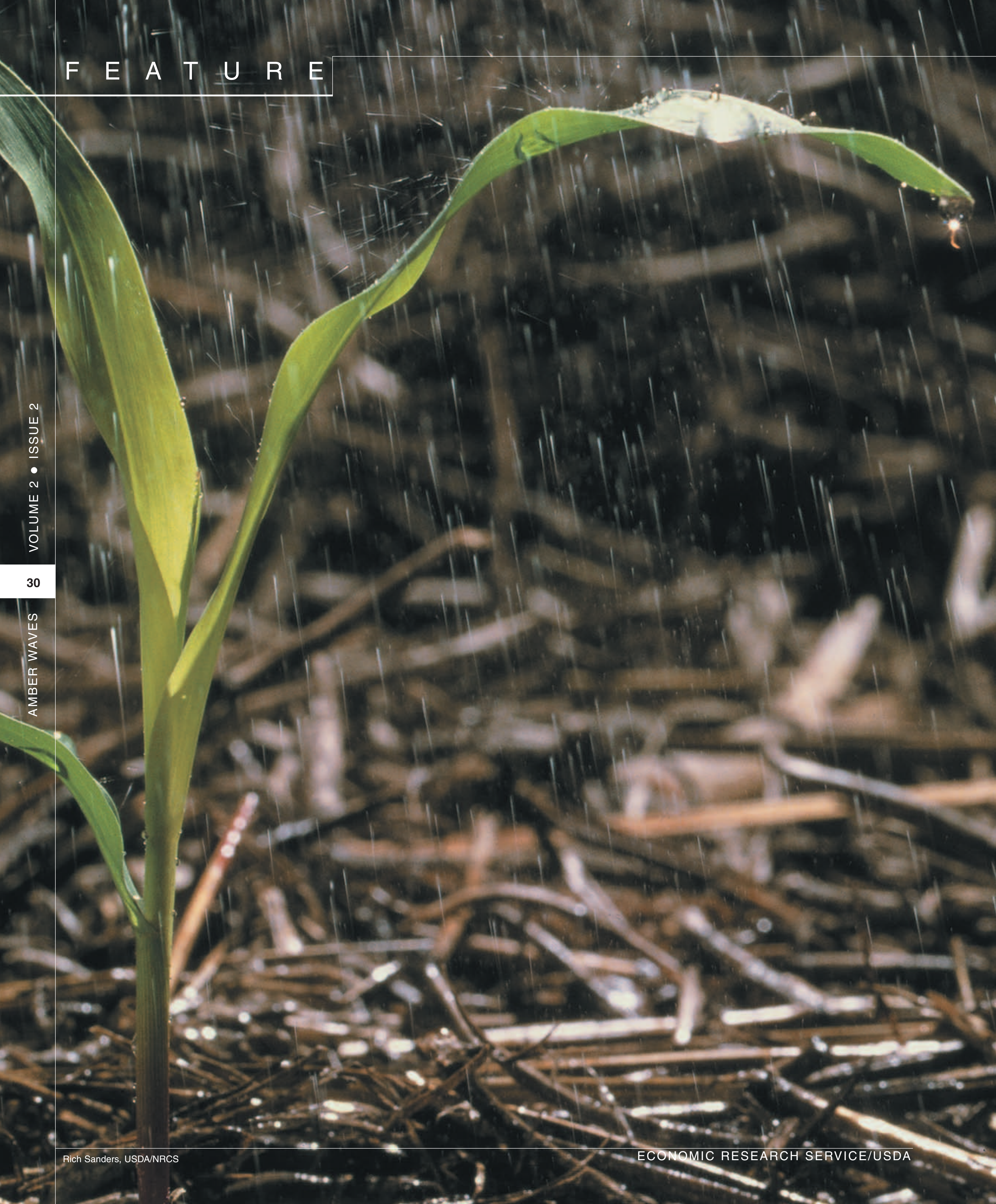

Rich Sanders, USDA/NRCS

Beyond Environmental Compliance

Stewardship as Good Business

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Agriculture is intrinsically linked to the environment: roughly half of all land in the lower 48 States is farmland, including cropland, land in the Conservation Reserve Program, pastureland, and rangeland. Both crop and animal production generate pollutants that enter the air as well as surface and ground waters. The Natural Resources Conservation Service estimates that the annual loss of soil from water erosion is approximately 1.07 billion tons per year. The U.S. Environmental Protection Agency (EPA) estimates, based upon areas sampled, that pollutants originating from this runoff contribute to an estimated 60 percent of impaired river areas, 30 percent of impaired lake areas, 15 percent of impaired estuarine areas, and 15 percent of impaired coastal shoreline.

