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FARMER ECONOMIC EVALUATION OF SUSTAINABLE AGRICULTURE IN SOUTH DAKOTA[1]

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Compared to conventional agriculture, "sustainable" ("low chemical input," "regenerative," "alternative") farming systems involve a much reduced use of synthetic chemical inputs (fertilizers, pesticides), reduced out-of-pocket production costs, greater use of legume-based crop rotations, greater integration of crop and livestock enterprises, and increased management requirements (Madden and Dobbs, 1988).[2]

Public interest in sustainable agriculture is much on the rise these days. This heightened interest arises because of farmer, policymaker, and general public concerns over environmental degradation (e.g., groundwater contamination, soil erosion), intensive capital needs and hence intensified producer risk exposure, and adverse personal health implications to farmers and diet-sensitive consumers that sometimes result from conventional farming practices. A related public concern is for an economically sustainable agriculture which is increasingly weaned of its dependency on huge Federal Government subsidies (Knezek, Hesterman, and Wink, 1988; Lee, 1987; Papendick, 1987; Rodale, 1988; Schaller, 1988).

While public interest in sustainable agriculture is currently great, public support for research on sustainable agriculture historically has been very limited (Crosson and Ostrov, 1988; Fleming, 1987). Thus, well-documented facts on the technical and economic performance of sustainable farming systems are also limited.

The primary motivation for undertaking the research reported in this paper was to help fill this informational lacuna. The paper reflects the judgments and experience of 32 sustainable farmers in South Dakota who have followed sustainable farming practices, on the average, for 14 years. Because of the very substantial experience of these farmers with sustainable agriculture, we believe this report on their economic evaluation of sustainable agriculture should be of particular interest to agricultural economists and others concerned with future development possibilities for U.S. agriculture.

MAIL SURVEY

The purpose of a Summer 1988 mail survey was to gain a clearer view of the different types of sustainable farming in South Dakota, the production and marketing practices of the state's sustainable farmers, and an economic evaluation of sustainable agriculture by these farmers. The latter point is covered in this paper. More detailed results from the survey are reported in Taylor, Dobbs, and Smolik (1989).

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[1]This paper results from research supported by South Dakota State University's (SDSU's) Agricultural Experiment Station and by Grant No. 88-0056 from the Northwest Area Foundation to SDSU.

[2]When the term "conventional" agriculture is used in this paper, nothing is implied about whether "traditional" or "modern" farming practices are used.

The mail survey questionnaire was sent in early June to the 93 farmers in the state whom we had come to know were possibly following sustainable farming practices. Those who had not responded by early July were sent follow-up letters and questionnaires. Those who had not responded as of late July and could be reached by telephone were so contacted. Resulting from this process were 32 completed questionnaires. Twenty five of the initially contacted respondents informed us that they either were no longer farming at all or were no longer farming sustainably. Twenty four informed us that they were farming sustainably, but failed to return completed questionnaires. Attempts to contact 12 other non-respondents were unfruitful. Thus, of those known to be sustainable farmers, the survey response rate was 57%.

SUSTAINABLE FARMS AND FARMERS

Nearly two-thirds of the survey respondents have diversified cash grain-livestock farms. The remaining respondents are more commonly specialized--in terms of annual gross farm sales--in cash grain than in livestock enterprises. Twenty eight (88%) of the 32 respondents raise livestock commercially. This is roughly comparable with the 84% (Lockeretz and Madden, 1987), 90% (Lockeretz, et al., 1981), 92% (Wernick and Lockeretz, 1977), and 100% (Klepper, et al., 1977) reported for sustainable farmers in the states directly east and south of South Dakota.

The survey respondents range in age from 27 to 72 years and average 44 years. They are somewhat younger than farmers generally in the state, who in 1982 averaged 49 years of age (USDC, 1984). Further, 45% of the surveyed sustainable farmers are between 35 and 45 years of age, which is well over twice the corresponding percentage for the state.

Our findings on the somewhat greater relative youth of sustainable farmers conform to those of Baker and Smith (1987) for sustainable farmers in New York and those of Harris, et al. (1980) for sustainable farmers in Michigan. They contrast, however, with the findings in several other studies which show the age of Midwestern sustainable farmers to be roughly comparable with that for conventional farmers (Lockeretz, et al., 1981; Lockeretz and Madden, 1987; Lockeretz and Wernick, 1980).

