The Value of Soil Water at Seeding

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Key Messages

- The value of stored soil moisture at seeding in the Northern Agricultural Region of WA is not well understood.
- In trials so far, value of stored soil moisture at seeding has varied depending on season and soil type.
- In 2013, additional water at seeding increased yield by about 500 kg/ha at the sand site, and by 1000-2000 t/ha at the loam site.
- Trials such as these will help to unravel the value of stored soil moisture so that it can better be used as a predictor of crop performance and nutritional requirements.
- Available water at sowing is a poor predictor of expected yield and cannot be used as a simple tool for adjusting input levels. We need to develop an ability to understand when and why the water will be of benefit.

Aim

To measure the role of water stored in the soil at sowing in affecting wheat yield.

Background

Water stored in the soil at sowing can contribute to the growth and yield of a crop. However, it is difficult to predict the extent of this benefit. If the soil has a low water holding capacity and substantial rain falls after seeding, we might expect little benefit because the stored water will result in little difference in the amount of water available soon after seeding. Indeed, the presence of stored soil water may result in greater leaching of nitrogen under wet seasonal conditions. On the other hand, if the soil has a reasonable water holding capacity and the rainfall after sowing is low-moderate, the stored water could have substantial value for establishing yield potential of the crop, and may also assist during the grain filling phase. This has not been tested experimentally. Knowing when and to what extent stored water is of benefit, will allow a better assessment of the likely returns to be expected from inputs.

By artificially altering the amount of water at sowing on different soils in different years, we aim to assess the value of stored water under the variable conditions of the Northern Agricultural Region of WA.

Trial Details

Property	G & H Pearse Pty Ltd, west Wubin
Plot size & replication:	4m x 4m x 4 replications x 2 sites
Soil type:	Two sites: Deep yellow sand, Heavy loam
Soil pH ($CaCl_2$)	Yellow sand: 0-10cm: 5.3 10-20cm: 4.6 20-40cm: 4.4. data not available for loam site.
EC (dS/m)	Yellow sand: 0.110 data not available for loam site
Paddock rotation:	2010: canola, 2011: wheat, 2012: Lupins
Seeding date:	28/05/13
Seeding rate:	70 kg/ha: Mace
Fertiliser :	28/05/13: 80 kg/ha Macro Pro Extra 28/06/13: 80kg Urea
Herbicides:	28/05/13: 2 L/ha Treflan, 1.2 L/ha Roundup Attack, 2% Ammonium Sulphate 28/06/13: 1 L/ha Jaguar, 0.5 L/ha LVE-MCPA
Growing Season Rainfall	228mm

Results

In 2011, there was no difference in yield for the different treatments at the sand site. The trial was repeated in 2012 at two sites. There was a yield benefit on the sandy site, but there was no difference in yield at the heavier soil site. In 2013, additional water at seeding resulted in increased yields at both sites. At the sand site, there was no appreciable difference in growth during the season, but yields were increased by approximately 500 kg/ha (Table 1). There was no difference in grain size or harvest index. At the loam site extra water at seeding resulted in an increased yield of 1.2 t/ha (30 mm) or 2.2 t/ha (60 mm). In this case, the extra water at seeding allowed better germination and establishment (Figure 1), and grain size was also increased.

Table 1: Crop yields (t/ha) for 3 different water applications in 2011, 2012 and 2013 at two sites, classed as a sand site and a loam site.

Year:	2011	2012	2012	2013	2013
Site:	Sand	Sand	Loam	Sand	Loam
No extra water	3.9	2.1	2.1	3.4	2.8
40 mm (2011) or 30 mm (2012, 13)	3.9	3.3	2.0	4.0	4.0
80 mm (2011) or 60 mm (2012, 13)	3.7	3.4	2.0	3.8	5.0

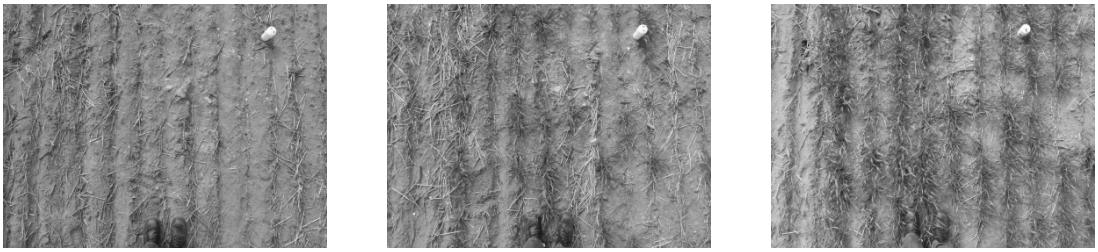

Figure 1: Examples of growth on the loam soil in 2013 after 0mm (left), 30mm (centre) or 60mm (right) extra water applied about 6 weeks before sowing.

Comments

Initially, the trial was set up to determine the impact of extra water at seeding on crop yield, particularly looking for differences during grain filling. Modelling suggests that on soils of low water holding capacity (that is, sands), and in wetter years, extra water at sowing may not be worth much because the soil is likely to fill to the upper limit during the season even in the absence of extra early water. This was probably the case in the 2011 trial, and also for the loam soil in 2012. Surprisingly, there was a difference in crop yield observed in the sand soil in 2012. Perhaps the extra water in the sand soil was stored lower in the soil, compared with the loam soil, resulting in differences in evaporation between the two soil types. Clearly, simply knowing the rainfall prior to sowing is not enough to give an accurate prediction of crop yield!

In 2013, differences in soil water storage on the loam soil resulted in very different plant growth early in the season, despite all plots having similar soil water content at seeding depth at the time of sowing. Perhaps the value of deeper moisture is not so much in getting better crop yields in a tight finish, but in getting better crop establishment and growth in a tight start. This also deserves some further investigation.

Please note that soil test parameters were not measured on the loam site.

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