Agricultural pollution is difficult to control. For one thing, agricultural pollutants are transmitted from widely dispersed sources, such as through runoff from many individual farms. For this reason, programs to address agricultural pollution have remained largely voluntary.

However, growing evidence suggests that good economic performance is compatible with good environmental performance. For example, firms in the Dow Jones Sustainability Index (companies that incorporate environmental and societal concerns into their long-term economic investment strategies) outperformed the 2,500 largest capitalized companies that make up the Dow Jones Global Index (with cumulative gains in nominal market value of 85 percent compared with 57 percent) between 1993 and 2003. The positive correlation between environmental and economic performance is especially apparent in industrial sectors with substantial exposure to environmental risk. This evidence challenges the traditional notion that complying with environmental regulations saps profitability and suggests that going "beyond compliance" can result in a competitive advantage. For example, firms with better environmental records may be more attractive to investors due to reduced compliance costs and a lower risk of future liabilities.

Recent ERS analysis suggests that agricultural producers can also benefit economically by voluntarily adopting environmentally beneficial practices. An efficient farm would naturally minimize unnecessary applications of pesticides and fertilizer, enhancing the bottom line as well as minimizing environmental impacts. But additional incentives may exist for farms to invest in environmental management. For example, those producers who accurately anticipate regulations or changes in consumer tastes for food grown with environmentally friendly technologies could gain a competitive advantage in the marketplace.

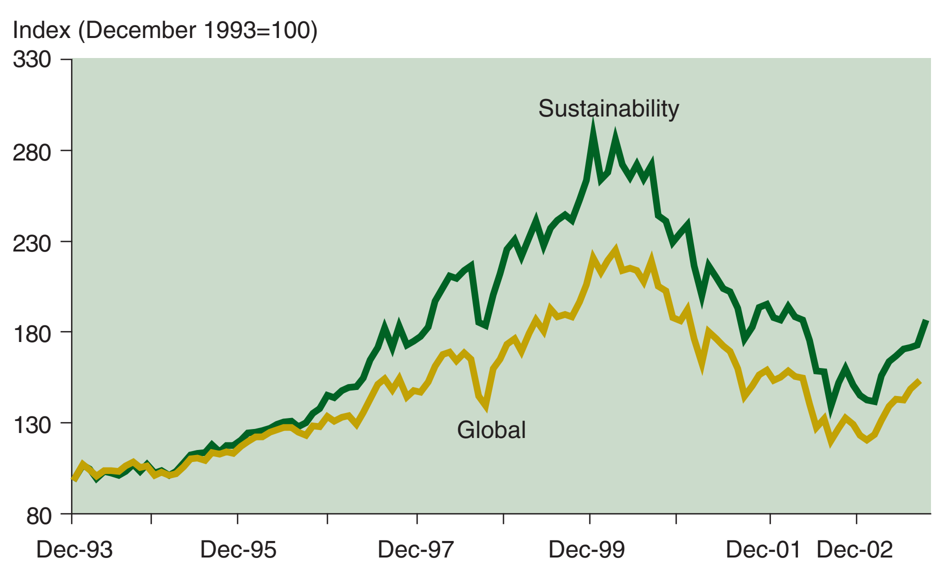
In other words, incentives facing agriculture are not that different from those facing other firms trying to plot a sustainable growth path. Specifically, ERS research found this to be true for U.S. corn producers who use crop residue management (CRM) to minimize damages from agricultural runoff. These producers enjoy a clear economic edge over non-CRM corn producers.

Nature of Agricultural Pollution

There are a few cases in which regulations affect agriculture directly. These include the Food Quality Protection Act of 1996, which enables the EPA to regulate pesticide use; the Endangered Species Act, which allows the Federal Government to restrict agricultural practices as part of species recovery plans; and the Federal Water Pollution Control Act of 1972 (including the Clean Water Act provisions), which requires landowners to obtain a permit before discharging pollutants into wetlands linked to navigable waters and restricts manure management practices on concentrated animal feeding operations.