Fifty five percent of the South Dakota respondents report using zero levels of all synthetic chemical inputs--fertilizers, perticides, and livestock feed additives (antibiotics) and growth stimulants--on all their farm enterprises. The other 45% report using moderate amounts of one or more synthetic inputs on one or more of their farm enterprises. The most common moderately used synthetic chemical input consists of herbicides, with some sustainable farmers making limited use of banded and spot-sprayed applications to particularly weed-prone fields or portions of fields.

Crop rotations constitute the single most important means that farmers use to control weeds, insects, and diseases on their sustainably farmed cropland. The legume forage and green manure cover crop components of crop rotations are considered the most important source of nitrogen and improved soil fertility for sustainably raised crops.

Seventy five percent of the respondents report using special tillage and residue management practices on their sustainably farmed cropland. The clearest reflection of modified tillage practices is the reduced use or elimination of the moldboard plow in land preparation. In those instances when the moldboard plow is used, it is most commonly for incorporation of green manure crops and small grain stubble. Farmers consider special tillage and residue management practices as important means to control both soil erosion and weed growth.

The surveyed sustainable farmers in South Dakota have followed sustainable farm production practices for an average of 14 years. The median length of time is 12-13 years. The longest period for one of the 32 surveyed farmers is 42 years,[3] and the shortest is one year. About 70% of the surveyed farmers have had between 5 and 19 years of experience with sustainable practices, and 5 farmers have had 20 or more years of sustainable farming experience.

This length of experience with sustainable practices for South Dakota farmers is greater than that reported for sustainable farmers in New York by Baker and Smith (1987) and in the Midwest by Klepper, et al. (1977), Lockeretz, et al. (1980), and Lockeretz and Wernick (1980). It is roughly comparable, however, to that reported for Midwestern sustainable farmers by Lockeretz and Madden (1987).

A strong flavor of "other-person" concern permeates the motivations of South Dakota farmers to follow sustainable practices. Of the 10 possible suggested reasons for farming sustainably, the four viewed as most important are to (1) be a good steward of the soil; (2) reduce pollution of ground and surface water; (3) raise a residue-free, high quality product; and (4) reduce possible harmful effects of farm chemicals on the health of the farmer and his/her family. Over time, the respondents have come to have increasingly strong reasons for following sustainable farming practices.

FARMER ECONOMIC EVALUATION OF SUSTAINABLE AGRICULTURE

The surveyed South Dakota sustainable farmers were asked to compare sustainable and conventional agriculture from four standpoints: crop yields, farm profits, farm labor requirements, and production and marketing problems. Each is covered in turn.

Crop yields

Fifty seven percent of the South Dakota surveyed farmers consider crop yields to be generally higher with conventional than sustainable farming practices. Of the remainder, about equal numbers (1) consider conventional and sustainable yields to be about the same, (2) consider sustainable yields to be generally higher, and (3) are unsure about yield differences. Several of those who consider crop yields now to be generally higher with conventional practices believe that, over time, sustainable yields will grow to become equal to or to exceed conventional yields. The building of soil that results from sustainable practices takes time, but as the soil does build up, they feel that prospective yields will almost inevitably increase.

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[3]One respondent reports that he is a fourth-generation sustainable farmer.

The six sustainable farmer-oriented survey reports showing comparative yields for conventional and sustainable fields that we reviewed (Berardi, 1978; Klepper, et al., 1977; Lockeretz, et al., 1978, 1980, 1981; Shearer, et al., 1981) reveal a definite tendency for conventional yields to be higher than sustainable yields. The margin of yield difference is most commonly in the range of 1% to 10%. In a few cases, the margin of difference is greater. This outcome is most common in years of unusually favorable weather and other production conditions. In some cases, however, sustainable yields are higher than conventional yields. This outcome occurs most commonly in years with unfavorable production conditions.

Farm profits

Two-thirds of the South Dakota surveyed farmers consider sustainable farming to be more profitable than conventional farming. Only two of the 32 farmers consider profits to be generally less with sustainable practices. Most respondents cite considerably lower out-of-pocket costs of production as the primary reason for greater profits with sustainable agriculture. Higher market prices for some sustainably raised commodities--as a result of selling in "organically certified" markets--and reduced production and price risks are reported to be additional economic benefits from following sustainable farming methods. The risk reduction arises because of better moisture retention in the sustainably farmed soil and greater enterprise diversification on the sustainable farms.

