

Wheat Variety Response to Seeding Depth

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Key Messages

- Wheat can emerge from being sown as deep as 100mm.
- Cultivars differ greatly in their establishment after deep sowing.
- Reduced establishment due to deep sowing can lead to reduced yield (Cobra and Mace yield was reduced by 12% and 10%).
- Cultivars with long coleoptiles are least sensitive to deep sowing but other factors such as seed vigour are also important.

Aim

1. Identify differences between commonly grown wheat varieties in their ability to emerge from very deep sowing (100mm) and relate to coleoptile lengths.
2. Quantify the effects of deep sowing on grain yield.

Background

The imperative to get crops sown early, the size of cropping programs, and the unreliability of early season rains in WA agricultural areas has meant that on soils with receding moisture, farmers will often sow deeper than normal to ensure seed is placed on moist soil and will germinate without having to wait for follow-up rain. This can reduce crop establishment, especially in varieties with short coleoptiles, however, coleoptile length is not an infallible guide to the ability to emerge from depth. In addition, data on coleoptile length is not available for some recently released varieties from Longreach and AGT.

Trial Details

Property	G & H Pearse Pty Ltd, west Wubin
Plot size & replication	18m x 1.54m x 4 replications
Soil type	Sandy loam
Soil pH (CaCl ₂)	0-10cm: 5.0 10-20cm: 4.3 20-40cm: 4.3
EC (dS/m)	0.085
Sowing date	23/05/13
Seeding rate	74-86 kg/ha, calculated to give 150 plants/m ² for each cultivar assuming 90% germination
Fertiliser	25/05/13: 80 kg/ha Macropro Plus banded
Paddock rotation	2010: canola, 2011: wheat, 2012: lupin
Herbicides	21/05/13: 1.5 L/ha Roundup 22/05/13: 2 L/ha SpraySeed, 118 g/ha Sakura 18/06/13: 300 mL/ha Axial, 0.5% Adigor
Growing Season Rainfall	228mm

Experimental Design

A factorial design with three levels of seeding depth and seven cultivars was laid out in four fully randomised blocks. The target seeding depths were 30mm (shallow), 50mm (normal), and 90mm (deep). The cultivars were Cobra, Corack, Emu Rock, Estoc, Mace, Magenta, and Wyalkatchem.

Results

Soil moisture conditions at seeding were good: volumetric moisture content two days before seeding was 7.3% at 0-6cm, 8.2% at 10-16 cm, and 11.3% at 20-26cm, which is close to the upper limit for this soil.

Seeding depth measured on 27 June averaged 28mm for the shallow treatment, 52mm for the normal treatment, and 119mm for the deep treatment.

Final crop establishment in the normal depth treatment (measured 5 weeks after seeding) ranged from 114 to 149 plants/m², depending on cultivar. There were no significant differences in establishment between shallow and normal seeding either 2 or 5 weeks after seeding, but deep seeding reduced final establishment by as much as 45% in Cobra and as little as 22% in Wyalkatchem (Figure 1). Figure 1 also shows that some cultivars

emerged more quickly than others. When sown at 50mm or shallower, more than 90% of Estoc, Magenta, Emu Rock, and Wyalkatchem emerged in the first 2 weeks and between 79 and 90% of the other cultivars. These differences are more pronounced when sown at 100mm: between 70 and 80% of Estoc and Wyalkatchem emerged in the first 2 weeks and only about 45% of Cobra and Corack, and less than 20% of Mace.

Table 1: Seed size and coleoptile lengths measured on the seed used in this trial under laboratory conditions.

Cultivar	Coleoptile length (mm)	Thousand seed weight (g)
Mace	46 ^a	42
Corack	49 ^a	49
Estoc	62 ^b	43
Cobra	63 ^b	43
Magenta	64 ^b	42
Wyalkatchem	64 ^b	42
Emu Rock	65 ^b	49
LSD:	8	

