Long coleoptile wheats on Eyre Peninsula in 2022

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Location
Cootra
Todd Matthews
Rainfall
Av. Annual: 338 mm
Av. GSR: 245 mm
2022 Total: 416 mm
2022 GSR: 304 mm
Yield
Potential: 4.9 t/ha (Yield Prophet)
Actual: 4.6 t/ha
Paddock history
2022: Barley
2021: Wheat
2020: Wheat
2019: Pasture
Soil type
Sand over sandy clay loam
Plot size
10 m x 1.8 m x 3 replicates
Trial design
RCBD
Yield limiting factors
Weed competition for deep sown varieties

Location
Cockleechie
Dan Adams
Rainfall
Av. Annual: 453 mm
Av. GSR: 336 mm
2022 Total: 593 mm
2022 GSR: 387 mm
Yield
Potential: 8.1 t/ha (Yield Prophet)
Actual: 5.6 t/ha
Paddock history
2022: Wheat
2021: Wheat
2020: Canola
2019: Wheat
Soil type
Clay loam over clay
Plot size
10 m x 1.8 m x 3 replicates
Trial design
RCBD
Yield limiting factors
Weed competition for deep sown varieties, foliar disease

Key messages

- **Plant establishment and grain yield of long coleoptile wheat was compromised when sown deeper (11 cm) than traditional sowing depths (4 cm) into a moist soil profile in 2022.**
- **Seeding at 8 cm may be an opportunity to make use of moisture just below the traditional seeding bed to establish crops in seasons where moisture at these depths exists.**
- **On-going work is still needed to optimise the use of long coleoptile genetics.**

Why do the trial?

The opportunity to establish a crop at a time of our choosing, harnessing the improved water use efficiency benefits of early sowing, whilst flowering at the optimum time to reduce damage by frost and heat, and not having to wait for season opening rainfall, presents as one of the largest opportunities to improve resilience in modern cropping systems.

Seeding deeper, into soil moisture stored below the 'normal seeding bed' may help to establish plants earlier without relying on an Autumn break for germination. Currently, wheat growers are restricted to a seeding depth of 3-5 cm because modern wheat varieties have a shortened coleoptile associated with dwarfing genes that were introduced in the 1960's to increase yields. The length of a coleoptile restricts seeding depth because it is a hollow organ that protects the first shoot as it grows towards the soil surface during germination. Breeders have now identified an alternate dwarfing gene Rht18 that allows a coleoptile up to 12 cm long, whilst maintaining the reduced height associated with modern high yielding wheat varieties.

These trials aim to assess how long coleoptile wheat performs in modern Eyre Peninsula farming systems.

How was it done?

Two trials were established: one on a sand over sandy loam soil in the Cootra area (central EP), and the other on a heavy clay loam at Cockaleechie (lower EP).

Fourteen cultivars were selected for genetic differences in coleoptile length. For the purposes of reporting the 14 cultivars will be displayed in their genetic groups as cultivars within groups performed similarly. The groups are: LC18: cultivars containing the Rh18 long coleoptile gene (including the Mace derivate Mace.18), LC13: cultivars containing an alternative long coleoptile gene Rh13, Normal: containing the shorter coleoptile varieties that are widely grown (including Scepter), Normal Long: cultivars that don't have one of the new long coleoptile genes but do have comparatively longer coleoptiles than most currently grown varieties (including Yitpi and Calibre).

Each cultivar was targeted to be planted at three depths 40 mm, 80 mm and 120 mm.

The Cootra trial was sown on 29 April with seeding rates targeting 160 plants/m^2. At seeding, the trial was fertilised with 16 kg/ha of phosphorus, and 14 kg/ha nitrogen. A further 92 kg/ha of nitrogen was applied post-emergent. A foliar application of 120 g/ha zinc, 150 g/ha manganese and 45 g/ha copper was applied at late tillering. Weed control was achieved through the application of 118 g/ha of Sakura®, and 1.6 L/ha of Avadex Xtra® applied prior to seeding and 25 g/ha of Paradigm®, 300 mL/ha of LVE MCPA, 500 mL/100L of Uptake®, applied post-emergent. 300 mL/ha of Prosaro®, 600 mL/ha of Aviator® and 70 mL/ha of Alpha Scud®, was applied to control disease and insects. The Cootra site was harvested on 15 December 2022.

