

COTTON ROOT AND SHOOT GROWTH UNDER DIFFERENT TILLAGE SYSTEMS

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activity or at least slower development. This could also influence above ground growth. Regardless of cause, tillage systems that had greater pre-bloom CGR's produced the best economic yields. Because of this, the NT system has the greatest potential as a successful conservation tillage system on this soil type.

Abstract

Improved soil conservation through adoption of reduced tillage programs is the major component in many compliance programs. Economic yield under conservation tillage systems may differ for various reasons. An analysis of growth above and below the soil would aid in identifying limitations as well as advantages of different conservation tillage systems. We determined crop growth rate (CGR), leaf area index (LAI), and net assimilation rate (NAR) of the shoot and determined root length density (RLD) or soil volumetric moisture content (VMC) to a depth of 0.9 m for three tillage systems on a Gigger silt loam soil. These were conventional tillage (CT), Ridge Tillage (RT) and No-till (NT). Four cover crops were factorially arranged with tillage system, but did not usually make a difference in terms of statistical interaction with tillage system. In 1991 the NT system produced a pre-bloom CGR of 11 g/m²/day compared to 7 and 7.5 g/m²/day for CT and RT, respectively. Accordingly NT also had a higher LAI. Net assimilation rate was not affected by tillage system in any year. Conversely, RLD across all sample depths and sampling dates in 1991 was greatest for CT and significantly lower for NT. In contrast, the 1992 growing season was much drier than 1991 resulting in lower CGR values. The NT system still had the highest pre-bloom CGR (7 g/m²/day). Root development in this drier year averaged greater than that in 1991 with NT having a pre-bloom RLD at 0 - 0.15 m of 1.51 cm/cm³ which was significantly higher than CT or RT at that time. The CT system increased RLD as the season progressed from 1.20 to 1.46 cm/cm³, but the RT system remained low at about 1.30 cm/cm³. Differences below 0.15 m were usually not significant but RLD averaged higher for the NT system. The results of 1994 were similar to 1992 except values for CGR and LAI were slightly higher. Soil VMC was lower for NT and CT than for RT indicating less moisture extraction by roots for the RT system. Across 3 years lint yields averaged 1057 kg/ha for NT, 1007 kg/ha for CT, and 890 kg/ha for RT. Increased shoot growth (CGR and LAI) was coupled with increased root growth or activity in 1992 and 1994 but not in 1991; a unique year because of a late planting and very little climatic stress on the crop. A reduction in soil impedance to less than 400 kPa at 0 - 0.15 m by the NT system would suggest the reason for greater root growth/activity at least in that area of the soil horizon. Accordingly, an observed soil impedance of over 550 kPa in the RT system would suggest less root growth and