The careful empirical measurement of farming profits involves a multitude of details and assumptions. Therefore, drawing meaningful conclusions from comparative reports of profits for different studies is somewhat problematic. Nevertheless, the review of the five reports that we found dealing with sustainable-conventional farming profits (Harris, et al., 1980; Klepper, et al., 1977; Lockeretz, et al., 1978 and 1981; and Shearer, et al., 1981) shows the following general conclusions. In a majority of the studies, profits from farming sustainably are reported to be roughly comparable with those from farming conventionally. Profits are sometimes reported to be higher with conventional practices, however, especially in years with unusually favorable production conditions. The pattern for relative improvement in sustainable compared to conventional yields when weather conditions are unfavorable also shows itself in regard to profits.

Farm labor requirements

Of the 31 South Dakota sustainable farmers answering a question on whether following sustainable rather than conventional farming practices adds to farm labor requirements, 23 (74%) said yes, 5 (16%) said no, and 3 (10%) said they were unsure. Those who responded yes indicated that the most important source of increased labor requirements is more time in weed control, including mechanical cultivation. A second level of importance for added labor being required with sustainable practices arises from (1) the added diversity of crop enterprises requiring attention and (2) more time in seeking out organic market outlets. The added time in crop insect and disease control with sustainable practices is considered to be relatively limited.

Somewhat analogous findings are reported from three other studies of sustainable agriculture. Berardi (1978) and Klepper, et al. (1981) show greater

labor requirements per unit of land with sustainable practices. Harris, et al. (1980), on the other hand, shows less hired labor on sustainable farms.

Production and marketing problems

The South Dakota sustainable farmers were asked to rate the relative importance of 15 suggested possible problems (difficulties) with sustainable agriculture on a 0 to 5 scale, where 0 meant not at all important and 5 meant very important. Two types of problem ratings were requested--one concerning persistent or continuing problems over time and the other concerning problems at the time of transition in converting from conventional to sustainable practices. Transition problems were described to respondents as exaggerated forms of what later came to be continuing problems, or as problems that arose during the transition period but eventually disappeared "by the end of the transition period." The farmers' responses are summarized in Table 1. Attention is first given to continuing problems, and then to transition problems.

The mean and median scores for no one continuing problem exceed 3, thus indicating that no persisting problems are, for the respondents collectively, "very important". The varying intensities of continuing problems lend themselves to a three-part characterization.

- Quite important. The two problems receiving the highest ratings are (1) difficulties in finding organic market outlets and (2) lack of up-to-date and accurate information on sustainable agriculture. Baker and Smith (1987), Blobaum (1984), Lockeretz, et al. (1981), and Lockeretz and Madden (1987) also draw attention to intensified marketing problems with sustainable agriculture, and Lockeretz, et al. (1981), Lockeretz and Madden (1987), and Madden (1987) to inadequate information.

- Somewhat important. Six problems fit this category for the South Dakota sustainable farmers: (1) ridicule from neighbors, (2) increased weed problems, (3) crop nitrogen shortages, (4) costly organic fertilizer and soil amendments, (5) increased management requirements, and (6) inadequate organic waste product supplies. Baker and Smith (1987), Blobaum (1984), Lockeretz and Madden (1987), Lockeretz, et al. (1981), and Madden (1987) also draw attention to increased weed problems with sustainable practices. Blobaum (1984) and Lockeretz, et al. (1981) affirm the importance of ridicule from neighbors and Lockeretz and Madden (1987) an added management requirement with sustainable farming.

- Relatively unimportant. The other seven possible problems indicated in Table 1 received the lowest ratings collectively by the respondents. Within these seven, the first four can probably be viewed as somewhat more important than the last three.

One striking feature of the sustainable farmers' responses to the possible-problems-with-sustainable-agriculture question is the wide range of views among respondents on the relative importance of individual possible continuing problems. For each possible problem, at least four farmers (not always the same ones) gave it a 0 ("totally unimportant") rating. At the other extreme, one or more farmers indicated a 5 ("very important") rating for each possible problem except three. This outcome reflects a certain degree of uniqueness among respondents in their respective production environments, managerial practices,

and problem perceptions.

In a next stage of the research, public forums are being planned at which different sustainable farmers will be asked to share their individual experiences with and reactions to sustainable agriculture. The forums will be orgainized around panel discussions concerning selected possible problems with sustainable agriculture. The panels will be constituted with farmer representatives holding different points of view concerning the existence of each selected problem chosen for discussion. We expect these forums to be instructive for both the individual farmer participants and others interested to learn more about sustainable agriculture.

The most important transition problem reported by the South Dakota sustainable farmers is (1) increased weed problems, followed by (2) a lack of up-to-date and accurate information on sustainable agriculture, (3) ridicule from neighbors, (4) difficulties in finding organic market outlets, and (5) crop nitrogen shortages (Table 1).

