Resources & Environment

Conservation Tillage Firmly Planted in U.S. Agriculture

Farmers across the nation used conservation tillage (no-till, ridge-till, and mulch-till) on more than 109 million acres of farmland in 2000, over 36 percent of U.S. planted cropland area and up from 26 percent in 1990. Expansion of no-till accounts for most of the growth in conservation tillage in the last decade. In 2000, no-till was used on over 52 million acres of 297 million cropland acres planted — 17.5 percent—a threefold increase in no-till acreage since 1990.

Some of the rise in no-till use since 1990 occurred as farmers implemented conservation compliance plans required to remain eligible for farm program benefits under the 1985 Food Security Act and subsequent farm legislation. As use of conservation tillage increased, acreage in no-till rose while use of ridge-till and mulch-till remained fairly stable through 1998.

With implementation of new and improved data collection procedures in 2000, acreage identified as mulch-till dropped substantially from 1998 (data were not collected in 1999). Whereas some of the expansion in no-till usage since 1998 likely came from farmers switching from mulch-till, the decline in reduced-tillage acreage is most likely a result of the new procedures that determined residue levels were below the 15-percent threshold, moving that acreage to the conventional/intensive-till category.

Conservation tillage is one component of conservation through crop residue management (CRM). CRM includes preserving residue from the previous crop and reducing the number of times equipment passes over a field. A cover of crop residue helps cut soil losses from wind and water erosion. Crop residue management practices, when applied appropriately, can improve soil quality, decrease emissions that contribute to global warming, enhance water and air quality, and provide higher economic returns to farmers.

CRM helps *improve soil quality* by reducing soil erosion, building soil organic matter, improving soil tilth (to aid root penetration), increasing soil moisture (through reduced water runoff, enhanced water infiltration, and suppressed evaporation), and minimizing soil compaction. These benefits can protect soil productivity to maintain or increase future crop yields.

Elimination or reduction of tillage activity through CRM slows the breakdown of soil organic matter into carbon dioxide, *reducing emissions* of one of the gases associated with global warming. Recent research indicates that continuous no-till has the potential to increase organic matter in the top 2 inches of soil by about 0.1 percent each year, on average, and to sequester up to 10 tons of atmospheric carbon per acre over 25-30 years. In addition, CRM requires fewer trips across the field and generally less horsepower for field operations, which in turn reduces fossil fuel emissions.

A major *water quality benefit* of CRM is to help keep nutrients and pesticides on the field where they can be used by crops, and reduce their movement into surface water (nearby lakes and streams) or groundwater. Crop residues left on the soil surface *improve air quality* by reducing wind erosion and the generation of dust that contributes to air pollution.

Economic benefits to farmers from CRM derive primarily from higher returns due to an overall reduction in input costs of $20-$40 per acre. Yield response to CRM is usually positive or neutral. Crop yields vary with site-specific soil characteristics, local climate, cropping patterns, and level of management skills. In general, decreasing the intensity of tillage and/or reducing the number of field operations results in lower machinery, fuel, and labor costs, as well as time requirements for the farm operator.

Cost savings of conservation or reduced tillage may be offset somewhat by increases in chemical costs for controlling weeds and insects and in starter fertilizer costs to attain optimal yields. But reducing labor and time requirements through use of conservation or reduced tillage may also cut the “opportunity costs” of time spent on farming—e.g., freeing time to add income by farming more acres, expanding other farm operations, or working at an off-farm job.

Expanded use of no-till, which can leave as much as 80 percent of the soil surface covered with crop residues, has been significant on all major crops over the last decade, but no-till continues to be more widely used for row crops such as corn and soybeans than for small grains or sorghum. Fields planted to row crops tend

