

**CONSERVATION TILLAGE EFFECTS ON INFILTRATION  
AND IRRIGATION ADVANCE TIMES IN ARIZONA COTTON**  
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**Abstract**

Cotton-barley double crop conservation tillage field experiments were initiated at sites in Marana, Coolidge and Goodyear, Arizona in 2001. Soil and water management assessments were made at the three sites to assess the impact of conservation tillage on surface irrigation performance during the 2002 cotton season. An additional site was added in the winter of 2002 at the University of Arizona Maricopa Agricultural Center. Data regarding soil texture, water infiltration, and rate of water advance were collected during the 2003 cotton season.

In general, conservation tillage non-wheel furrows infiltrated water faster than conventional tillage furrows at all sites. At the Coolidge site (300 m field length), which had the highest sand content, the conservation tillage plots had higher infiltration rates than the conventional tillage plots. At the Marana site (200 m field length), with the highest clay content, initial infiltration rates were higher for the conservation tillage plots than the conventional tillage plots, but the rates were similar at the end of a 4-hour measurement period in 2002. In 2003 at Marana, the conventional tillage plots infiltrated more water than the conservation tillage plots. Compared to the 2002 rate, infiltration in the conservation tillage plots increased only slightly. There was a much greater increase in rate in the conventional tillage plots, about 36 mm in the 4-hour measurement period. Non-wheel furrows account for 66-75% of cotton fields in terms of area and cotton water use, regardless of tillage. At all sites where furrow irrigation was applied, the advance times of non-wheel furrows were greater than for wheel furrows. This was partly due to the presence and amount of crop residue in the furrows of the conservation tillage plots. At the Marana site the greatest advance times were observed in the conventional tillage non-wheel furrow, followed by the conservation tillage non-wheel furrow, conservation tillage wheel furrow and the conventional tillage wheel furrow, which had the fastest advance time. At the Goodyear site (333 m field length), which had the highest silt content, the conservation tillage plots infiltrated more than the conventional tillage plots in 2002. This resulted from a much slower advance time for the conservation tillage plots than the conventional tillage plots. In 2003, due to tillage by the Goodyear grower, treatment effects could not be compared. At Maricopa (200 m field length) the soil was dominated by clay in the upper 8 cm but it became sandier as the depth increased. At this site, the conservation tillage plots infiltrated almost 60 mm more water than the conventional tillage plots in a 4-hour period. Similar differences were also observed in the advance times, which showed that water reached the end of the conventional tillage wheel furrow (200 m) in 2 hour while it took 5 hour to cover the same distance in the conservation tillage wheel furrow.

Irrigation water amounts applied to each treatment were equal for all the sites except the Coolidge site, where the long field length (300 m) combined with the sandy soil made it difficult to adequately irrigate the conservation tillage plots. In 2002, 53 cm more water was applied to the conservation tillage plots than the conventional tillage plots at Coolidge, whereas only 32 cm of extra water was applied to the conservation tillage plots in 2003. The conservation tillage treatment produced more lint than the conventional tillage treatment in 2002 at Coolidge probably due to the greater amount of irrigation water applied. The actual amount of water applied to the conventional tillage plots at Coolidge (141 cm) may not have been enough and the plants may have been stressed, leading to a yield loss. In 2003, the conventional tillage plots produced more lint than the conservation tillage plots at Coolidge and Maricopa due to layby herbicide injury in the conservation tillage plots. There were no yield differences at Marana between the conservation tillage and conventional tillage treatments planted on the same day. The increase in infiltration in conservation tillage should be beneficial in most agronomic scenarios. However, in large-scale surface irrigation systems, the slower water advance down the furrow may actually reduce the efficiency of the irrigation system and may reduce yields.