfactorily monitor nutrient application rates from on-farm produced sources of soil nutrients; and (4) slow release of soil nitrogen following farmyard manure field applications.

Weed control.[8] The primary way that sustainable farmers control weeds is crop rotation. Rotations interrupt growth cycles of individual weed species. This control is achieved by alternating forage crops with row and small grain crops. It includes (1) both warm- and cool-season crops and (2) crops with different harvesting dates that together provide year-to-year variation in the growing environment for weeds.

The effectiveness of forage legumes in combating weeds arises from the competitive nature of these crops and their multiple harvests (mowing). The allelopathic effects (chemicals released by plants that suppress growth of other plants), heavy tillering (space competition), and wide leaf canopy (shading) features of crops such as rye, millet, and buckwheat are also believed to contribute to weed control.

After crop rotations, the most important means of weed control is mechanical tillage. The sustainable farmers in the study undertake an average of about four weed control operations with corn and soybeans. One weed control operation is used in about three fourths of the rotations which have spring-planted small grains.

Sustainable farmers stress the critical importance of timing in mechanical tillage. Some indicate, for example, that rotary hoeing has to be done at "exactly the right time," whereas herbicides may be selected to suit the stage of weed growth at which farmers find the time to undertake chemical weed control. They acknowledge that it is "easier" to select from a range of herbicides to control a particular weed at a particular time than it is to maintain and select from a range of different types of tillage equipment the means of mechanical tillage likely to be most effective.

Conventional farmers stress that the economic pressures of the 1980s have forced them to become increasingly careful in monitoring the need for and limiting the use of herbicides. Two commonly emphasized approaches in limiting chemical use are combining mechanical with chemical weed control and banding herbicide applications. Many believe that, for a comparable level of weed control, the costs of owning, maintaining, and operating sprayers (including herbicide costs) are less than the costs associated with ownership and use of mechanical tillage equipment. Most also believe that their current practices are not environmentally damaging.

Other factors constraining more widespread reliance on non-chemical means of weed control include perceived (1) greater soil moisture losses (and, to a lesser extent, greater soil erosion) from mechanical control; (2) more time required—at especially critical times—to perform mechanical control; and (3) inadequate ranges of mechanical tillage equipment on farms.

Sustainable farmers acknowledge the possibility of greater soil moisture loss with mechanical tillage, but they believe that steps can be taken to at least partially overcome these possible soil moisture losses (e.g., "discing after combining to kill weeds and then chisel plowing before the soil freezes to open the soil so that the snow melt and early spring

---

[8] Cultural practices for controlling weeds in addition to those discussed in this section include (1) delayed planting of row crops to allow later pre-plant tillage (in the south where growing seasons are longer), (2) planting early season crops (e.g., soybeans, sunflowers) the following year, (3) increasing plant populations to provide greater competition for weeds, (4) using only certified and/or "clean" seed, (5) selecting weed competitive crops (e.g., rye, buckwheat), (6) composting manure to destroy weed seeds, and (7) hand weeding (soybeans).

rains will soak in"). Further, they believe that the improved soil tilth resulting from sustainable practices helps to mitigate soil moisture loss.

Perhaps even more fundamental to the sustainable vs. conventional weed control controversy are different underlying philosophies concerning the presence of weeds in farmers' fields. The essence of the contrasting philosophies is captured in the following two quotes, the first one from a conventional farmer and the second from a sustainable farmer.

> We have pride in the appearance of our fields; we don't like to see weeds.
>
> *vs.*
>
> Weeds are a part of the eco-system. Our goal should not be to totally eliminate them, but to bring them within tolerable limits.

Livestock

Until now in SDSU's research on sustainable agriculture, much less attention has been focused on livestock than on crop production management. This section is, therefore, briefer, and its findings are more preliminary. It is primarily based on the responses of the 18 personally interviewed sustainable farmers who had commercial (arbitrarily defined to involve five or more head) livestock enterprises.

Beef cattle are by far the most common livestock enterprise on the sustainable farms, with 67% of the studied farms having commercial herds of beef cattle and 19% having hogs and 5% having dairy cattle. The percentage of sustainable farms with livestock is slightly greater than that for farms generally in South Dakota.[9]

The size of livestock enterprises on individual sustainable farms, however, appears to be below average, relative to farms generally in the state. For example, of the 13 sustainable farms with cow-calf enterprises in the study, the average number of cows per herd is 45, compared to the statewide average of 79. Similarly, the average sustainable cattle finishing enterprise of 26 head is far smaller than the state average of 150 head per cattle feeder.

Those producers who consider themselves to raise beef cattle sustainably follow three distinctive types of practices. They feed only "organically" grown grain and roughage to their cattle; they rely much less on grain in finishing cattle than conventional farmers do;[10] and they do not use antibiotics and other additives in concentrate feeds, hormones and other growth promotants, insecticides, vaccinations, or closed confinement facilities. They generally believe that the physical and economic performance of their cattle is comparable, or perhaps even superior, to that of cattle raised with conventional practices.

Conventional producers question those claims. They indicate that research shows cattle not receiving ionophores, growth implants, vaccinations, and antibiotics to have poorer physical performance and more fragile health.

Sustainable producers counter by saying that those research results are based on single-component research designs, in which only one management practice is varied at a time and all other practices are held the same. They believe that interactions among practices have an important impact on cattle performance and that cattle managed with their packages of practices can perform just as well as cattle managed with packages of conventional practices.

We do not know which set of views is more accurate. However, SDSU's Economics Department, in collaboration with several other departments at SDSU, has recently initiated a new 4-year research project, "Sustainability of 'organic' vs. 'conventional' beef production in South Dakota." This project is designed to compare the economic performance of similar types of cattle on farms with similar natural and economic resources and similar management levels, but in one case on selected farms following "organic" management technologies and in another on selected farms following "conventional" management technologies.

---

[9] Unless otherwise noted, the data base for "farmers in general in South Dakota" is the 1987 Census of Agriculture for South Dakota.

[10] For example, none of the cattle feeders in this study includes more than 40% dry grain in finishing cattle rations, whereas the average percentage of dry grain for the state's cattle feeders is 80% (D. Taylor and J. Wagner, *South Dakota Feedlot Management*, SDAES B 709, 1991).