Crop Residue Management for Systematic Conservation

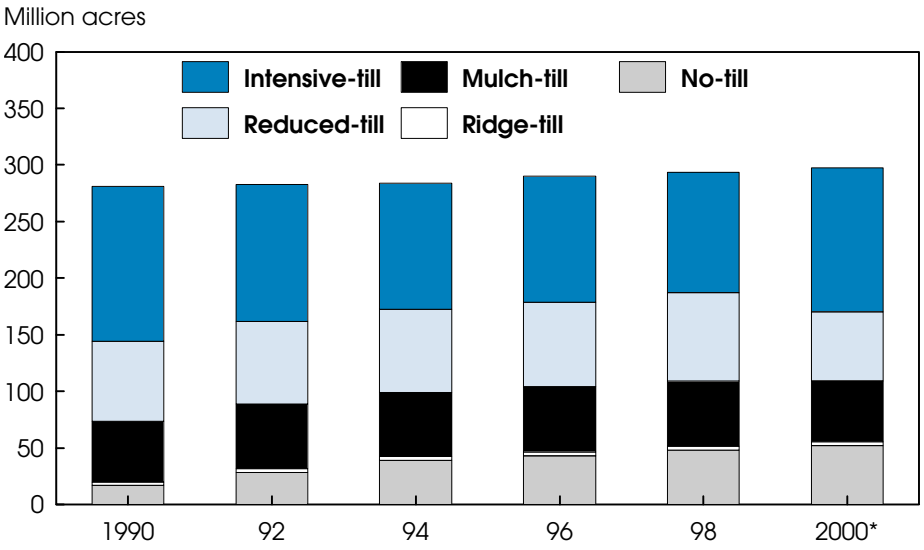
Crop residue management (CRM) systems use fewer and/or less intensive tillage operations, including the elimination of plowing (inversion of the surface layer of soil). CRM systems are often combined with cover crops and other conservation practices to provide sufficient residue cover to protect soil from wind and water erosion. Tillage systems associated with CRM practices are:

- ***reduced tillage*** (15-30 percent residue), and
- ***conservation tillage*** (more than 30 percent residue), which includes *mulch-till* (soil is disturbed prior to planting), *ridge-till* (residue left on the surface between tilled ridges), and *no-till* (no tillage performed).

CRM is generally a cost-effective method of erosion control that requires fewer resources than intensive structural measures such as terraces, and can be implemented in a timely manner to meet conservation requirements and environmental goals.

Briefs

Use of No-Till Planting Showed Gains Throughout the 1990's



* Change in data collection procedures in 2000 accounts for increased share of intensive-till.

Economic Research Service, USDA

to be more susceptible to erosion because these crops provide less vegetative cover, especially early in the growing season.

Use of no-till is especially important for double-cropping because it facilitates planting the second crop quickly and limits its potential moisture losses in the seedbed, allowing greater flexibility in cropping sequence or rotation. No-till was used on more than 60 percent of acreage double-cropped to soybeans in 2000.

Most of the increase in no-till acreage since 1998 occurred in Illinois, Indiana, Iowa, and Ohio, where no-till soybean acreage was up by a total of 1.8 million acres. Ohio and Indiana used no-till on 60 percent of planted soybean acreage. Illinois, Indiana, and Iowa increased no-till corn acres by 1.4 million in the past 2 years.

In 2000, the Midwest region planted almost 27 million cropland acres using no-till—25 percent of total cropland acres. Kansas increased no-till acres by almost 830,000 acres between 1998 and 2000, but still trailed Nebraska in overall use of no-till among Northern Plains states. Tennessee and Kentucky both planted 55 percent of their corn acres with no-till in 2000, and Tennessee used no-till in planting 45 percent of its cotton acres. Improvements in weed control options, including genetically engineered (biotech) cotton, contributed to the no-till increase in the Southeast region.

Given the conservation and potential economic advantages of conservation tillage systems and efforts to promote conservation, why aren't conservation systems used more widely on U.S. cropland? First, adoption is the final step in a complex process, so the one-fifth of cropland acres already in reduced tillage may be in a transitional stage to conservation tillage. Second, for some soil, climatic, or cropping situations, use of conservation tillage systems has not yet been demonstrated to consistently produce the healthy plant population required for favorable economic results. Third, the additional management skill requirements and potential economic risk involved in changing systems are further deterrents to adoption of conservation tillage practices. Additional limiting factors include attitudes and perceptions against new practices and, in some cases, institutional constraints such as lenders or landlords that are reluctant to encourage adoption of new technology because it has the potential to increase variability of yields and net returns.

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 outlook for CRM adoption for the 2001 growing season will likely be positively influenced by a combination of low commodity prices and higher input costs, especially for diesel fuel, that encourage farmers to seek potential cost-savings from CRM without sacrificing yield. AO

Carmen Sandretto (202) 694-5622
carmens@ers.usda.gov

USDA's Crop Residue Management Survey

The Crop Residue Management Survey, conducted by USDA's Natural Resources Conservation Service (NRCS), collects information on crops planted, residue level for various tillage systems, and other field data from each agricultural county in the U.S. To derive 2000 tillage/residue estimates, NRCS and other conservation partners adopted new data collection procedures to provide more accurate information and to include more crops in the assessment of tillage system usage by crop. Findings of the 2000 Crop Residue Management Survey are reported by the Conservation Technology Information Center (CTIC) in West Lafayette, Indiana (see www.ctic.purdue.edu).