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Crop residue management: Adoption in the Un

by Carmen Sandretto

Crop residue management adoption increasing

Crop residue management (CRM) systems use fewer and/or less-intensive tillage operations, often combined with cover crops and other conservation practices, to provide sufficient residue cover to help protect soil from wind and water erosion. CRM practices include reduced tillage (15–30 percent residue) and conservation tillage (more than 30 percent residue) such as no-till, ridge-till, and mulch-till. CRM is generally a cost-effective method of erosion control (requiring fewer resources than intensive structural measures such as terraces) that can be implemented in a timely manner to meet conservation requirements and environmental goals (Sandretto, Bull, and Magleby).

Crop residue management practices, when appropriately applied, can provide the following benefits:

- **Soil improvement benefits.** CRM reduces soil erosion, helps build soil organic matter, improves soil tilth, increases soil moisture (through reduced water runoff, enhanced water infiltration, and suppressed evaporation), and minimizes soil compaction (Edwards). These benefits can protect soil productivity to maintain or increase future crop yields.
- **Water quality and environmental benefits.** CRM practices keep more nutrients and pesticides on the field where they can be used by crops and help to prevent their movement into surface or groundwater. Intensive tillage contributes to the conversion of soil carbon to carbon dioxide. Increased crop residue and reduced tillage enhance the level of naturally occurring carbon in the soil and contribute to lower carbon dioxide emissions. In addition, CRM reduces the number of trips across a field and therefore uses less horsepower, which in turn reduces fossil fuel emissions. Crop residues reduce wind erosion and the generation of dust-caused air pollution (CTIC).
- **Farm economic benefits.** Higher economic returns with CRM have been found to result primarily from some combination of increased or stable crop yields and an overall reduction in input costs (Clark, Johnson, and Brundson). Yield response varies with site-specific soil characteristics, local climate, cropping patterns, and level of management skills. Choice of tillage sys-

tem affects machinery, chemical, fuel, and labor costs. In general, decreasing the intensity of tillage or reducing the number of operations results in lower machinery, fuel, and labor costs. These cost savings may be offset somewhat by increases in chemical costs depending on the herbicides selected for weed control and the fertilizers required to attain optimal yields (Sandretto, Bull, and Magleby).

Conservation tillage (no-till, ridge-till, and mulch-till) was used on almost 110 million acres in 1997, over 37 percent of U.S. planted cropland area (figure 1). Most of the growth in conservation tillage since 1989 came from expanded no-till and a concurrent decline in conventional tillage. Use of no-till, which can leave as much as 70 percent of the soil surface covered with crop residues, increased to 46 million acres in 1997. At least some of the greater no-till use occurred as farmers implemented conservation compliance plans as required under the 1985 Food Security Act and subsequent farm legislation. Since 1989, no-till's share of conservation tillage acreage increased while the share with mulch-till and ridge-till remained fairly stable.

The Corn Belt and Northern Plains, with 51 percent of the nation's planted cropland, accounted for over three-fifths (68 million) of total conservation tillage acres (figure 2). These regions, plus the Lake States, Mountain Region, and Southern Plains, had substantial acreage with 15–30 percent residue cover which, with

improved crop residue management, has the potential to qualify for conservation tillage status (which requires 30 percent or more surface residue cover).

Conservation tillage was used mainly on corn, soybeans, small grains, and sorghum in 1997 (figure 3). Over 47 percent of the total acreage planted to corn and soybeans was conservation-tilled. Expanded use of no-till has been significant on all major crops since

Figure 1. National use of crop residue management (in millions of acres and by percentage of total CRM acres)

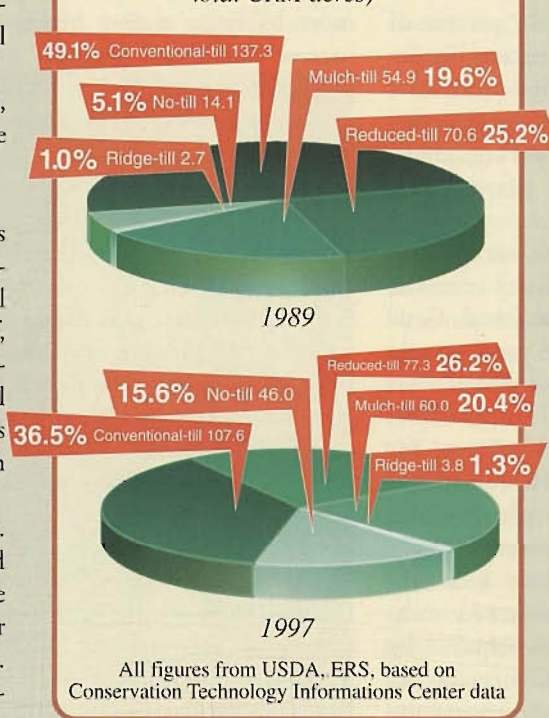
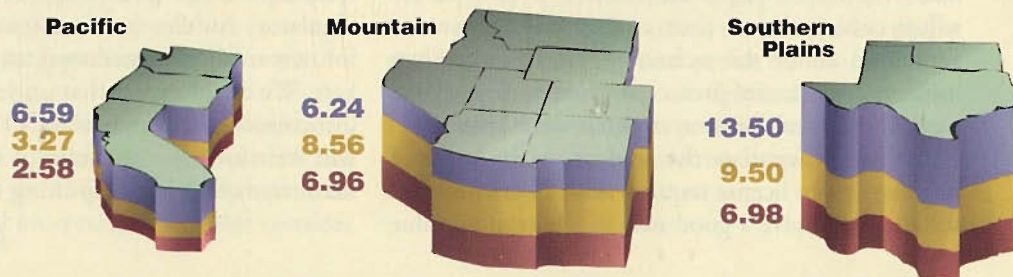


Figure 2. Crop residue levels on planted acreage by region, 1997 (million acres)



1989, but no-till use continues to be greater for corn and soybeans than for small grains or sorghum. Fields planted to row crops tend to be more susceptible to erosion because these crops provide less vegetative cover, especially earlier in the growing season. On double-cropped fields, conservation tillage was used on more than two-thirds of soybean acreage, about half of corn acreage, and about one-third of sorghum acreage. The use of no-till with double-cropping facilitates getting the second crop planted quickly and limits potential moisture losses from the germination zone in the seedbed, allowing greater flexibility in cropping sequence or rotation.

Outlook for CRM adoption

Given the conservation and potential economic advantages of conservation tillage systems, and the promotion that has occurred, why aren't the systems used on more than 37 percent of U.S. cropland? First, adoption is the final step in a complex process, and a quarter of cropland acres are in reduced tillage, which may be a transitional stage to conservation tillage. Second, conservation tillage systems have not yet demonstrated that they can consistently produce good economic results for some specific soil, climatic, or cropping situations. Third, the additional management skill requirements and potential economic risk involved in changing systems are further deterrents. Additional limiting factors include attitudes and perceptions against new practices, and, in some cases, institutional constraints. Agricultural researchers and farm equipment manufacturers have improved conservation tillage equipment designs over the last decade to produce a range of CRM equipment suitable for use under a variety of field conditions. The potential cost-savings to producers from CRM through

reduced fuel, labor, machinery, and time requirements, while usually maintaining or increasing crop yields, make greater adoption likely (Sandretto, Bull, and Magleby).

For more information

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Figure 3. Conservation tillage use by major crop, 1989 and 1997 (percentage of acres planted)

