AN ECONOMIST'S VIEW

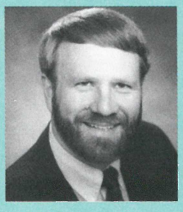
# *Is Precision Farming Good for Society?*

By Luther Tweeten

In our market economy, technology isn't adopted by firms unless benefits exceed costs. The articles in this issue show many advantages of precision farming for production agriculture, and the technology seems destined to pass the profitability test on large numbers of farms. But it is well to go beyond the farm to examine whether precision farming is good for society on national economic, social and environmental grounds.

## National Economic Impact

The nationwide economic impact of precision farming will depend on whether the technology mainly saves inputs and costs or mainly increases output. By combining soil test, seeding rate, yield, pesticide and fertilizer application data for hundreds of plots per farm, precision farming offers unprecedented "experimental" data. Such data more precisely dictate optimal economic input and crop



# *Dr. Paul E. Fixen Appointed PPI North American Program Coordinator*

Dr. Paul E. Fixen of Brookings, South Dakota has been named North American Program Coordinator and Director of Research in North American Programs for PPI. His new responsibilities begin immediately.

Announcement of the promotion came from Dr. David W. Dibb, President of PPI. "Paul Fixen has been a valuable asset to PPI with his work in the Northcentral region and we know he will be an even greater asset in his new role," Dr. Dibb emphasized.

A native of Minnesota, Dr. Fixen received his B.S. and M.S. degrees at South Dakota State University in Agricultural Education and Soil Fertility, respectively. He earned his Ph.D. degree at Colorado State University in 1978 with a specialization in soil fertility, plant nutrition and soil chemistry. Dr. Fixen joined the staff of PPI in 1989 as the Northcentral Regional Director and has served Minnesota, Iowa, North Dakota, South Dakota, Montana, Kansas and Nebraska.

Dr. Fixen and his family will continue to reside in Brookings. An office will be established there for coordination of the Institute's agronomic research and education programs in North American regions. BC

yield. As a result, producers achieve greater crop output per pound of fertilizer, seed and pesticide. If the enlarged output-input ratio comes from using less fertilizer and other inputs, it will cut farmers' costs and save natural resources. Such an outcome is anticipated by Clayton Ogg (*Choices*, First Quarter 1996, pp. 37-38) who cites various studies showing nitrogen (N) application could be cut 24 to 40 percent with improved crediting of farm-produced N alone. Eventually, cost-saving benefits will be bid into land prices.

If the greater output-input ratio does not save fertilizer and other inputs but instead comes as greater output, the result will be lower crop and food prices benefiting consumers. Benefits are relatively largest for low income families because they spend a high proportion of their income for food.

In reality, economic benefits of precision farming are likely to come from more efficient use of inputs and from additional farm output. Successful early adopters of precision farming gain the most because they produce before output prices fall. As more farmers adopt, output expands and commodity prices fall, passing benefits to consumers. Farmers who do not adopt as crop prices fall will lose from precision farming. Based on historic experience with technology, I conclude that more of the long-term economic benefits of precision farming are likely to accrue to consumers than to land owners.

Precision farming will be widely adopted because it is profitable on individual farms. However, in this era of skeptics questioning all manner of technology, scientists also must examine the broader economic, social and environmental consequences. On that basis, precision farming receives mostly high marks.

## Social Impact

The social impact of precision farming on family farms and rural farm communities depends heavily on what it does to (1) economies of size...costs of production on large versus small farms and (2) labor requirements in farming. Precision farming can be as effective on an acre on a small farm as on a large farm. But economies arise because precision farming requires lumpy inputs: investment in machinery, equipment, grid mapping, soil testing and the like. Computer controlled seed, fertilizer, and pesticide application equipment requires operating and maintenance skills. A custom operator or cooperative could serve several small farms, no one of which could afford a stand-alone precision farming system. But custom precision farming operators will have lower transaction and setup costs per acre when they can work on larger fields and with large farms. Thus some economies of size will accrue to bigger operations, and many small operators will not adopt precision farming because it is too costly or too much bother.

Nonetheless, I conclude that precision farming will have a small impact on farm structure compared to the tractor or combine. First, precision farming does not save labor so farms will not need to expand to better utilize each operator's labor. Second, many small farms will be able to share in economies of size through hiring of custom operators or working with cooperatives. Finally, numerous part-time small farm operators, although slow to adopt cost-saving precision farming, will not be driven out by losses from higher land costs or lower commodity prices caused by widespread adoption of precision farming by other operators. The reason is that

most part-time small farm operators are driven by lifestyle rather than profit – as evident from the fact that most lose money farming and support their farming avocation with off-farm income.

Turning now to impacts on rural communities, an important principle is that rural people shift their shopping to larger towns and cities as income rises. Some commercial farmers doing well from precision farming will shift their shopping to larger communities. But the rural community impact of precision farming will not be great because the impact on farm size, numbers and population will not be great.

## Environmental Impact

Principal environmental problems of agriculture include water, air and food quality, and natural resource depletion. Conventional blanket application of fertilizer means excessive application on some areas and inadequate application in other areas in the field. Application in excess of plant uptake causes surplus effluent to be carried away into groundwater or surface water. If, as some experts believe, producers on average will apply less fertilizer under precision farming nutrient runoff is likely to be less with precision farming. Reductions in fertilizer use are unlikely to be large, however, because conventional blanket rates often shortchange plots giving high fertilizer response. In such cases, fertilizer use will increase.

Pesticide savings will be more common than fertilizer savings, because producers often apply blanket pesticides to fields requiring only spot treatment. Some operators successively blanket fields with one pesticide to kill one weed or bug and another pesticide to kill another pest. Sensors and mapping could better tailor the type, volume and location of pesticide application to site-specific needs.

Precision farming is likely to raise productivity of land, decreasing land requirements to meet food and fiber demand. This frees land for species preservation, wildlife, trees, grazing and other uses consistent with soil conservation and a sound environment. Precision farming can help to achieve uniformly robust crop stands, providing a cover against erosion.

Site-specific control offered by precision farming could tailor chemical application to ameliorate environmental hot spots. According to a survey from the U.S. Environmental Protection Agency (EPA), 2 percent of rural wells contain nitrate levels and 0.6 percent of wells contain pesticide levels in excess of EPA safety standards. Precision agriculture may provide a means to reduce application on sites contributing to such water quality problems.

## Conclusions

Is precision farming good for society? Based on what we know now, precision farming will save natural resources and/or reduce food prices to benefit consumers. More precise chemical applications can reduce contamination of water and food. Compared to the tractor and its complements, precision farming will not displace many farms or farm families. Of course, much remains to be learned about precision farming, and scientists around the country are seeking more answers. BC

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