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■ by John Ikerd, Sandra Monson, and Donald Van Dyne

In short

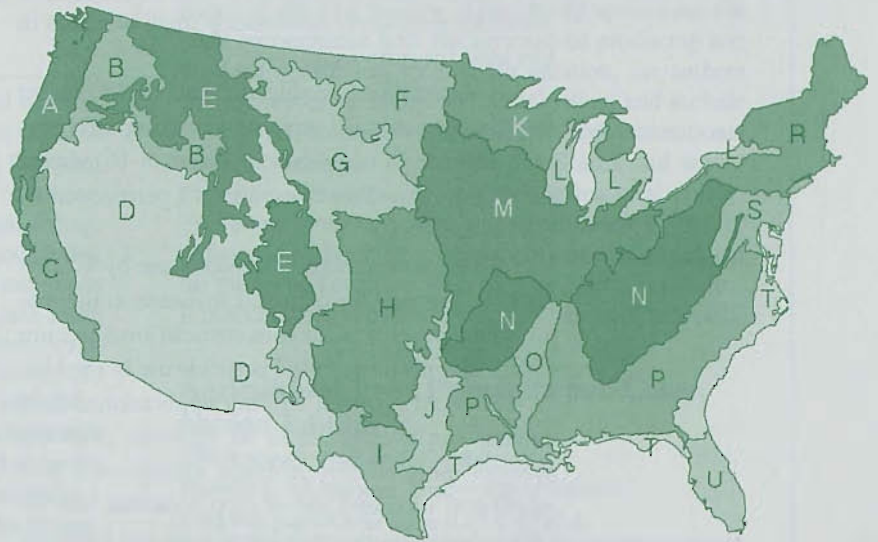
Alternative farming systems for U.S. agriculture: New estimates of profit and environmental effects

A sustainable agriculture must maintain its productivity of food and fiber and usefulness indefinitely: it must be ecologically sound and economically viable. Various people and groups have proposed that alternative production systems be used to meet environmental concerns, but are these alternatives profitable? Are they sustainable? Our recent study provides initial, partial answers and helps build our meager knowledge about alternative and hopefully sustainable agriculture.

We estimated and compared the farm level costs, returns, chemical use, and soil loss for conventional and alternative systems of production for corn, soybeans, milo, small grains, cotton, peanuts, and tobacco for nine major crop-producing regions of the U.S. (see map). These nine resource areas account for over 80 percent of total U.S. production of each of the crops included in our study. The crops selected account for over 70 percent of the inorganic nitrogen fertilizer and 75 percent of agricultural pesticides used in the U.S. Funding for our study came from the U.S. Environmental Protection Agency, U.S. Department of Energy, and U.S. Department of Agriculture.

Our conventional farming scenario used crop rotations in use during 1984-87 as reported in the 1987 National Resource Inventory (NRI) of the Soil Conservation Service. Other information for our conventional production systems (including tillage practices, inputs and input levels, cash costs, and production levels) came from crop budgets obtained from extension specialists in 13 states and from data on conservation and tillage practices reported in the NRI.

Our alternative crop production systems used dif-



In the present study, nine land resource regions were selected that collectively account for at least 80 percent of the crop acres devoted to major U.S. crops.

B-Northwestern Wheat and Flange Region T-Atlantic and Gulf Coast Lowland Forest and Crop Region
 F-Northern Great Plains Spring Wheat Region N-East and Central Farming and Forest Region
 G-Western Great Plains and Irrigated Region H-Central Great Plains Winter Wheat and Range Region
 M-Central Feed Grains and Livestock Region J-Southwestern Prairies Cotton and Forage Region
 O & P-Combined region: Mississippi Delta Cotton and Feed Grains Region and the South Atlantic and Gulf Slope Cash Crops, Forest and Livestock Region

ferent crop rotation patterns, tillage methods, and pesticide and fertilizer input levels based on soil erodibility of each area as identified in the NRI. Consultant agronomists helped specify alternative crop rotations for each area. Our alternative systems were chosen specifically to maintain productivity and profitability and reduce apparent soil loss and water quality risks. The alternative systems reflect, we believe, ones that farmers would seriously consider. Many farmers already use the farming practices and methods in our alternative scenarios. They are not radical departures from current farming methods in the respective regions.