Yet, these affect only a subset of agricultural producers. Agricultural rowcrop production is for the most part exempt from Federal environmental regulation. Many regulatory approaches used in other industries are not well suited for

Dow Jones Sustainability Index exceeds Dow Jones Global Index



Source: ERS tabulation of Dow Jones index data, www.djindexes.com

Barry Runk/Stan, Grant Heilman Photography

agriculture. Agricultural pollutants are transmitted through runoff, through groundwater leaching, or through the atmosphere, so it is difficult to identify individual sources of excessive agricultural pollutants in a stream or lake. Similarly, the amount of pollutants leaving a particular farm in a particular year may not be "excessive," but, over time and combined with runoff from other farms, these pollutants may contribute to a significant degradation of U.S. air, water, and soil.

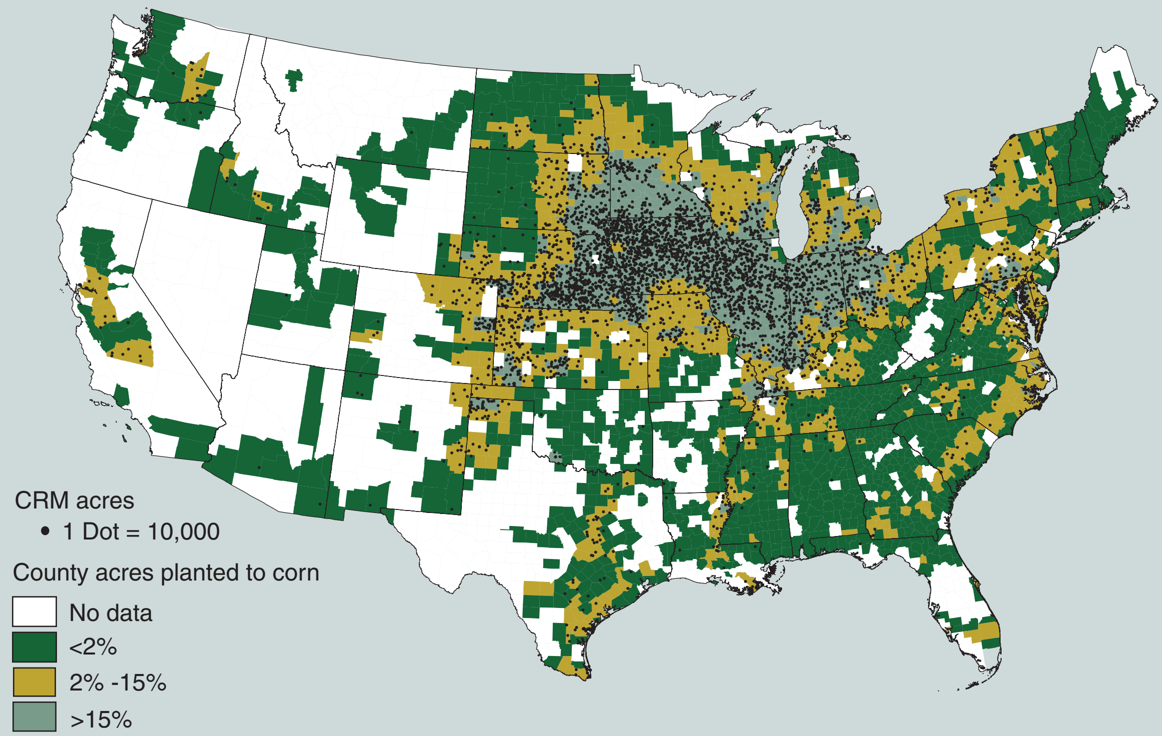
For the most part, U.S. agricultural policies have relied on voluntary programs—such as the Conservation Reserve Program and the Environmental Quality Incentives Program—to reduce or mitigate impacts of agricultural production on the environment. Highly erodible acreage is subject to conservation compliance requirements, which tie the receipt of most Federal farm payments to the adoption of an approved soil conservation system. Although 87 percent of all corn farmers participate in farm commodity and environmental programs, only 30 percent operate highly erodible lands. Yet, 60 percent of corn farmers use crop residue management, even though many do not need to in order to meet conservation compliance requirements. Links between economic performance on U.S. farms and their environmental management can be identified regardless of the regulatory environment.