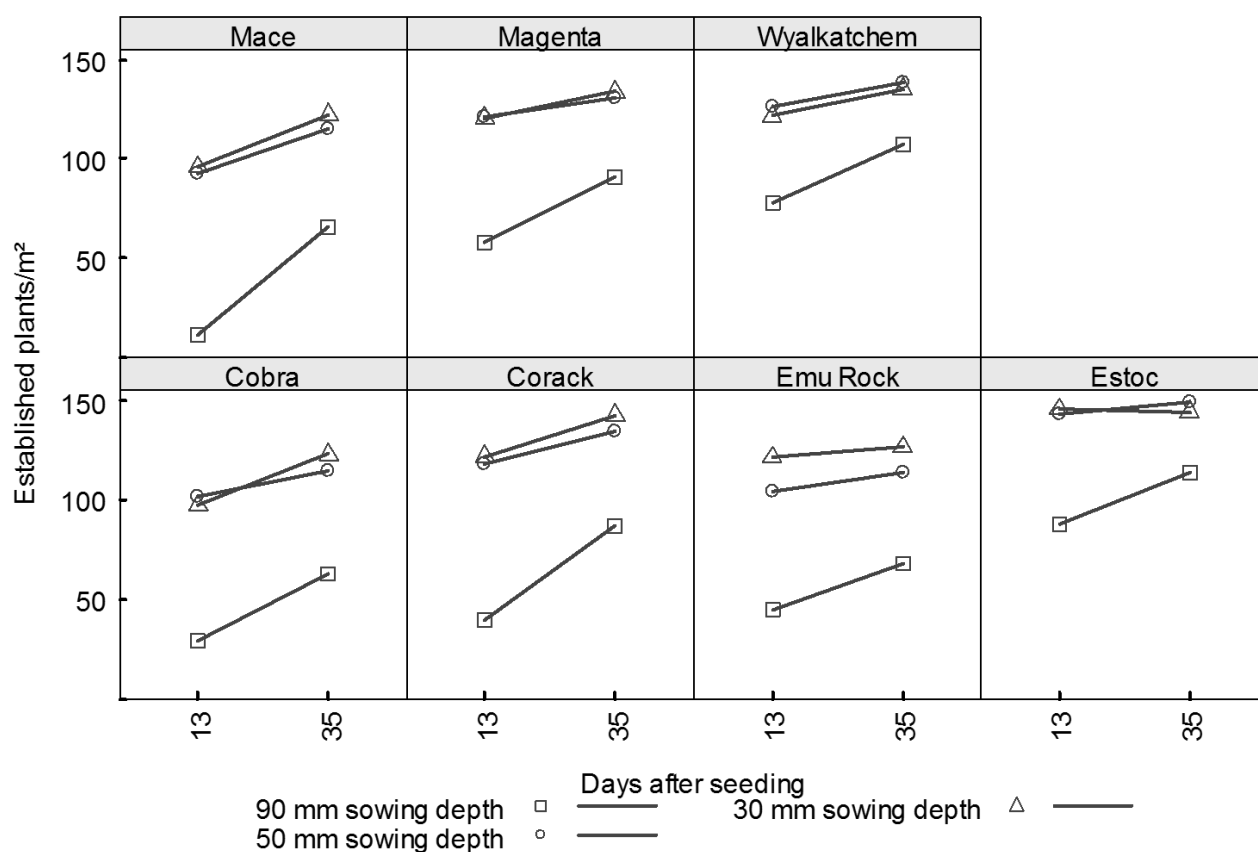


Figure 1: Response of wheat crop establishment to seeding depth in 7 wheat cultivars at west Wubin in 2013

Deep seeding reduced grain yield in some cultivars (Table 2). The reduction was greatest in cultivars suffering the largest reductions in establishment (Figure 2). The relationship between reduced establishment and grain yield and coleoptile length was not particularly good: although the cultivars least affected by deep sowing (Estoc, Magenta and Wyalkatchem) had long coleoptiles so too did the most affected cultivar Cobra. Note that Wyalkatchem is usually considered as a short coleoptile variety, so the seed we used may not have actually been Wyalkatchem. However, it had a lower emergence rate (measured as the proportion of total emergence after 2 weeks) that inhibited its ability to emerge from deep seeding.

Table 2: Grain yield response (t/ha) to seeding depth in 7 wheat cultivars at west Wubin in 2013. Least significant difference ($P=0.05$) = 0.15.

