



Tillage Intensity and Conservation Cropping in the United States

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What Is the Issue?

Tillage is used to control weeds, incorporate crop residue, and prepare land for planting, but minimizing soil disturbance and maintaining soil cover are critical to improving soil health. Crop choice is typically driven by crop prices, soils, and climate, but crop rotations can also break weed and pest cycles, improve crop yields, and reduce soil erosion. USDA conservation programs are increasingly focused on reducing tillage and promoting cropping practices (like cover crops and crop rotations) that could improve soil health. Progress toward improving soil health and soil erosion control can be monitored, at least in part, by tracking trends in the use of practices that reduce or minimize soil disturbance and increase soil cover.

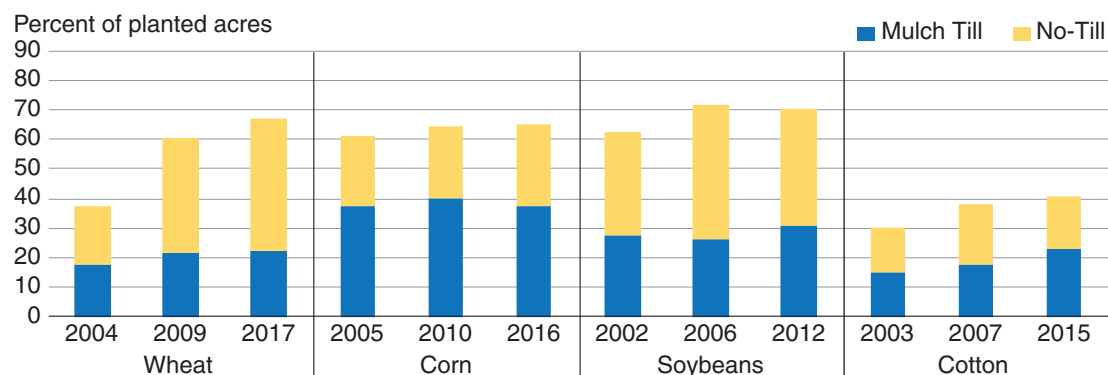
What Did the Study Find?

Conservation tillage practices—including no-till, strip-till, and mulch-till—vary widely across crops and regions:

- Conservation tillage was used on roughly 70 percent of soybean (2012), 65 percent of corn (2016), 67 percent of wheat (2017), and 40 percent of cotton (2015) acres.
- The share of total conservation tillage that is no-till also varied from 67 percent (45 percent of total acreage) in wheat (2017) and 56 percent (40 percent of total acreage) in soybeans (2012) to 44 percent (18 percent of total acreage) in cotton (2015) and 42 percent (27 percent of total acreage) in corn (2016).
- Despite initial increases in no-till wheat (2004–09) and soybeans (2002–06), more recent data show less rapid gains for wheat (2009–17) and an apparent decline in no-till adoption on soybeans (2006–12).
- For individual crops, the rate of no-till varies by region. The likelihood of no-till corn, for example, is relatively high in the Northern Great Plains (50 percent of conservation tillage in corn, 34 percent of total corn acreage), Prairie Gateway (69 percent of conservation tillage, 49 percent of corn), and the South (the Eastern Uplands, Southern Seaboard, and Mississippi Portal combined) (67 percent of conservation tillage, 53 percent of corn).
- Almost 50 percent of corn, soybean, wheat, and cotton acreage was in no-till or strip-till at some time over a 4-year period (including the survey and 3 previous years), but only about 20 percent of these acres were in no-till or strip-till all 4 years.

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Trends in conservation tillage adoption



Note: Mulch till is land with tillage and a Soil Tillage Intensity Rating less than 80.

Source: USDA Economic Research Service, based on USDA Agricultural Resource Management Survey (ARMS) data for 2002-2017.

Residue and cover practices can also affect soil health by determining—in conjunction with tillage practices—the extent to which soil remains covered throughout the year. Adoption of these practices varies across crops and, to some extent, across tillage practices:

- Conservation crop rotations (rotations that include high-residue crops that require relatively little nitrogen) are more frequently identified on land in the survey of corn producers (2016) than in the soybean, wheat, or cotton surveys.
- Double cropping and cover crops—which increase crop residue—were used on 12 percent or less of all surveyed fields.
- Fallowing—which typically reduces crop residue—was used on 13 percent of wheat acreage and less than 5 percent of other crops.
- Corn stover (residue) removal through grazing or harvest—which reduces residue—occurred on about 16 percent of corn acres.
- Evidence suggests that farms using no-till or strip-till practices, at least in some years, are more likely to also adopt residue- and cover-increasing practices.

How Was the Study Conducted?

All data are from the Agricultural Resource Management Survey (ARMS), a national-level survey of farming operations conducted by USDA's National Agricultural Statistics Service (NASS) and ERS. Data are based on the three most recent field-level, crop-specific production practice surveys of the four most widely grown U.S. crops: corn (2005, 2010, and 2016); soybeans (2002, 2006, and 2012); cotton (2003, 2007, and 2015); and wheat (2004, 2009, and 2017). Data on tillage operations, supplied by survey respondents, are used to identify fields in no-till (absence of tillage operations) and mulch till (tillage operations with a Soil Tillage Intensity Rating (STIR) less than 80). Using the STIR—rather than methods based on soil residue cover (previously used by ERS to estimate conservation tillage adoption)—focuses our estimates on soil disturbance, rather than a combination of soil disturbance and residue from the previous crop. To capture the interaction of tillage and practices that increase soil cover, we estimate the extent to which conservation crop rotations, cover crops, double cropping, and fallow are used in conjunction with no-till. ARMS data provide a 4-year history of crops grown (including cover crops) and an indicator of no-till or strip-till for each crop in the history, as identified by the survey respondent.