U.S. Corn Sector

Corn production occupies a large share of land used in agriculture—76 million acres—and generated $19 billion in sales in 2001, over 75 percent of total U.S. grain production. In addition, corn production uses more than 40 percent of commercial fertilizer applied to crops. Rainfall and snowmelt can cause significant erosion on cornfields, which has been linked to declining soil quality, contamination of surface-water drinking supplies, and degraded aquatic habitats and recreational opportunities. Thus, the environmental stewardship of corn producers has a significant bearing on the overall environmental performance of U.S. agriculture.

Many management technologies are available to mitigate the environmental impacts of erosion and agricultural runoff from grain production. Such practices include alternative fertilization, tillage, crop rotation, and pesticide regimes. ERS research has focused on one such practice: conservation tillage or crop residue management (CRM). Conventional or "clean tillage" practices turn over soil in order to clear away the remains of the previous crop and prepare the seedbed prior to planting. With CRM, the producer plants the new crop directly into residue from the previous crop. This practice has been used for several decades because it reduces area planted or yields only

Corn acres and CRM acres



Source: ERS analysis of Conservation Technology Information Center data (CTIC, 2000).

slightly, yet significantly decreases soil loss and agricultural runoff relative to conventional tillage. Agricultural engineers estimate that soil erosion can be reduced by a third if 15 percent of after-harvest residue from corn is left on the field rather than turned under by tilling. Higher rates of CRM (i.e., leaving more crop residues on top of the soil) will reduce soil erosion even further, but at a diminishing rate.

On the other hand, adoption of a specific environmental management system, such as CRM, by itself does not necessarily result in overall improvements in environmental performance. Environmental performance is multifaceted and improvement in one area may come at the expense of another. For example, use of CRM sometimes requires higher pesticide use, in which case reduced soil erosion must be weighed against a greater potential for pesticide runoff.

Good Environmental Managers Are Also Efficient

Recent ERS research indicates a relationship between corn producers' economic efficiency and their investments in environmental management, with CRM adherents enjoying a clear economic edge over farmers using conventional tillage. The research was based on data from the 2001 Agricultural Resource Management Survey. The average total resource cost (which includes land and operator labor costs as well as material inputs) across all farms producing corn was $1.78 per dollar of output. The average was 31 cents lower for CRM corn farms versus non-CRM corn farms. The two groups vary in other ways as well. For example, CRM users generally operate larger acreages (273 acres versus 151 acres on non-CRM farms) and had higher yields per acre (131 versus 121 bushels.) These differences complicate efficiency comparisons.

A number of studies have noted that CRM tends to lower costs of labor, equipment, and fuel in corn production, and that these costs savings more than offset declines in crop yields or increased pesticide use. The gap in economic efficiency is observable not only at the mean, but among both lowest cost and highest cost farms as well. Of course, economic efficiency varies widely among both adopters

Agricultural Resource Management Survey (ARMS) — 2001 Corn Producers

Studies of publicly held businesses use stock prices to examine the correlation between economic and environmental performance. In lieu of stock prices, ERS uses the "total farm expense ratio," or total resource costs per dollar of corn output, as a measure of a farm's economic performance or efficiency. This measure of farm efficiency is endorsed by the Farm Financial Standards Council.

The data used in the analysis of crop residue management (CRM) and farm efficiency come from the 2001 Agricultural Resource Management Survey (ARMS) of U.S. corn farm operators. Our subsample of 1,544 corn producers, when expanded, represents 94 percent of all acres planted to corn for grain. (Full coverage is not possible because detailed corn data were drawn only from the 19 highest producing States). ARMS is USDA's primary source of information on the financial condition, production practices, resource use, and economic well being of America's farm households. Sponsored jointly by ERS and the National Agricultural Statistics Service (NASS), ARMS began in 1996 as a synthesis of the former USDA cropping practice, chemical use, and farm costs and returns surveys, which dated back to 1975. ARMS data are essential to USDA, congressional, administration, and industry decisionmakers when weighing alternative policies and programs that touch the farm sector or affect farm families. In short, ARMS is the mirror in which American farming views itself.