Economic Performance of Sustainable Systems

Yields

The economic performance of sustainable farming systems in comparison to conventional systems depends on several factors, including the mix of crops in different systems, market prices, federal farm program provisions, and relative crop yields. The following judgments on comparative sustainable and conventional crop yields are those of the 22 personally interviewed sustainable farmers. The judgments are with respect to corn, soybean, oat, spring wheat, and alfalfa yields during years of unusually favorable conditions, normal conditions, and unusually unfavorable production conditions.

Under normal production conditions, some sustainable farmers believe sustainable row crop and small grain yields are greater than conventional crop yields. Larger numbers of sustainable farmers, however, believe that sustainable yields are less. During unusually favorable growing conditions, the yield advantage to conventionally raised crops is perceived to be even greater.

During years of exceptionally unfavorable production conditions, however, the yield advantage to conventionally raised crops essentially disappears. In other words, most respondents believe that yields of sustainably raised crops are little different from those for conventionally raised crops. This perception is consistent with yield comparisons generally reported in the literature. It reflects, at least in part, an improvement in soil properties linked to rotational benefits of sustainable farming practices.

In general, yield differences between crops grown under sustainable vs. conventional farming practices are believed to be greatest for row crops (corn and soybeans), intermediate for small grains (oats and spring wheat), and least for alfalfa. This finding is understandable, because the heaviest synthetic fertilizer and pesticide use by conventional farmers is with row crops and the least use is with alfalfa. Herbicides also allow use of certain agronomically advantageous cultural practices, such as narrow-row soybeans, that increase yields.

Relative profitability of crop systems

Profitability comparisons for the case farms in each agro-climatic region are shown in Table 1. For the east-central case farms, average annual results for a 6-year (1985-1990) period are shown. Some of the crop production from the east-central sustainable farm is sold in organic markets, at varying price premiums. The effect of such premiums is explained in a table footnote.

"Typical year" (late 1980s) profitability estimates are shown in Table 1 for the case farms in the other four agro-climatic areas. In the "typical year," crop rotations, cultural practices, and federal farm program set-aside requirements represent 1988, the year for which survey data were collected in the on-farm interviews with sustainable farmers. Crop yields are intended to reflect "normal" yields for each type of farm (not the actual yields in 1988, a drought year). Results are shown both without (w/o) and with (w) organic premiums, except for the south-central area sustainable farm which does not sell any of its crop production in organic markets. The analyses "with" include approximations of actual premiums received for those portions of crops sold in organic markets by individual farmers.

Direct costs (sometimes referred to as "operating" or as "cash" costs) are lower for the sustainable farms in all cases (Table 1). In most cases, this is due to (1) the types of crop rotations and (2) minimal or no use of chemical fertilizers and pesticides on the sustainable farms.

Differences in direct costs are quite small in the western wheat growing areas of South Dakota, however. The semi-arid climate in that part of the state induces even the more conventional farmers to go light on purchased chemical inputs. Moreover, the northwest South Dakota sustainable farmer uses an "organic" fertilizer which adds about $9/acre to the costs of several of his crops; hence, direct costs on the northwest sustainable farm are almost as high as on the comparison conventional farm.

Gross income (including applicable government deficiency payments for program crops) on the conventional farms is higher than on the sustainable farms, especially in the south-

Table 1. Profitability of sustainable and conventional agriculture, on-farm studies, South Dakota.

	Direct costs other than labor	Gross income***	Net income after subtracting all costs except: Land, labor, and management	Land and management	Management
	U.S. dollars/acre				
6-year (1985-1990) average comparison of east-central corn-soybean area case farms					
1. Actual sustainable farm (w/o organic premiums)*	46	167	90	78	42
2. Actual conventional farm	87	224	109	101	65
Typical-year (late 1980s) comparisons of case farms					
A. South-central corn-soybean area:					
1. Actual sustainable farm (no organic premiums)**	36	129	62	50	12
2. Typical conventional farm	63	174	77	65	27
B. Northeast spring wheat area:					
1. Actual sustainable farm					
a. w/o organic premiums	24	64	18	11	-14
b. w organic premiums	24	72	27	19	-6
2. Typical conventional farm	46	96	23	15	-11
C. Northwest spring wheat area:					
1. Actual sustainable farm					
a. w/o organic premiums	27	47	2	-2	-18
b. w organic premiums	27	50	6	1	-14
2. Typical conventional farm	29	50	1	-6	-21
D. Southwest winter wheat area:					
1. Actual sustainable farm					
a. w/o organic premiums	23	70	29	23	6
b. w organic premiums	23	76	35	29	12
2. Typical conventional farm	27	78	32	25	8

* Analysis of organic premiums for the east-central sustainable farm showed that such premiums can add several dollars/acre to the farm's net income. In one particularly good year for this farm's organic premiums, the premiums added $17/acre (on a whole-farm basis) to net income.

** This sustainable farm did not sell any crop products in organic markets.

*** This includes applicable government deficiency payments for program crops.

central and east-central parts of the state where corn-soybean combinations have generally enjoyed a comparative advantage over other crops. Average precipitation is higher in these corn-soybean areas than in the other parts of the state.

In the northeast, where spring wheat, other small grains, and row crops are grown, the difference in gross income between the conventional and the sustainable farm is not as great. In the northwest (spring wheat) and southwest (winter wheat) areas of the state, gross income is only slightly higher on the conventional farms. Inclusion of organic premiums on the sustainable farms closes the gross income gap completely in the northwest area and nearly eliminates the gap in the southwest area.

Several measures of net farm income are presented in the last three columns of Table 1. The first measure includes a deduction for all costs (including fertilizer, herbicides, and items like machinery depreciation and interest) except for land, labor, and management. The next measure of net income differs from the first only in that costs for family and hired labor also are subtracted. In computing the final measure, a land charge (based on 1988 land market conditions and approximate property tax rates) is also deducted. The land charge is the same for the conventional and the sustainable farm **within** each region. "Net income after subtracting all costs except management" constitutes what is often referred to as pure profit or as return to management for planning and risk taking.