The Cockaleechie trial was sown on 12 May with seeding rates targeting 160 plants/m^2. At seeding, the trial was fertilised with 16 kg/ha of phosphorus, and 14 kg/ha nitrogen. A further 138 kg/ha of nitrogen was applied post-emergent. A foliar application of 120 g/ha zinc, 150 g/ha manganese and 45 g/ha copper was applied at late tillering. Weed control was achieved through the application of 118 g/ha of Sakura®, and 1.6 L/ha of Avadex Xtra® applied prior to seeding and 25 g/ha of Paradigm®, 300 mL/ha of LVE MCPA, 500 mL/100L of Uptake®, applied post-emergent. 300 mL/ha of Prosaro®, 600 mL/ha of Aviator® and 70 mL/ha of Alpha Scud®, was applied to control disease and insects. The Cockaleechie site was harvested on 19 December 2022.

Measurements were taken for: emergence, coleoptile length, longest leaf length, sub-crown internode length, seeding depth, tillers, above and below ground biomass (at Zadoks growth stages: 12 and 21), growth stages, head density, harvest index, grain yield, grain protein, screenings and test weight. Only a selection of these measurements are reported here. Results were analysed using Genstat® version 22.

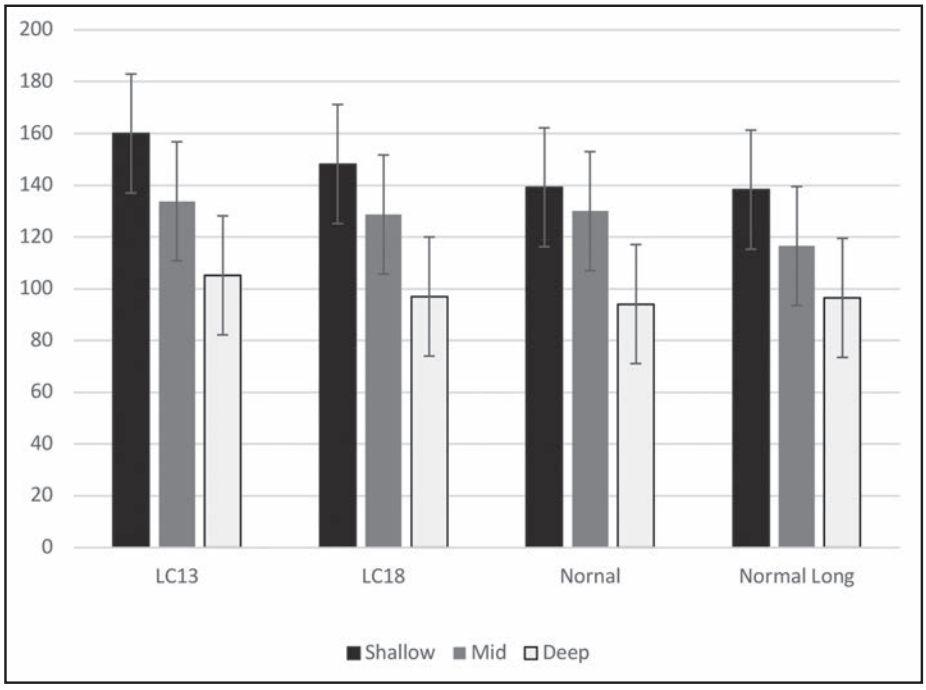

Figure 1. Plant establishment (plants/m^2) of coleoptile groups for wheat, 38 days after sowing at Cootra, 2022.

