

Variability in wheat growth on a duplex soil in Western Australia

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Duplex soils are widespread in the cropping area of Western Australia, but yields of cereals are lower than the potential yield estimated from growing season rainfall, particularly in wetter years (1). Reasons for this are thought to include transient waterlogging at the sand/clay interface, leading to shallow rooting in winter and restricted uptake of water and nutrients during hot, dry conditions in spring. In a field trial in 1988, the occurrence of transient waterlogging and its effect on crop growth and yield was determined on a duplex soil where the only variable was thought to be the depth of sand over clay.

Methods

A duplex soil (sand over yellow clay, Northcote Dy 2.82) at East Beverley 200 km east of Perth, was chosen for the trial. Annual and growing season rainfall at the site was 382 and 299 mm respectively. Depth of sand over clay varied from 20 to 50 cm along a 220 m transect of the site. Measurement points were established at 20 m intervals along two such transects, to record crop establishment, development, shoot and root growth, water use, nutrient uptake, grain yield and yield components. The depth of perched water was measured in a network of 72 piezometers. Wheat cv. Aroona was sown on May 27 using farm scale machinery. The previous crop was lupins.

Results and discussion

Rainfall quantity and distribution in 1988 was close to the long term average. Seedling depth and time of emergence was uniform across the paddock, but by the 3 leaf stage, large differences in crop growth were apparent. This pattern of variability persisted throughout the season, and was little modified by waterlogging at the end of July and in early August. Areas of good growth were characterised by shallow (20 cm) depth of sand over clay; however, the clay was permeable, which allowed infiltration and storage of water in winter and extraction of this stored water to at least 1.20 m in spring. Yields in these areas ranged from 4.0 to 5.0 t/ha. Areas of poor growth were often associated with deeper (40-50 cm) sand over clay, but the permeability of the clay was poor; this led to perching of water, little storage of winter rainfall, and shallow root growth and water extraction in summer. Yields were usually <1.5 t/ha.

However, regression of grain yield against mean water table depth at all piezometer positions showed that waterlogging accounted for little (< 30%) of the variation in yield. In a wetter year, waterlogging may have had larger effects on crop performance. Future work will aim to describe the variability in both physical and chemical properties of the duplex soil across the site, measure crop responses to this variation, and consider economic ways to ameliorate unfavourable conditions.

1. Anderson, W.K. (1985). Western Australian Dept. Agric. Technote No. 11/85.