Profitability measures in the longitudinal study of two east-central South Dakota farms show the conventional farm to have been more profitable than the sustainable farm, on average, over the 1985-1990 time period. Direct costs were much lower on the sustainable farm. However, on average, gross income was enough higher on the conventional farm to cause that farm to be more profitable. The sustainable farm was more profitable in one of the years (1988), even ignoring organic premiums. Organic premiums were sufficient to make it more profitable than the conventional farm in at least one other year (1989), also.

Case studies in the other areas of South Dakota show the conventional farm to be more profitable in a "typical" year in the late 1980s than the low-input farm in the south-central corn-soybean area, but show little difference in profitability between conventional and low-input farms in the wheat growing areas. In fact, when organic premiums are included for the low-input farms in the three wheat growing areas, those farms are slightly more profitable than their conventional counterparts.

The effects of energy price increases on direct costs and relative profitabilities of conventional and sustainable farming systems in South Dakota have been estimated as part of our research. Such price increases could result either from supply and demand factors in petroleum markets or from special taxes on petroleum-based inputs. We simulated, in the whole-farm budgets, 50% increases **over 1988 levels** in fuel, inorganic nitrogen fertilizer, and herbicide prices and a 25% increase in crop drying costs.

Those hypothetical price increases reduce the profitability differences between conventional and sustainable case farms by $15/acre and $7/acre in the east-central and south-central areas, respectively. In the northeast area, such price increases reduce net income by $6/acre more on the conventional farm than on the sustainable farm—making the sustainable farm more profitable than the conventional farm, even when organic premiums are ignored. Profitability is decreased by $4/acre and $2/acre more on the conventional farm than on the sustainable farm in the northwest and southwest areas, respectively, as a result of such price increases. Ignoring organic premiums, the original profitability advantage increases for the northwest sustainable farm and vanishes for the southwest conventional farm.

Overall, it is clear that future increases in the prices of purchased agricultural inputs which are derived in part from fossil fuels will enhance the **relative** profitability of sustainable farming systems.

Inclusion of livestock on sustainable farms

Nine out of 12 sustainable farms for which economic analyses were conducted have livestock. This section of the report is based upon an integration of the results of the respective sustainable crop rotation budgets, enterprise budgets for some conventional crops and rotations on those

farms, and livestock budgets on those nine sustainable farms.

All nine of these farms raise beef cattle; two also raise hogs. Seven of the nine cattle producers have beef cow herds, with herd sizes ranging from 15 to 150 cows. Most of the cattle operations are rather modest in size, with only two having gross cattle receipts exceeding $36,000. In the two exceptional cases, gross cattle receipts amount to $61,790 and $234,320.

Net income is reported here in terms of income after subtracting all costs except management. Strict attention was given to all economic opportunity costs of production, including all out-of-pocket costs plus imputed values for (a) interest on investment and variable costs—even if producers did not actually borrow money to finance the expenditures; (b) labor—even if the labor was provided by the producer and his family; (c) home-raised feed, at prices that could have been received if the feed had been sold, not the costs of feed production; and (d) investment in and real estate taxes for all land, including permanent pasture. In most cases, such net returns considerably understate annual cash flows available to producer families to meet living expenses.

With expected cattle prices for 1988 used in the analysis and home-raised feeds priced at market values to the livestock, all nine cattle producers realize negative returns to management.[11] With one exception, however, the negative returns do not exceed $6,800.

The two hog producers in the study have farrow-finish operations. One has 12 sows and the other 45 sows. With prices estimated in a manner similar to that for beef cattle, both producers realize positive returns to management ($7,460 and $34,990).

On five of the nine farms, the gross value of sales from livestock exceeds that from crops (including government payments). Three of these farms are quite equally balanced between crops and livestock and two are weighted heavily in favor of the livestock. The other four farms realize considerably more gross income from crops than livestock.

Under expected 1988 commodity and input prices, whole-farm returns to management are widely variable for the nine farms. Six have positive net incomes, with the highest being $43,900, and three have negative net incomes, with the biggest loss amounting to $25,665. For eight of the nine case farms, crops contribute to net income more strongly than livestock.

[11] In the whole-farm analysis of the east-central case sustainable farm **when livestock were included**, a "typical year" approach was used (the same as for the other sustainable farms), rather than a 6-year average as reported in Table 1 for the crops portion of this farm.

Implications of Alternative Policies

Government farm policy can have much impact on absolute and relative profitabilities of conventional and sustainable farming systems. For example, the two east-central South Dakota case study farms benefited from government payments in such forms as deficiency payments, payments for optional paid acreage reductions (including participation in the "0-92" program), and amounts by which government commodity loan levels exceeded market prices in some years. These payments averaged $27 and $33/acre over 5 years (1985-1989) for the sustainable and conventional farms, respectively.

On a 700-acre whole-farm basis, the government payments averaged $18,900 for the sustainable farm and $23,100 for the conventional farm. These payments were 16% of the average gross income and 66% of the average net income for the sustainable farm (ignoring organic premiums), and they were 15% of the average gross income and 55% of the average net income for the conventional farm.

SDSU's grant from the Northwest Area Foundation has had a major focus on the implications of possible alternative farm and environmental policies on the relative economic attractiveness, to farmers, of conventional and sustainable farming systems. Among the alternative policies analyzed were (1) a tax on commercial fertilizers and pesticides; (2) reduced target prices; (3) mandatory supply controls; and (4) programs involving more planting flexibility than government programs of the 1980s.

Tax on fertilizers and pesticides

A tax on commercial fertilizers and pesticides is an environmental policy option often discussed at state levels as a possible means to reduce the application of chemical inputs which may threaten groundwater quality.

Thus far, taxes of this nature, such as the one in Iowa, have been set at rates which help raise revenues for monitoring, research, and education on groundwater quality; however, the rates are not high enough to significantly discourage use of the chemical inputs. We examined a considerably higher rate, 25% of the retail price of commercial fertilizers and pesticides.

When chemical input prices were increased by 25% on the east-central South Dakota case farms, the 1985-1989 5-year average of net income after subtracting all costs except management decreased by only $1/acre (from $41 to $40/acre) for the sustainable farm. This is because chemicals (in limited quantities) were used on only a portion of that farm. On the conventional farm, however, average net income for the 5-year period decreased by $9/acre (from $60 to $51/acre).