The authors are, respectively, Extension professor, research assistant professor, and research associate professor in agricultural economics at the University of Missouri.

Our study showed that in comparison to conventional systems, the alternative systems have the following effects:

- Increased profits. Cash production costs fell by an average \$7 per acre (17 percent) while total production and returns stayed essentially unchanged.

- Reduced soil loss by 70 percent (on average across all regions assuming 100 percent adoption of alternative systems), and brought sheet and rill erosion down to "T" on all but the most highly erodible lands and below "2T" on nearly all land.

- Reduced total fossil-fuel based energy use by 22 percent (on average across all regions) with reductions in energy use associated with fertilizers and pesticides completely dominating small increases in fuel used for cultivation.

- Reduced direct production costs by 17 percent (on average across all regions), reflecting a 38 percent decrease in crop chemical costs, a 16 percent reduction in fertilizer costs, and a 7 percent reduction in fuel costs.

- Reduced commercial herbicide use by 40 percent (on average) for corn and soybeans in the major producing areas. Our corn-soybean areas account for a major portion of total pesticide use in the U.S.

- Reduced nitrogen fertilizer applications by 30 percent (on average across all regions), primarily through more efficient nutrient management programs and increased use of crop rotations, specifically reducing mono-cropping of corn and soybeans.

- Increased crop labor requirements by no more than 7 percent, but increased the management requirements significantly and increased the management/land ratio.

In general, the study indicates that cropping systems which incorporate reduced tillage, greater cropping diversity, and more efficient management of commercial pesticides and fertilizers can improve resource conservation, reduce environmental risks, reduce costs of production, and increase short run profits in comparison to conventional systems of farming.

Our alternative farming systems used farming practices, methods, and technologies which are currently used successfully by a number of farmers in the regions studied. But if such systems are profitable, why haven't they been more widely adopted? First, "profitability" in this study was based on "cash" production expenses and did not include the costs of equipment or other durable assets. These costs, for conservation tillage equipment and equipment

for banded application of fertilizers and pesticides, may be quite significant for some farming operations. Also, the cost of new information, knowledge, and management skills needed to adopt our alternative systems may be high. Thus, even though our study shows modest increases in short run profits, these profits may or may not be sufficient to profitably pay for new investment in equipment and skills. We don't know and farmers probably don't know, but at least our positive short run profits are encouraging.

Second, the alternative systems in this study reflect shifts in crop acreages within regions. In general, these shifts result in more intensive use of more productive and less ecologically vulnerable soils and less intensive use of less productive, more ecologically fragile soils. These shifts may not be consistent with participation in the current commodity programs. The 1990 farm bill allows farmers increased flexibility in crop selection, and conservation program provisions provide some incentives for farmers to reduce soil loss on highly erodible soils. However, there are no economic incentives in government programs to encourage farmers to shift cropping patterns among farms to reduce ecological risks.

Publicly funded research and extension have obvious roles to encourage sustainable farming. Little research-based information is available on the ecological and economic effects of alternative farming systems. This lack of information may be a major deterrent to system adoption. Studies like ours are a step in the right direction, but more information is needed. We have shown that a number of alternative systems actually improve short run profits, and have very favorable environmental effects. But farmers still need to know if those net returns are great enough to justify the investment costs of new machinery and management skills used in our systems. Relatively little of this type of information has been forthcoming from publicly funded research and extension programs. ■

■ For more information

Ikerd, John E., Sandra J. Monson, and Donald L. Van Dyne. "Financial Incentives Needed to Encourage Adoption of Sustainable Agriculture." A Special Report of the Environmental Protection Agency and USDA. Sponsored Project, University of Missouri, Columbia, MO, April 1992.