ABSTRACT

Previous studies have demonstrated benefits of individual cover crop species, but the value of diverse cover crop mixtures has received less attention. The objectives of this research were to determine the effects of spring-sown cover crop mixture diversity and mechanical cover crop termination method on cover crop and/or cash crop productivity, soil moisture and N, and profitability in an organic cropping system. An experiment was conducted between 2009 and 2011 near Mead, NE, where mixtures of two (2CC), four (4CC), six (6CC), and eight (8CC) cover crop species, or a summer annual weed mixture were included in a sunflower–soybean–corn rotation. Cover crops were terminated in late May using a field disk or sweep plow undercutter. Undercutting cover crops increased soil NO$_3$–N (0–20 cm) by 1.0 and 1.8 mg NO$_3$–N kg$^{-1}$ relative to disk incorporation in 2010 and 2011, respectively. Cover crop mixtures often reduced soil moisture (0–8 cm) before main crop planting, though cover crop termination with the undercutter increased soil moisture content by as much as 0.024 cm$^3$ cm$^{-3}$ compared to termination with the disk during early main crop growth. Crop yields were not influenced by cover crop mixture, but termination with the undercutter increased corn and soybean yield by as much as 1.40 and 0.88 Mg ha$^{-1}$, respectively. Despite differences in productivity between spring cover crop mixtures and weed communities, crop yield was not different among these treatments; thus, profitability of the weed mixture–undercutter treatment combination was greatest due to reduced input costs.

Despite the demonstrated benefits, on-farm adoption remains limited due to farmer concerns about the potential cost and management implications of cover crop use. One of the top concerns among farmers is the amount of soil water used by cover crops, potentially reducing available soil moisture for the cash crop. During seasons with average and above-average rainfall conditions, differences in available soil moisture among cover crop species and mixtures are often undetectable. However, when cover crop productivity is high and precipitation becomes limiting, species can differ greatly in their effects on soil moisture (Unger and Vigil, 1998; Daniel et al., 1999). While transpiration demands will undoubtedly vary among species, the method of cover crop termination and residue management may have a greater impact on available soil moisture during main crop growth. Daniel et al. (1999) found that volumetric soil moisture (%) was increased by as much as 2.4% to a depth of 61 cm when cover crops were terminated with herbicides in a no-till system compared to conventional termination with a field disk. Soil water savings associated with no-till practices have been well documented (Blevins et al., 1983; De Vita et al., 2007), but the additional benefits of cover crop residue in a conservation tillage system are not as clear. Liebl et al. (1992) found that transpiration reduced available soil moisture during dry periods, but following no-till termination cover crop residue conserved soil moisture relative to a no-till system without cover crops. Given that the driest portion of the growing season in the western Corn Belt typically occurs after cover crop growth (i.e., June–August), potential soil moisture savings offered by the residue (post-termination) throughout the growing season may negate moisture deficits observed during cover crop growth.

Organic Agriculture & Agroecology