Chemical input price increases of this magnitude do not appear to be sufficient, by themselves, to equalize the net returns for the two types of farming systems. However, the higher chemical input prices, together with organic premiums for some of the products of the sustainable farm, could be sufficient to bring net returns of sustainable systems close to or higher than those of conventional systems.

The effects of such a tax are greatest on conventional farms in the eastern part of the state, where there are more row crops and where conditions are conducive to more intensive use of chemicals. In general, however, a 25% tax does not appear to be sufficiently steep to cause farmers to switch from conventional to sustainable systems except where the systems are of near equal profitability without the tax, as in the wheat growing areas. Of course, such a tax could very well induce conventional farmers to **reduce** their fertilizer and herbicide application rates without completely changing their crop rotations or radically reducing their purchases of chemical inputs.

Reduced target prices

A second policy option is to further reduce federal farm commodity program target prices. Under the 1985 Food Security Act, target prices were held constant the first 2 years (1986 and 1987) and then reduced in stages over the next 3 years. Primarily because of strong pressure on the federal budget, further reductions in target prices during the 1990s were considered by policy makers. In our analyses, we considered a further decrease in target prices—to levels 25% below those of 1990.

A 25% reduction in target prices lowers the profitability of all the farming systems. The reduction in net income is greater for the conventional farm in each area except the northwest, where the reduction is the same for both the conventional and sustainable farms. In absolute terms, the decrease in net income across all five areas averages $14/acre on the conventional farms and $8/acre on the sustainable farms (using 1990 as the baseline, for comparison). Conventional farms tend to have a higher proportion of their acreage devoted to program crops covered by target prices and resulting deficiency payments; hence, reductions in target prices normally have greater absolute effects on net incomes of the conventional farms than on net incomes of the sustainable farms.

In the northeast area, the reduction in target prices shifts the sustainable farm from "less" to "more" profitable (ignoring organic premiums) than the conventional farm. The reduced target prices cause the sustainable farm in the southwest area to shift from "equally" to "more" profitable than the conventional farm. However, in the corn-soybean areas of south-central

and east-central South Dakota, the greater reductions in profits on conventional farms do not appear to be sufficient to induce changes from conventional to sustainable systems.

Mandatory supply controls

The third policy option we analyzed consists of a mandatory acreage control program, patterned in part after Senator Tom Harkin's proposed "Save the Family Farm Act" of 1986. In the scheme which we analyzed, minimum price supports, in the form of loan rates, were set at 72% of parity in 1990. There are no target prices or deficiency payments under the supply control policy option we analyzed. Relatively high (33%) mandatory acreage set-aside requirements were assumed for program crops, including soybeans, in attempts to raise market prices to support levels.

Mandatory supply controls implemented through severe restrictions on the planted acreage of "program" crops were found to favor the conventional farming systems. This is primarily because of the very high prices induced by those restrictions on crops (e.g., corn, soybeans, wheat) tending to predominate in conventional systems. In principle, however, one could design a mandatory acreage control program which requires compliance with certain sustainability practices, such as the use of crop rotations which include legumes. Alternatively, taxes on commercial chemical inputs might be used to partially offset the effect mandatory acreage controls tend to have on application rates of those inputs.

Planting flexibility options

Various proposals for increased planting "flexibility" were offered and discussed in debates leading up to passage of the 1990 Farm Bill (the 1990 Food, Agriculture, Conservation, and Trade Act). Although ultimately not adopted, a Normal Crop Acreage (NCA) program was the Bush administration's original proposal for the new 5-year farm program. We included in our analysis an NCA policy option patterned after that of the Bush administration.

In such an option, an NCA for a farm is established by summing the individual crop acreage bases and historical oilseed (i.e., soybeans, sunflowers, rapeseed, and canola) plantings for the farm. Any combination of program crops and oilseeds may be planted on the NCA. The planting and harvesting of non-program or non-oilseed crops on the NCA results in a reduction in deficiency payments. In our case study NCA calculations—since none of the case farms grew sunflowers, rapeseed, or canola—the only oilseed crop considered was soybeans.

Government deficiency payments in the NCA option just described are based on historical plantings and base yields—i.e., they are essentially "decoupled"—except for deductions based on any planting of harvested non-program or non-oilseed crops on the NCA. We also analyzed a second version of the NCA option, in which harvesting of legumes and other non-program crops (such as millet and buckwheat) planted on the NCA base was allowed without any deduction from deficiency payments. In both versions, set-aside requirements had to be met, meaning legumes or other crops could not be harvested on the set-aside acres.

The research results indicated that NCA proposals do offer some promise for encouraging more use of sustainable farming systems. Where conventional corn and soybean production is quite profitable, as in parts of eastern South Dakota, NCA options by themselves appear to be insufficient to induce changeovers from conventional to sustainable cropping systems. In wheat growing areas of northern and western South Dakota, however, where conventional and sustainable systems often may be at near equal profitability, NCA policies could significantly influence conversions from conventional to sustainable systems, particularly if deficiency payments are not reduced for harvesting legumes and other non-program crops on NCA base (the second NCA version analyzed). To achieve this positive effect on sustainable systems, it may be necessary for NCA policies to be structured and introduced gradually, in ways that limit adverse effects on the markets for legumes and other non-program crops which are important in the rotations of existing sustainable farmers.

A rather complex form of flexibility was approved as a pilot program in the final version of the 1990 Farm Bill. The pilot Integrated Farm Management Program Option (IFMPO) is a voluntary commodity program designed to give farmers additional flexibility in developing more diverse, resource-con-

serving crop rotations. The IFMPO provides farm program payments for planting resource-conserving crops on acres eligible for deficiency payments and allows **some** harvesting of set-aside acres. To participate in the IFMPO, a farmer must plant at least 20% of his or her crop acreage base to resource-conserving crops.

A limited analysis was conducted for the IFMPO, using the case farms in the two corn-soybean agro-climatic areas (the south-central and east-central areas) and in one of the wheat areas (the northwest). The analysis indicated that participation in the IFMPO, together with adoption of associated sustainable-type farming practices, generally does not appear economically advantageous for conventional farms in the corn-soybean areas. In the wheat area included in the analysis, the IFMPO appears advantageous for the conventional case farm—because the sustainable practices it could adopt in association with the IFMPO are attractive economically and because the farm could continue to receive deficiency payments on corn, even though corn no longer would necessarily be part of the farm's crop rotation.

