Answering the Call:

Conservation Tillage and Increased Productivity to Reduce Erosion

By Luther Tweeten and Lynn Forster

THE OUTLOOK for the 21st century is rosy for many dimensions of agriculture. The great farm-to-urban exodus is behind us. More operators will enter farming than will leave in mid-career if the 21st century is like the 1980s. The family farm will be around for decades, although numbers will continue to fall modestly. The modern North American farm, on average, is performing well financially and will continue to do so into the 21st century. There is good evidence that major environmental problems associated with grain farms are under control. Small farms are successfully combining off-farm income to achieve total household income comparable to that of non-farm households. These impressive achievements are a triumph of initiative and hard work by farm families. They are also a tribute to the successful interaction of markets, education, science and industry.

Conservation Tillage

The progress in conservation tillage is apparent from the benchmark for corn. In the 1950s, virtually all corn ground was tilled with a moldboard plow, leaving only 2 percent residue on average. Erosion rates were high, but farmers needed to bury stalks to control the pesky corn borer. Now biological predators have been introduced by scientists to control the corn borer. That has helped free farmers to turn attention to erosion control.

According to USDA numbers, in the Corn Belt in 1991 only 12 percent of corn ground was prepared by conventional moldboard plow. The remaining 88 percent was prepared as follows:

- 49 percent with chisel plows, disc harrows and other tools, leaving 16 percent residue on average;
- 25 percent with mulch till, leaving 37 percent residue on average;
- 12 percent with no-till, leaving 64 percent residue on average;
- 2 percent with ridge-till, leaving 45 percent residue on average.

The already considerable use of no-till and other conservation tillage systems continues to expand. The 1993 National Crop Residue Management Survey conducted by the Conservation Technology Information Center puts conservation tillage systems such as no-till, mulch-till and ridge-till at nearly 35 percent of the total acres planted in the U.S. That is within 4 percent of the acres that are clean tilled. Conservation tillage could soon be considered the "conventional" practice. While some additional machinery may be required initially, conservation tillage systems lessen trips over the field, reduce labor requirements, consume less fuel, and generally result in lower machinery costs in the long run because a smaller machinery component is required. Experiences from crop farmers are that conservation tillage systems need not reduce, and may even enhance, net farm income while maintaining output. However, some conservation tillage systems are not profitable on poorly drained soils.

USDA data show that no-till requires 0.2 hours per acre to grow corn in the Corn Belt. Conventional moldboard tillage takes 0.8 hours per acre . . . four times as much. This means a farm family can handle four times as many acres with conservation tillage, which supports the trend toward fewer, larger family farms.

Machinery power requirements also are less with conservation tillage. The declining power and machinery requirement helps to explain why farm machinery depreciation has exceeded capital expenditures every year since 1980 without creating machinery shortages.

The Decreasing Rate of Soil Erosion

Soil erosion causes on-farm and downstream damage. Costs of both types of damage are being cut by an impressive reduction in erosion. Based on data reported in the 1938 Yearbook of Agriculture and the 1987 Conservation Needs Inventory, sheet and rill erosion fell from over 3.5 billion tons in 1938 to 1.6 billion tons in 1987. Led by the Conservation Reserve Program, soil erosion was 650 million tons less in 1991 than it was in 1986 and now averages about 3.5 tons/A. Two major reasons for the dramatic improvement in holding our soil resources on the farm are the expanding use of no-till and other conservation tillage systems and the continual increase in productivity per acre.

The societal benefits (of reducing erosion and sedimentation) to downstream water users are substantial. For example, research results indicate that a 10 percent reduction in soil erosion allows local communities using surface water to reduce their water treatment costs by 4 percent. Similarly, conservation tillage reduces the need for dredging of ditches, rivers, lakes and harbors while it enhances recreational water uses. A 16-year Ohio study completed in 1990, based on 6,000 observations from three river systems, found that the phosphorus (P) load to Lake Erie had been reduced by 39 percent, or 1,414 tons annually from the 3,650 tons deposited in 1975.

Environmental Benefits from Improved Productivity

As illustrated in **Figure 1**, total U.S. crop production in 1990 would have required 734 million acres if produced with 1950 technology as measured by yields. That's 393 million acres more than the 341 million acres that were harvested in 1991. The nation doesn't have 393 million additional acres of prime farmland. Had the expansion of crops onto fragile soils been necessary, soil erosion would have increased dramatically.

About 1 acre in each thousand of prime farmland is annually converted to urban and other non-farm uses . . . a 10 percent loss in a century. Also, estimates are that erosion, if continued at current rates of soil loss, will reduce productivity by another 3 percent in the next century. Current productivity gains of 1.5 percent per year would offset these losses in only nine years. ■

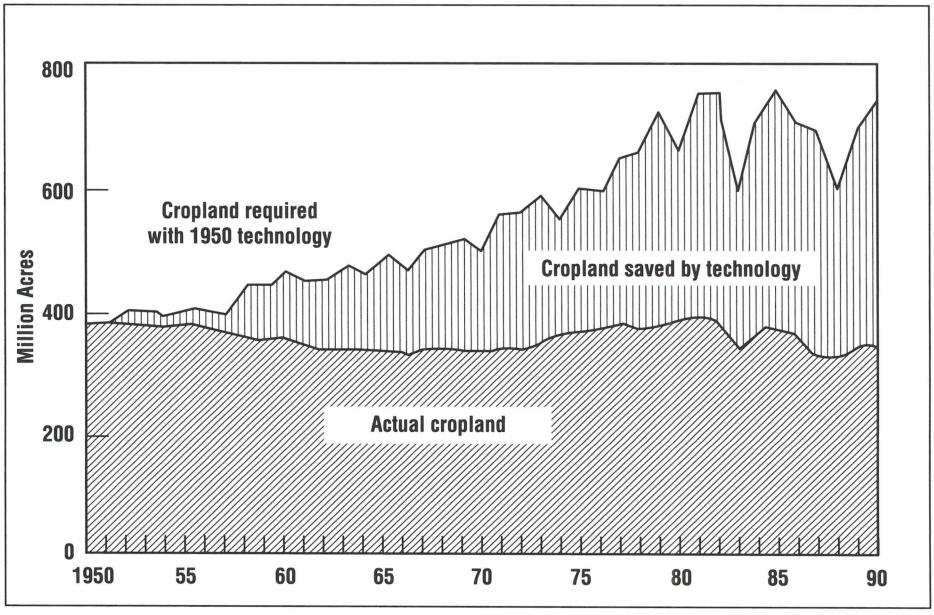

Figure 1. Acres required for crop production with 1950 technology, 1950-1990.