ABSTRACT

Continuous no-till (NT) cropping systems are appropriate on thousands of hectares of highly erodible land, but concern among producers about potential yield reductions in corn has limited its adoption in the northern Corn Belt, especially on poorly-drained soils. Short term NT or rotational tillage systems are preferred in the northern Corn Belt because of time, labor, and fuel savings, conservation compliance, and less risk of a yield penalty compared with long-term or continuous NT. The objectives of this 4-yr study were to quantify the effects of rotational full-width tillage compared with long-term NT and zone tillage (ZT) systems with and without in-season row cultivation (RC) on corn production and in-row soil penetrometer resistance (PR). The study was conducted at the University of Minnesota Southern Research and Outreach Center, Waseca, Minnesota on a tile drained Nicollet-Webster clay loam soil complex (fine-loamy, mixed, superactive, mesic Aquic Hapludolls and fine-loamy, mixed, superactive, mesic Typic Endoaquolls, respectively). Eighteen treatments were arranged in a randomized, complete–block design with four replications. Sixteen of the 18 treatments were comprised from a factorial arrangement of three factors: (i) tillage treatment for corn following soybean [NT, 38-cm deep ZT, 20-cm deep fall strip tillage (ST), and spring field cultivate (SFC)], (ii) residual effects of tillage treatment for soybean following corn [NT or chisel plow (CP) plus SFC], and (iii) in-season RC for corn (with or without). Penetrometer resistance was measured in 15-mm depth increments directly in the row area with a recording penetrometer. Penetrometer resistance was reduced to a 30- and 20-cm depth with ZT and ST, respectively and the effects were evident from April through June. Corn production parameters (residue cover, plant height, emerged stand, corn grain yield, and grain moisture) were affected by the main effects of tillage for corn and tillage for the previous year's soybean, but generally were not affected by RC. After planting, residue cover averaged 67, 41, 56, and 41% with NT, ZT, ST, and SFC tillage for corn, respectively and was 9 to 10 percentage points greater when NT was used for the previous year's soybean crop compared with CP+SFC tillage. Corn grain yields averaged 9.6, 10.1, 10.1, and 9.7 Mg ha^{-1} with NT, ZT, ST, and SFC tillage for corn, respectively. No tillage for the previous year's soybean crop reduced yields in two of four years compared with CP+SFC tillage (0.4 Mg ha^{-1} reduction with NT for soybean when averaged across years). Moreover, when full-width tillage (CP+SFC) for soybean was rotated with ZT and ST for corn, these systems produced greater yields than annual full-width tillage systems (CP+SFC). Thus, rotational tillage practices

can be effective in reducing the risk of a yield loss and managing residue accumulation on these relatively flat soils.

Abbreviations: CP=chisel plow, CP+SFC=chisel plow plus spring field cultivate, d=day, GWC=gravimetric water content, NT=no-till, PR=penetrometer resistance, RC=row cultivation, SFC=spring field cultivate, ST=strip tillage, TC=tillage for corn, TS=tillage for soybean, yr=year, and ZT=zone tillage.