Results also were mixed regarding whether or not the IFMPO is economically advantageous to farms already using sustainable practices. A provision of the IFMPO (as interpreted during the 1991 crop year) which reduced its attractiveness for some such farmers in the first year of operation was one specifying that traditionally "underplanted" program crop acres are not eligible for deficiency payments. However, this provision has been changed starting with the 1992 crop year.

Overall, increased planting flexibility appears to have potential for encouraging more farmers to adopt "sustainable" practices. However, a "general" program (as opposed to a "pilot" program) somehow needs to be less complex than is the IFMPO. Perhaps a version of the NCA which allows deficiency payments to be paid on at least some acres of harvested resource-conserving crops needs further consideration by policy makers. In a way, that is what the IFMPO does. The IFMPO, however, presently entails a great deal of complexity.

Implications for Rural Communities

As debate about sustainable agriculture continues to broaden, the role of sustainable agriculture in revitalization of rural areas is receiving increased attention. Critics of sustainable farming systems often contend that farm conversions from conventional to sustainable systems would adversely affect rural community economies, primarily because of fewer purchased inputs by sustainable farmers from local agricultural supply firms. Others suggest that sustainable agriculture may provide a foundation on which the economic health of rural communities can be strengthened.

As part of SDSU's research under its Northwest Area Foundation grant, **short-term** economic effects of conversions from conventional to sustainable farming systems were examined. We estimated the rural area personal income effects of such conversions, breaking out direct (or primary) effects on agricultural households (including both family and hired labor) and indirect and induced (or secondary) effects on (1) backward linked businesses in the local community (fertilizer and machinery dealers, etc.), (2) forward linked businesses (e.g., local grain handling businesses), and (3) local businesses which sell consumer goods. The forward and backward linkages are illustrated in Figure 2. Data from the case study conventional and sustainable farms in south-central, east-central, northeast, northwest, and southwest South Dakota were used in the quantitative analysis.

The analysis showed that the largest personal income effects within rural areas of conversions to sustainable agriculture are those on the agricultural households themselves. Estimated effects varied somewhat among the five local study

areas, but indirect and induced personal income effects average $0.87 for each $1.00 of direct effect.

Of the indirect effects, backward linkage effects were found generally to be of much greater significance than forward linkage effects; this reflects, in part, the general lack of local value-added agricultural industries in South Dakota.

Because (1) agricultural households were estimated to have less personal income with sustainable systems (not counting organic price premiums) than with conventional systems in all case study areas of South Dakota except in the northwest area and (2) most of the short-run indirect and induced personal income effects on non-agricultural households were negative, **overall** personal income effects of the hypothesized change to sustainable systems were negative in all areas except the northwest. Negative indirect personal income effects tended to be especially high in the retail trade subsector, which included agricultural chemical dealerships.

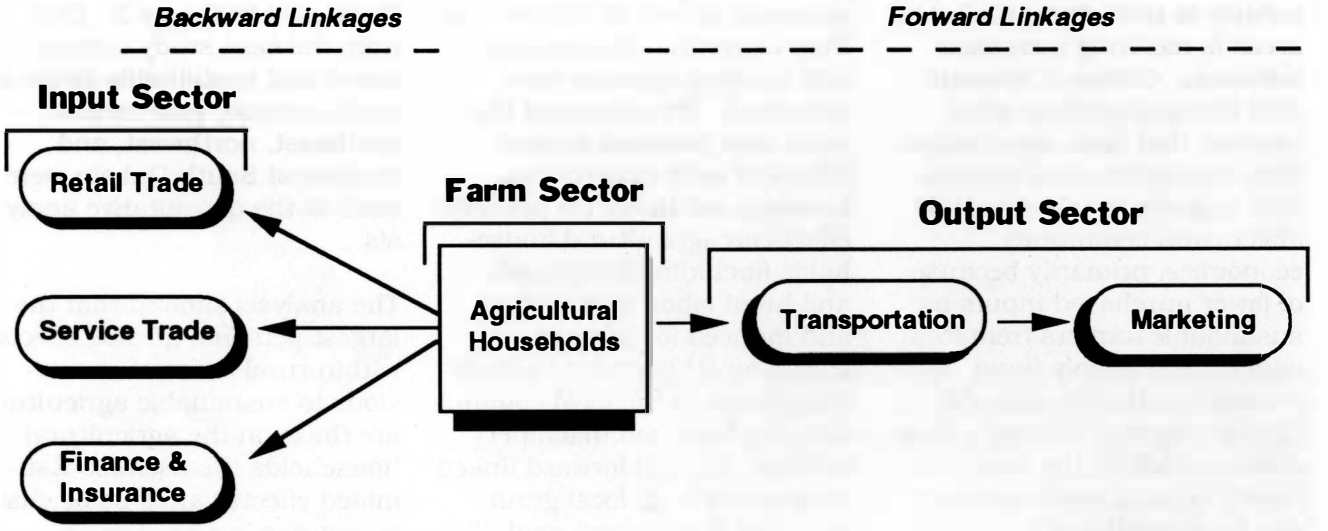
These results were based upon analysis which ignored organic premiums. As has been noted previously in this report, taking organic premiums into account reduces, and in some cases eliminates, net income differentials between conventional and sustainable farms. Inclusion of organic premiums in rural community sensitivity analyses enhanced agricultural household personal incomes in four of the five case comparisons, thereby offsetting some of the negative secondary forward and backward linkage personal income effects associated with conversions to sustainable systems.

In the longer term, a variety of on- and off-farm adjustments might take place which could alter these estimates. For example, as research on "sustainable" agriculture technologies intensifies over the next few years, **relative** economic profitabilities of sustainable systems are likely to be enhanced. Changes in federal farm programs and energy prices also are likely to increase the relative profitabilities of sustainable practices.

Both agricultural household income and induced secondary effects would be impacted by those changes. Thus, long-term rural economy effects of conversions from conventional to sustainable agricultural practices are likely to appear more positive (or less negative) than the short-term effects we estimated.

