Conservation agriculture, which is based on continuous minimum mechanical disturbance of soil, permanent residue soil cover, and diversification of crop species grown in sequences and/or associations, is becoming increasingly popular worldwide. This agricultural management system involves soil management practices (i.e., minimum tillage, mulch tillage, and no tillage) that have the potential to generate both economic and environmental benefits (mitigating soil erosion, reducing energy use and C emissions, enhancing wildlife habitat, increasing timeliness of planting, and saving labor and time). The improvements generated by the adoption of conservation tillage techniques often have positive effects on crop growth and yield, but contradictory yield results (as well as considerable year-to-year variation in yield) have been reported in comparisons of conservation tillage and conventional tillage (CT). Moreover, relatively few long-term experiments have been conducted in Mediterranean areas, particularly under semiarid conditions, and even fewer have investigated the combined effects of tillage system and crop sequence.

In the September–October 2013 issue of Agronomy Journal, a team of researchers from the University of Palermo (Italy) reports on the results of a study of a long-term experiment (18 years) investigating the effects of the continuous use of conservation tillage techniques—no tillage (NT) and reduced tillage (RT) compared with CT—on the performance of crops in cereal–legume rotation systems typical of the semiarid Mediterranean environment (faba bean–wheat and berseem clover–wheat compared with continuous wheat). Specific objectives of the study were to evaluate the effects of climatic variability on responses to the treatments and to determine whether cumulative effects on durum wheat grain yield and quality occur as a result of the continuous application of the treatments.

The authors proposed a new approach to estimate the cumulative effects of treatments (tillage and crop sequence) over time and the effects of treatments with varying climatic conditions. They constructed a statistical model that, by including a crop water stress index and time as covariates, allowed them to separate the fixed effects from the random nuisance effects that often make it difficult to test and estimate time × treatment interactions.

The findings of this study showed that NT guaranteed superior wheat grain yield compared with CT when water stress during the crop cycle was high. In contrast, when water availability was adequate, wheat produced more with CT. Hence, the study suggests that NT is a valuable tillage option in the rainfed cereal-based systems of Mediterranean environments characterized by a low and erratic rainfall pattern during the growing season. However, the statistical model adopted permitted to show a cumulative detrimental effect of NT over time for continuous wheat, probably a consequence of the progressive increase in the incidence of certain residue-borne pathogens of wheat. On average, wheat grain protein content varied significantly by tillage system (CT > RT > NT). This suggests that fertilizer N requirements increase with NT compared with CT because of changes in N cycling that lead to a reduction in plant-soil N.