The degree of problem importance during the transition from conventional to sustainable practices--as reflected by mean and median values--is greater than the continuing degree of importance for nearly all problems. The degree of difference is most exaggerated for increased weed problems, with the mean transition versus conventional problem ratings being 3.30 and 2.07, respectively, and the median transition versus conventional problem ratings being 4 and 2, respectively.

To our knowledge, other researchers have not attempted to identify transition problems empirically through a farmer survey approach such as ours. The general literature on sustainable farming, however, does draw attention to increased weed problems and nitrogen shortages (e.g., Culik, 1983; Cacek and Langner, 1986) as problems whose importance during the period of converting from conventional to sustainable practices is likely to be accentuated.

CONCLUSION

This study does not provide direct, hard evidence that "sustainable"--meaning low synthetic chemical input--farming practices are economically sustainable over the long-term. Twenty of the 32 surveyed farmers believe that sustainable agriculture is more profitable than conventional agriculture, however, and only two of the farmers believe that sustainable agriculture is less profitable. Perhaps "more telling" is the fact that the 32 surveyed farmers have followed sustainable farming practices for an average of 14 years. If those farming practices were not indeed economically sustainable, we could have expected those farmers, over time, to have been either forced out of business through bankruptcy or forced to "revert" back to conventional practices.

This conclusion is acknowledged to be somewhat conjectural. The research program on sustainable agriculture at South Dakota State University is geared, among other things, toward trying to ascertain more directly the longer-term physical and economic sustainability of low synthetic chemical input farming

practices.[4] This assessment includes Winter 1989 personal interviews with over 20 of the 32 mail survey respondents--to determine in detail the configuration of, and specific cultural practices followed in, the farmers' crop rotations. Based on this, detailed crop rotation budgets will be developed and whole farm economic analyses will be undertaken. The methodology used in this analysis will be built on that already used in our comparative study of experimental field plots involving sustainable, conventional, ridge till, and minimum till crop rotations.

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[4]An important component of SDSU's research program on sustainable agriculture, not touched upon in this paper, concerns the experimental field plot comparative testing since 1985 of sustainable, ridge till, minimum till, and conventional farming practices at the University's Northeast Research Station north of Watertown. For selected reports of findings from this work, see Dobbs, Leddy, and Smolik (1988) and Dobbs and Mends (1989).

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Table 1. Continuing and transition problems with sustainable agriculture, South Dakota survey respondent farmers.

Possible problem with sustainable agriculture[a]	Degree of importance[b]					
	Continuing problem			Transition problem		
	Mean	Median	Range	Mean	Median	Range
Difficult to find organic market outlets	2.83	3	0-5	2.83	3	0-5
Lack of up-to-date and accurate information on sustainable agriculture	2.45	2	0-5	3.09	3	0-5
Receive personal ridicule from neighbors	2.21	2	0-5	2.96	3	0-5
Increased weed problems	2.07	2	0-5	3.30	4	0-5
Crops experience nitrogen shortages	1.97	2	0-5	2.78	3	0-5
Organic fertilizer and soil amendments are costly	1.93	2	0-5	2.52	3	0-5
Tough to cope with management requirements	1.86	2	0-5	2.48	3	0-5
Difficult to find adequate organic waste products (manure, compost, industrial)	1.79	2	0-5	2.22	2	0-5
Forces me to reduce my base acreage in the Federal farm program	1.55	0	0-5	1.78	1	0-5
Creditors are reluctant to grant loans	1.21	0	0-5	1.57	2	0-5
Forces me to have less farmland in high valued crops	1.10	0	0-5	1.57	1	0-5
Lack of pest resistant varieties	0.97	0	0-4	1.17	0	0-4
Forces me to be a livestock farmer	0.59	0	0-5	0.83	0	0-5
Increased insect problems	0.52	0	0-2	1.26	1	0-4
Increased disease problems	0.41	0	0-2	1.17	0	0-4

[a]Each of four respondents indicated one additional problem with sustainable agriculture: having to cope with the pollution of the land rented from others (5 rating), moisture in dry years--green manuring (5), pollution from neighbors (2), and increased labor requirements (2).

[b]Each respondent rated the relative severity of each possible problem with sustainable agriculture on a scale of 0 to 5, where 0 meant not at all important and 5 meant very important. The degree of importance of various problems is reflected by the mean, median, and range values for the problem-ratings by the individual survey respondents.