Detailed cost and return data allow for assessment of the efficiency of the corn operation within the overall farm. Corn returns are calculated as the market value of a farm's corn output, but do not include the value of government payments received. Costs are calculated as the sum of the value of all purchased inputs and the opportunity costs associated with land, capital, and labor. While both prices and quantities are available from the ARMS for many purchased inputs such as chemicals, fuel, and seeds, the cost of some resources must be estimated (such as the cost of replacing capital) based on the value of a farm's corn output relative to the value of all other outputs. The value of an operator's own labor is estimated on the basis of wages paid to farm operators working off-farm, and cropland is valued at the cash rental value for similar acreage in the area.

The analysis cited in the main text compared total resource costs of CRM users versus nonadopters. Total resource costs include operating costs (items used as inputs in corn production), the annualized cost of maintaining the machinery and other capital invested, and the cost for other resources such as land and the operator's labor. These costs averaged $1.78 per dollar of output. Average operating costs alone were $0.76 per dollar of output, and average operating and ownership costs (excluding land and operator labor) were $1.20 per dollar of output.

Approximately 60 percent of corn farms reported using CRM in 2001. Farm-level data show that the best way to predict whether any individual farm uses CRM is whether the farm has used it in the past. Farms that operated acreage particularly susceptible to erosion due to soil type, the lay of their fields, or the amount of rainfall received were also especially likely to adopt CRM. Farmers with highly erodible fields (about 20 percent of all corn farms operate such fields) are required under Conservation Compliance to apply an approved soil conservation system in order to maintain their eligibility for commodity program benefits. Interestingly, farms that are more efficient economically were also more likely to adopt CRM than less profitable farms, testament to the dual economic and environmental payoff of CRM adoption.

Corn production survey data (2001)

Characteristic	Units	All corn farms	CRM adopters	Nonadopters
Crop residue management user	Percent	60	100	0
Corn acres planted	Acres	224	273	151
Economic efficiency (cost per $ of output)	$ input/$ output	1.78	1.66	1.97
Operator age	Years	52	52	52
Limited-resource part-time	Percent	25	24	26
Received cost-share	Percent	3	4	1
Installed drainage system	Percent	38	41	33
Actual yield	Bushels per acre	127	131	121
Yield goal	Bushels per acre	140	143	135
Owned share of total corn acres	Percent	53	53	52
Sold corn in cash market	Percent	46	46	48
Precision agriculture user	Percent	16	20	10
Corn acreage is highly erodible	Percent	19	24	11
Used no-till in the past	Percent	24	33	10

Source: ARMS.

