Waterlogging of wheat in the field i. a method for the control of waterlogging and drainage in the field

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The exact cost of waterlogging to Western Australian agriculture is not known, but has been estimated at $19M/annum(1). Waterlogging is frequently highly variable within a field site and may also vary considerably from year to year. This spatial and temporal variability makes it difficult to study effects of waterlogging on crop germination and growth in the field and to compare the responses of different cultivars. This paper describes a method to overcome this problem by controlling the degree of waterlogging in the field.

Site Details

A field site in the lower part of the landscape (upslope from a natural creek line) and subject to natural waterlogging was chosen at Muresk Agricultural College. The soil profile consisted of about 50cm of loamy sand overlying 10cm of grey impermeable clay. A Sandstone fragipan was present at about 60cm. A mottled zone was apparent 10-15cm from the soil surface.

Construction of Plots

Four special plots (3m x 3m) were constructed which could be drained or artificially waterlogged. A 90-100cm trench (10cm wide) was dug around the perimeter of each plot extending through the clay, and 30-40cm into the sandstone. Trenches were lined to this depth with plastic sheeting to inhibit lateral water flow. Disturbed soil was replaced and compacted to a depth of 20-30cm in the bottom of the trench (70cm from the surface). Slotted plastic piping (10cm diameter) was laid in the trench; the slotted pipe was surrounded with blue metal to improve the hydraulic conductivity. The trenches were filled to the surface with the remainder of the disturbed soil. The surface of each plot was then levelled.

The degree of waterlogging in the plots was controlled by varying water movement into or out of the buried slotted pipe. On the uphill side of each plot, the slotted pipe was connected to a vertically standing reservoir (15 cm PVC pipe); which extended 100cm above the soil surface. On the downhill side of each plot the slotted pipe was connected to an outlet. Waterlogging was imposed by simultaneously running water into the slotted pipe, via the reservoir and plugging the outlets; water levels in the reservoirs are controlled with float valves.

Imposition of Waterlogging or Drainage

Waterlogging (saturation to the soil surface) could be achieved in a few hours. Oxygen concentrations in the soil water were monitored using a TAPS digital O_2 meter (LC82), within 24 hours O_2 concentration in the soil water of waterlogged plots fell to less than 10% (0.6mg O_2 l^{-1}) of levels in drained plots. After drainage by removing plugs from the end of the outlet pipes, O_2 concentrations in the soil water returned to control levels (6-8mg O_2 l^{-1}) within 24 hours.

Reference

1. Bligh, K.J., Grasby, J.C. & Negus, T.R. 1983. J. Agric. West. Aust. 24:58.