A variety of other rural economy changes also are likely to accompany conversions to sustainable systems after structural adjustments have had time to take place. For example, some agricultural input suppliers may increasingly become providers of information services—such as integrated pest management, fertility management, specialty crop management, etc. This could replace some of the lost economic activity in chemical fer-

Fig 2. Conceptualization of conventional and sustainable agriculture effects on local economies.



tilizers and pesticides. Thus, as demands for some types of conventional agricultural inputs decline, demands for other, less conventional inputs may increase. Likewise, as farmers diversify into other crops in the process of adopting sustainable rotations, the need for new and different types of local marketing facilities, machinery, and services is likely to expand.

In short, the "structure of agriculture" could change if there were widespread shifts by farmers to sustainable practices. This could have substantial implications for rural community economies, especially if the viability of moderate-sized family farms were strengthened.

Conclusions

Sustainable agriculture takes on different **agronomic** dimensions in different agro-climatic areas. For example, differences between sustainable and conventional farmers in application rates of synthetic chemical fertilizers tend to be much greater in the eastern corn-soybean areas of South Dakota than in the northeastern and western wheat areas. Consequently, **economic** differences between sustainable and conventional farmers also vary by agro-climatic area.

There are substantial differences in profitability between sustainable and conventional farms in the corn-soybean areas when organic premiums are absent or ignored. There appears to be less difference in profitability in the wheat areas. In fact, when organic premiums for those farms that qualify are factored in, sustainable farms in the wheat areas appear to be slightly more profitable than their conventional counterparts.

Higher energy prices and federal farm policies which permit greater planting flexibility without sacrifice of support payments will enhance the **relative** profitability of sustainable systems. In wheat areas, such changes in the years ahead could often tip the balance, making sustainable systems more profitable even without organic premiums. More dramatic changes in prices or federal farm programs—or in a combination of those factors **and** in environmental policies—would be required for sustainable systems to generally be more profitable than conventional systems in corn-soybean areas.

We are likely to see a stronger set of **incentives** for sustainable systems and **constraints** on conventional systems in areas that are particularly vulnerable environmentally to conventional farming practices. Corn-soybean areas in which groundwater quality is of increasing concern constitute an example.

While a number of policy options and their respective implications have been clarified in this study, further research is needed to design policy sets which incorporate **combinations** of federal farm commodity program policy (e.g., increased planting flexibility, together with conservation compliance provisions) and environmental policy (e.g., taxes or application restrictions on particular chemicals).

Rapid widespread conversion from conventional to sustainable farming systems could cause some economic adjustment difficulties for rural communities. However, most economic conversions take place gradually over time. Hence, some adverse effects shown in this study's analysis would likely be mitigated. Moreover, there could be a number of positive long-term effects on rural communities from conversions to sustainable systems. These are difficult to quantify in advance. **If** systems can be developed which enhance the long-run economic and environmental sustainability of moderate-sized family farms, then the economic health of rural communities also may be enhanced.

This study has identified some key differences between "sustainable" and "conventional" farming systems in South Dakota **at this point in time** (1992). It has also provided some tentative ideas about the relative economic attractiveness to farmers of selected systems, given current and possible

alternative farm and environmental policies.

Much of the analysis was based upon **case studies**. Case studies are extremely valuable in providing specific, detailed insights. However, caution must always be used in generalizing from such studies. A great deal of judgment is required in selection of cases for study, and whatever cases are selected will not be representative of all systems or situations in a given agro-climatic area. Consequently, profitability comparisons based upon case studies should be considered indicative, not definitive.

Moreover, technologies and systems for a more sustainable agriculture are very fluid at the present time. With much new research having begun in just the last 4 or 5 years, and with many farmers now themselves experimenting with more "sustainable" practices and systems, new insights are rapidly emerging. Farming systems thought by some to be best today may be replaced by other farming systems a few years from now, as research and farmer experimentation bear fruit.

Thus, this report should be considered a partial picture of a rapidly changing scene. Even with that qualification, it should be useful to farmers, policy makers, researchers, and educators as they attempt to develop a sustainable agriculture for South Dakota and the northern Great Plains.

Annex A

Publications Resulting from Northwest Area Foundation Grant to SDSU, "Sustainable Agriculture as a Rural Revitalization Strategy: Public Policy Influences"

South Dakota's sustainable agriculture farmers. By D.C. Taylor and T.L. Dobbs. SDSU Econ Newsletter 264. Nov 21, 1988. 4pp.

Presents preliminary findings from a Summer 1988 mail survey of 32 South Dakota sustainable farmers.

"Sustainable" ag: focus on producers. By D.C. Taylor and T.L. Dobbs. *South Dakota Farm & Home Research* 40(1):11-18. 1989.

Presents overview of findings from the Summer 1988 mail survey of sustainable farmers in South Dakota.

Sustainable agriculture in South Dakota. By D.C. Taylor, T.L. Dobbs, and J.D. Smolik. SDSU Economics Research Report 89-1. April 1989. 107pp. ($6.00)

A comprehensive report of the Summer 1988 mail survey of 32 sustainable farmers in South Dakota. Describes (1) the nature of the sustainable farms and farmers, (2) the farm production and marketing practices followed by the farmers, and (3) the farmers' evaluation of comparative yields, profits, and problems with sustainable vs. conventional agriculture. The insightful responses from individual respondents to a wide array of questions on sustainable agriculture are documented in a series of annexes.

Economic considerations in evaluating alternative agricultural practices. By T.L. Dobbs and D.C. Taylor. In Proceedings of 1989 Annual Meeting of the Great Plains Agricultural Council, Lubbock, Texas, pp 109-131. ($1.50)

Describes economic considerations in farmer, public, and policy maker decisions about low-input/sustainable agriculture practices. Results of selected economic studies are presented, and policy and research issues for the Great Plains are identified.

Farmer economic evaluation of sustainable agriculture in South Dakota. By D.C. Taylor and T.L. Dobbs. Selected paper presented at the 1989 Annual Meeting of the Western Agricultural Economics Association in Coeur d'Alene, Idaho on July 9-12, 1989. 10pp. ($1.00)

Presents the evaluation of 32 South Dakota sustainable farmers on relative (1) crop yields, (2) farm profits, (3) farm labor requirements, and (4) production and marketing problems with sustainable vs. conventional farming practices.