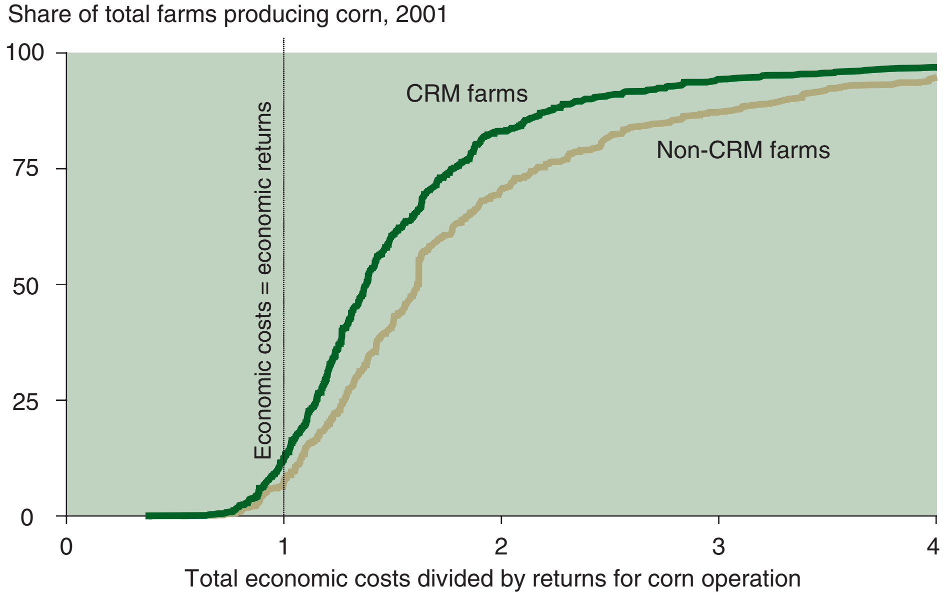

Tim McCabe, USDA/NRCS

and nonadopters of CRM, due to underlying differences in management and growing conditions. Along the full range of corn farms, those that employ CRM are more efficient than those that do not. In general, the gap in efficiency between the two groups grows as total costs per dollar of output increase. The benefits of CRM vary with soil and climate conditions, among other factors. About two-thirds of CRM corn farms are found in the Heartland, the most favorable climate for corn production; CRM is less likely to be found in the northernmost reaches of the Heartland.

Unobservable differences (such as management abilities) between the groups are important in determining the CRM premium, affecting both the decision to adopt CRM as well as the economic efficiency of the corn enterprise. As a result, even with the promise of increased economic efficiency, some farms may not switch from conventional tillage to residue management. Nonadopters may have lower overall management abilities, they may believe that conventional tillage simplifies their overall farm management, or off-farm work may preclude the deployment of management-intensive production systems. (CRM use requires an operator to pay closer attention to moisture and weather conditions during the planting season, especially during cool and damp weather.) The average economic efficiency of CRM users, after correcting for unobservable sample selection effects, was estimated to be $1.05 (in other words, on average $1.05 of costs were incurred in the production of a dollar's worth of corn). Compared with the overall average ($1.78), this represents a premium for CRM adoption of 73 cents, much higher than the 31-cent premium found from a simple comparison of adopter and nonadopter means.

CRM farms more efficient than non-CRM corn farms

Share of total farms producing corn, 2001



Source: ARMS.

Going Beyond the Bottom Line

This study builds on the growing literature that documents and explains the positive relationship between environmental performance and financial performance within and across many industrial sectors, especially those with considerable exposure to risky and undesirable environmental outcomes. In general, improved environmental performance over the past 15 years in these industries has been the result of environmental regulation; innovation has taken place in part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because of the need to comply with those regulations. However, a growing number of firms in all sectors have voluntarily introduced measures that go beyond compliance and have simultaneously improved economic performance. This trend suggests that industry can be a major force in improving environmental conditions, not just in the U.S. but worldwide.

Might not the same be true for agriculture? U.S. agriculture contributes more than $80 billion a year to GDP and has significant links to the environment. Although agriculture has not been heavily regulated with respect to its environmental impacts, it is coming under increasing scrutiny in this regard from some consumers. Affluent consumers are demanding more environmentally benign products, and large foodservice firms are responding. Agriculture too has the potential to improve environmental conditions through efforts that go beyond compliance with program requirements. The extent to which this potential is realized will depend on the market and policy incentives that shape farmers' decisions.

In the corn sector, many farmers are employing crop residue management practices voluntarily. Although, in part, CRM use is likely the result of the desire to maintain eligibility for farm program payments, CRM also brings demonstrable efficiency gains to farmers. So why have 40 percent of the corn farms sampled not adopted this technology?

For one, farmers may consider the benefits small relative to other ways that can improve profitability. Moreover, year-to-year fluctuations in costs and returns may obscure the returns to CRM. The technology may also be less suited to some regions and soil types. In particular, CRM adoption rates have been lower in colder and wetter climates. However, our results indicate that even in these areas corn producers adopting CRM on their corn acres were no less profitable than nonadopters. The data behind the ERS survey, although extensive, are unfortunately not comprehensive enough to control for everything affecting farm profitability, and some of these factors could help explain nonadoption. Farmers ultimately make "bottom-line" decisions in a context that includes not only market conditions but also regulations, voluntary incentive programs, and household goals and objectives. While our findings indicate that many farmers will choose to go beyond compliance with program requirements, whether farmers go "far enough" to meet broader environmental objectives remains an open question. W

This article is drawn from . . .

"Beyond Compliance: Sustainable Business Practices and the Bottom Line," by Dennis Aigner, Jeffrey Hopkins, and Robert Johannson, *American Journal of Agricultural Economics*, December 2003.

The ERS Briefing Room on Farm Income and Costs: ww.ers.usda.gov/briefing/farmincome/