Cultivar	Shallow	Normal	Deep
Cobra	2.97	3.11	2.72
Corack	3.43	3.28	3.11

Emu Rock	2.94	2.91	2.72
Estoc	2.82	2.72	2.90
Mace	3.14	3.09	2.78
Magenta	3.44	3.41	3.18
Wyalkatchem	3.14	3.13	3.17

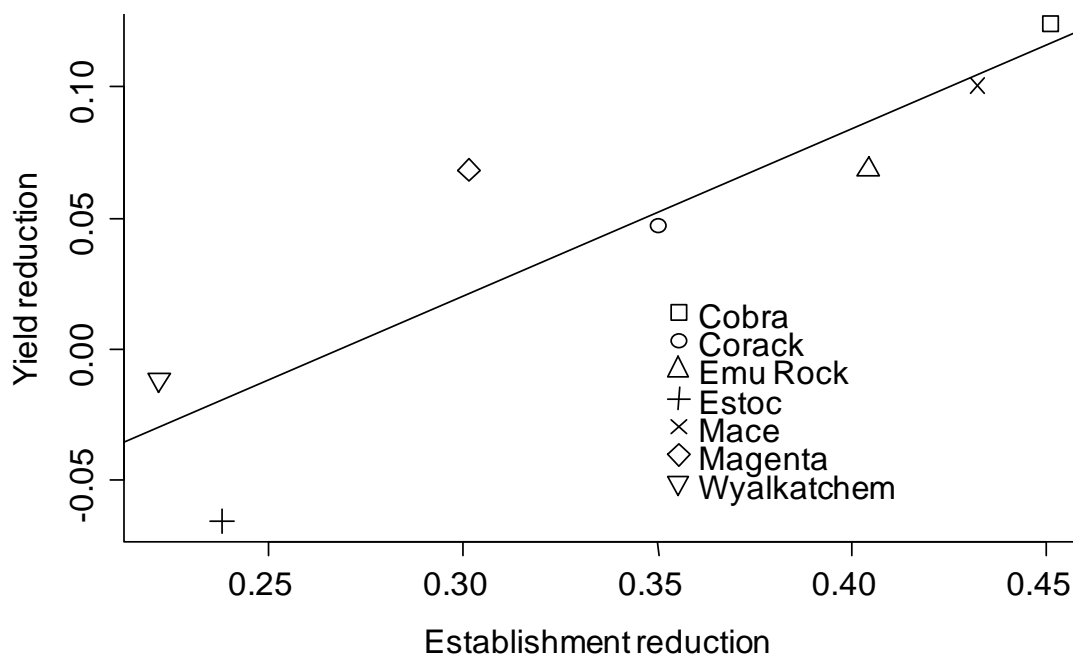


Figure 2: Relationship between proportional reduction in grain yield and proportional reduction in establishment due to deep seeding in 7 wheat cultivars at west Wubin 2013.

Comments

Wheat showed a surprising ability to emerge from deep sowing which was well over 100mm in this trial. How much this is due to soil type and good moisture conditions is difficult to say from this data; however it is potentially a useful tool in getting crops established early.

Some wheat varieties are better suited to deep sowing than others. Crop establishment was reduced in Estoc, Magenta and Wyalkatchem than in other varieties, and this resulted in a smaller yield reduction due to deep sowing. However, sensitivity to deep sowing should not be the only consideration. There were late infestations of *Septoria* and yellow spot at this site which particularly affected Estoc so, although its yield was not affected by deep sowing, its yield was not outstanding.

Cultivars that were insensitive to deep sowing had coleoptiles over 60mm but having long coleoptiles did not guarantee good performance when sown deep. The most sensitive cultivar to deep sowing, Cobra, had as long a coleoptile as any other cultivar in this set, so other factors are important as well. One seems to be seed vigour since Cobra took longer to fully emerge than the better performing cultivars, particularly when sown deep. This is likely to be a feature of the particular seed lot rather than the variety in general. So it is important once a cultivar for deep sowing has been chosen to use the best quality seed available.

Finally, the yield penalty for deep sowing may be much smaller than the penalty for delayed emergence, so it can be a worthwhile tradeoff in order to get the crop in a timely fashion. You should also bear in mind the question mark over the identity of the Wyalkatchem seed used in this trial.

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