South Dakota's sustainable agriculture technology. By D.C. Taylor, T.L. Dobbs, and J.D. Smolik. Selected paper presented at the 1989 Annual Meeting of the American Agricultural Economics Association, Louisiana State University, Baton Rouge, July 30-Aug 2, 1989. 13pp. ($1.00)

Describes (1) the sustainable production techniques—involving synthetic chemical input practices; crop rotations; special weed, insect, and disease control practices; special tillage and residue management practices; and special grain drying and storing practices—and (2) the sustainable marketing practices and experiences of 32 sustainable farmers in South Dakota.

Farm program participation and policy perspectives of sustainable farmers in South Dakota. T.L. Dobbs, D.L. Becker, and D.C. Taylor. SDSU Econ Staff Paper 89-7. Oct 1989. 17pp. ($1.50)

Presents information on current participation in federal commodity programs and views by 21 South Dakota sustainable farmers concerning desired changes in federal farm programs and actions by state and local governments to promote sustainable agriculture.

Crop and livestock enterprises, risk evaluation, and management strategies on South Dakota sustainable farms. D.C. Taylor, T.L. Dobbs, D.L. Becker, and J.D. Smolik. SDSU Res Rep 89-5. Nov 1989. 98 pp. ($6.00)

A comprehensive report of the Jan-Mar 1989 personal interview survey of 22 South Dakota sustainable farmers. Describes (1) who the sustainable farmers are, (2) their crop rotations, (3) their livestock enterprises, (4) their judgments on the relative riskiness of sustainable vs. conventional farming, and (5) managerial strategies for overcoming critical problems with sustainable agriculture.

On-farm management of sustainable agriculture. D.C. Taylor, T.L. Dobbs, D.L. Becker, and J.D. Smolik. SDSU Econ Commentator 277. Dec 5, 1989. 3 pp.

Presents the views of 22 sustainable farmers concerning on-farm managerial practices and off-farm strategies for dealing with transition weed problems, transition nitrogen shortages, inadequate markets for "organic" produce, and inadequate information about sustainable agriculture.

LISA public policy: from capitol to courthouse, debate over ag and environment continues. By T.L. Dobbs, D.L. Becker, and D.C. Taylor, *and* **LISA in the "real world": veteran producers report how they farm and the risks they encounter.** By D.C. Taylor, T.L. Dobbs, D.L. Becker, and J.D. Smolik. *South Dakota Farm and Home Research* 41(1): 3-6, 10-13. 1990.

Presents summary information on the sustainable crop rotations, crop cultural operations, and livestock management practices followed by 22 sustainable farmers in South Dakota. Covers views of farmers on the relative risks with sustainable and conventional agriculture and managerial strategies for overcoming several potential problems with sustainable agriculture. Presents summary information on the views of 21 sustainable farmers in South Dakota on desired changes in (1) the federal farm program regarding flexibility on crops grown, conservation/environmental compliance, and a variety of other policy issues and (2) state and local government actions regarding education, research, and environmental quality controls and incentives.

On-farm research comparing conventional and low-input/sustainable agricultural systems in the Northern Great Plains. By T.L. Dobbs, J.D. Smolik, and C. Mends. Ch. 15 in *Sustainable Agriculture Research and Education in the Field: A Proceedings*, B.J. Rice (ed.) Washington, D.C.: National Academy Press. 1991. pp. 250-265. ($1.50)

Presents comparative 5-year yield and whole-farm economic results for a conventional farm and a sustainable farm in east-central South Dakota. Covers results for each farm for the baseline 1985-1989 period, with and without organic commodity price premiums. Also covers simulated alternative policy situations involving (1) an assumed 25% increase in purchased chemical fertilizer and herbicide input prices and (2) an assumed 25% reduction in federal farm program target prices for corn and small grains.

Crop enterprise and principal rotation budgets for sustainable agriculture case farms in South Dakota. By D.L. Becker, T.L. Dobbs, and D.C. Taylor. SDSU Economics Research Report 90-2. May 1990. 79 pp. ($5.00)

Describes procedures for and underlying assumptions used in determining individual baseline sustainable crop enterprise and overall crop rotation budgets. Presents budget spreadsheets for 12 South Dakota sustainable farms. Economic effects of organic commodity price premiums are briefly explored.

Crop enterprise and whole-farm budgets for "conventional" farming systems in five areas of South Dakota. By J.D. Cole and T.L. Dobbs. SDSU Economics Research Report 90-3. July 1990. 47 pp. ($4.00)

Describes procedures for and underlying assumptions used in preparing budgets for "conventional" farming systems. Presents baseline whole-farm budgets for one actual conventional and four synthetic conventional farms in different areas of the state.

On-farm sustainable agriculture research: lessons from the past, directions for the future. By D.C. Taylor. *Journal of Sustainable Agriculture* 1(2):43-88. 1990. ($2.00)

Covers the unique roles of on-farm research in (1) documenting the sustainable practices and experiences of commercial sustainable farmers and (2) experimenting with new sustainable practices/enterprises on the fields of commercial sustainable farmers. Presents a review of the on-farm sustainable agriculture research undertaken over the past 15 years in the U.S. and outlines four critical methodological issues facing the next generation of on-farm sustainable agriculture researchers.

Sustainable agriculture policy analyses: South Dakota on-farm case studies. By T.L. Dobbs, D.L. Becker, and D.C. Taylor. *Journal for Farming Systems Research-Extension* II(2): 109-124. 1991. ($1.50) A longer version of this article was presented as Staff Paper 90-5 at the 10th Annual Symposium of the Assoc. for Farming Systems Research-Extension, East Lansing, MI.

Presents the effects of alternative public policies on the relative profitability of "conventional" and "sustainable" farming systems in five agroclimatic areas of South Dakota.

Effects of public policies on the relative profitability of conventional and sustainable farming systems. By T.L. Dobbs, D.L. Becker, and D.C. Taylor. SDSU Econ Commentator 290. Nov. 6, 1990. 4 pp.

Provides an overview of the comparative effects of reduced government farm program target prices on the profitability of five pairs of "sustainable" and "conventional" farms in South Dakota.

Comparisons of sustainable and conventional crop enterprise budgets in South Dakota. By J. Cole (with assistance from S. Van Der Werff). SDSU Economics Pamphlet 90-1. Nov. 1990. 40 pp. ($3.00)

Compares "conventional" and "sustainable" crop enterprise budget costs, by key cost categories. Also compares yield estimates. Data drawn from several sources.

Implications of a mandatory supply control program for sustainable agriculture in South Dakota. By D.L. Becker and T.L. Dobbs. SDSU Economics Research Report 90-6. Dec. 1990. 31 pp. ($3.00)

Examines the comparative profitability and wider economic implications of a mandatory supply control program for selected "sustainable" and "conventional" farming systems in South Dakota.

Livestock budgets and whole-farm economic analysis: South Dakota sustainable agriculture case farms. By D.C. Taylor, C. Mends, and T.L. Dobbs. SDSU Economics Research Report 90-7. Dec. 1990. 88 pp. ($6.00)

Describes the underlying assumptions and production coefficients for the various beef cattle and hog production enterprises on nine sustainable case farms in South Dakota. Presents the results of whole-farm economic analysis in which the various livestock and crop enterprises on the respective farms are integrated with each other. Results of analyses of (1) livestock price sensitivity and (2) on-farm manure production and disposition are also presented.

Integration of crop and livestock enterprises: South Dakota sustainable case farms. By D.C. Taylor, C. Mends, and T.L. Dobbs. SDSU Econ Commentator 293. Jan. 31, 1991. 4 pp.

Provides an overview of the linkages between crops and livestock on nine sustainable case farms via home-raised feed production for on-farm livestock use, livestock manure production and use on cropland, and the relative importance of crops and livestock in generating income on the respective farms.

Rural economy implications of farms converting to sustainable agriculture practices: some estimates for South Dakota. By T.L. Dobbs and J.D. Cole. SDSU Economics Research Report 91-1. Feb. 1991. 55 pp. ($5.00)

Presents some of the rural economy implications of conversions from "conventional" to "sustainable" farming systems in five areas of South Dakota. Describes underlying assumptions and the nature and magnitudes of (1) direct agricultural household effects, (2) first-round indirect backward- and forward- linkage effects, and (3) additional multiplier effects, e.g., consumer expenditures by farm households, purchases of supplies by forward- and backward-linked firms, and purchases of consumer goods by owners and employees of firms affected by various rounds of expenditures.

Impacts of rising energy prices on the attractiveness of sustainable farming systems. By T.L. Dobbs and J.D. Cole. SDSU Economics Staff Paper 91-4. June 1991. 29 pp. ($2.50)

Energy costs are compared for case "conventional" and "sustainable" farms in five different agro-climatic areas of South Dakota. Energy costs are broken into fertilizer, herbicide, fuel and lubrication, and crop drying categories. Energy cost increases are simulated to determine effects on relative profitabilities of conventional and sustainable farms.

Potential effects on rural economies of conversion to sustainable farming systems. By T.L. Dobbs and J.D. Cole. Selected paper presented at the 1991 Annual Meeting of the American Agricultural Economics Association, Kansas State University, Manhattan, Aug. 4-7, 1991. ($1.50) A longer version of this paper has been accepted for publication in the *American Journal of Alternative Agriculture.*

Summarizes study of potential direct and indirect (multiplier) economic effects on local economies of conversions from "conventional" to "sustainable" farming systems in five different agro-climatic areas of South Dakota. Also discusses potential effects which were not quantified in the study.

Crop production management in South Dakota: LISA farmers compared to farmers in general. By D.C. Taylor, D.L. Becker, J.D. Cole, and T.L. Dobbs. SDSU Economics Staff Paper 91-7. September 1991. ($2.50)

Summarizes (1) contrasts in crop production management between LISA and conventional farmers in South Dakota and (2) reactions of panels of LISA farmers, conventional farmers, and other key informants to the existence of and apparent contrasts in crop production practices between LISA and conventional farmers.

Farm program flexibility options and sustainable agriculture. By T.L. Dobbs and D.L. Becker. SDSU Economics Research Report 91-9. September 1991. 42 pp. ($4.00)

Describes such farm program flexibility options as Normal Crop Acreage programs, the Triple Base program, and the Integrated Farm Management Program Option. Presents results of research which examines the effect adoption of such flexibility options might have on the relative profitabilities of sustainable and conventional case farming systems in South Dakota.

Economic impacts of low-input agriculture on farmers and rural development. By T.L. Dobbs. Paper prepared for Workshop on Sustainable Development of Agriculture. Sponsored by U.S.A. National Academy of Sciences and Bulgarian Academy of Sciences, Sofia, Bulgaria. October 1991. 29 pp. ($2.50)

Presents research results on, and discusses implications of, low-input agricultural systems for farmers and rural areas. Implications of the research findings for agricultural policies in economic transition countries of Eastern Europe are also discussed.

Mandatory supply controls vs. flexibility policy options for encouraging sustainable farming systems. By T.L. Dobbs and D.L. Becker. Accepted for publication in the *American Journal of Alternative Agriculture.* ($1.50, after it becomes available.)

Examines how two very different sets of policy options affect the relative profitability of "conventional" and "sustainable" farming systems. The options consist of (1) mandatory acreage controls and (2) variations of a Normal Crop Acreage (NCA) program.

Beliefs and practices of sustainable farmers in South Dakota. By D.C. Taylor, T.L. Dobbs, and J.D. Smolik. Accepted for publication in *Journal of Production Agriculture.* ($1.50, after it becomes available.)

Describes—from the standpoints of crops grown, cultural practices, and perceived risks—how "conventional" and "sustainable" farming systems in South Dakota differ. Draws on surveys and interviews with farmer and key informant panels.

B 713

FARM, RURAL ECONOMY, AND POLICY IMPLICATIONS OF SUSTAINABLE AGRICULTURE IN SOUTH DAKOTA

Contents

Figures

Tables

Published in accordance with an act passed in 1881 by the 14th Legislative Assembly, Dakota Territory, establishing the Dakota Agricultural College and with the act of re-organization passed in 1887 by the 17th Legislative Assembly, which established the Agricultural Experiment Station at South Dakota State University. Educational programs and materials offered without regard to age, race, color, religion, sex, handicap, or national origin. An Equal Opportunity Employer.

2,500 copies printed at a cost of 64¢ each by South Dakota Agricultural Experiment Station and the SDSU Department of Economics with AGRITEK ink (containing soy, corn, and other vegetable oils) on recycled paper. May 1992 AX058