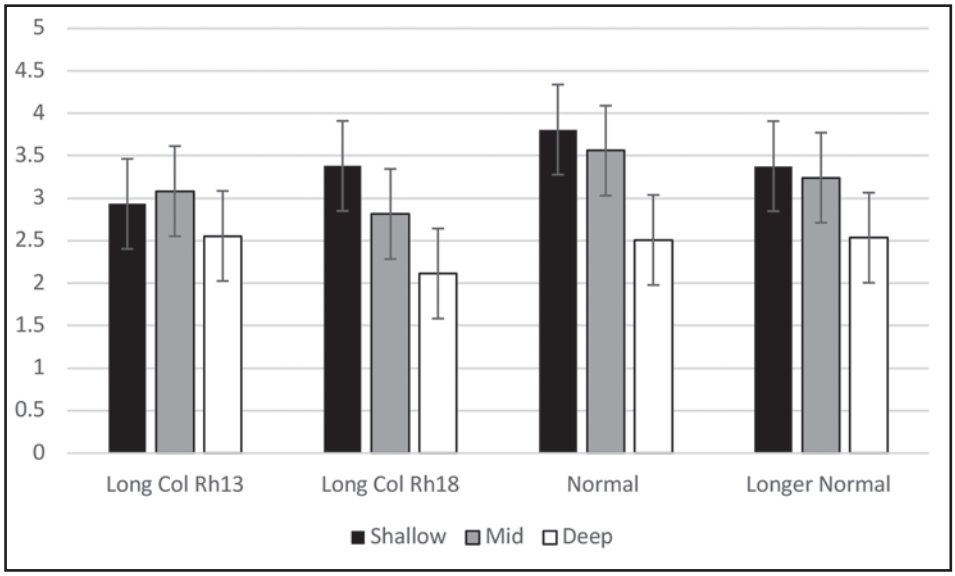

Figure 2. Grain yield (t/ha) at Cootra 2022.

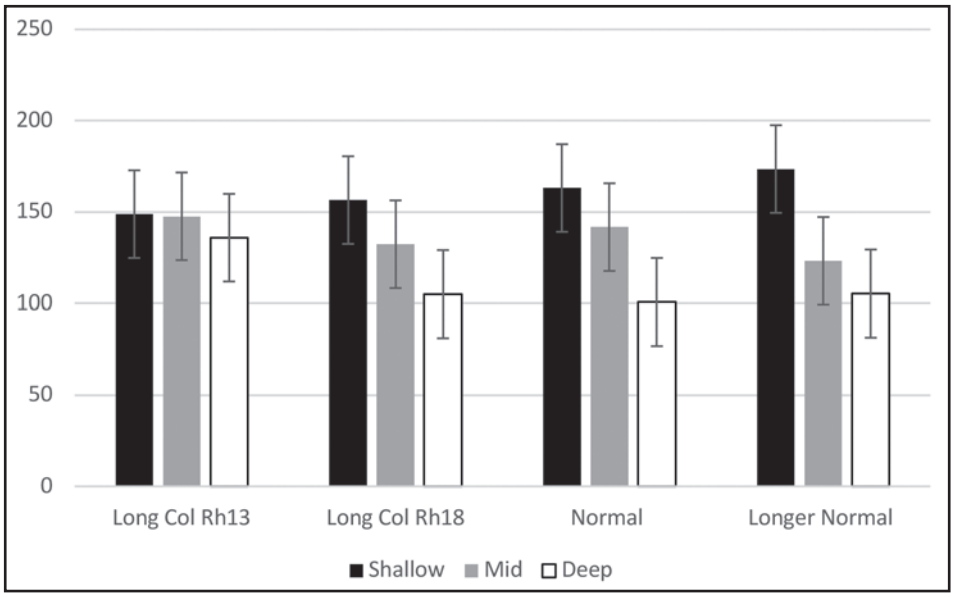

Figure 3. Plant establishment (plants/m^2) 41 days after sowing at Cockaleechie, 2022.

What happened?

Cootra Trial

Cootra actual seed depth achieved: shallow = 35 mm, medium = 85 mm and deep = 110 mm.

The shallowest sown treatments had more plants establish, regardless of coleoptile group (Figure 1).

Deep placement of seed (110 mm) reduced grain yield across all coleptile groups. Deeper sown treatments had higher levels of weed infestation which may have been due to lower plant establishment, poorer vigour from deeper sowing or less herbicide efficacy from deeper sowing.

Cockaleechie Trial

Cockaleechie actual seed depth achieved: shallow = 60 mm, medium = 95 mm and deep = 105 mm.

Plant establishment at Cockaleechie (Figure 3) showed a similar trend to the 2022 Cootra trial (Figure 1), where shallow sowing had higher establishment.

Yield data at Cockaleechie was compromised with high levels of disease, including eye spot, Septoria and powdery mildew, despite application of foliar fungicides (as timing of these was compromised due to paddock trafficability), and as such yield data is not reported here.

What does this mean?

The large amount of summer and autumn rain that fell across Eyre Peninsula in early 2022 meant that the traditional seed bed was moist enough to germinate wheat seed at any time from early April onwards. This resulted in the benefit of being able to establish a crop earlier through deeper sowing being nullified.

Both plant establishment and grain yield were negatively affected by sowing as deep as 110 mm for all coleoptile groups. These data are contrary to the 2021 trial at Cootra that demonstrated that the long coleoptile genetics were able to establish better from deeper sowing.

There are several possibilities for the difference between the two seasons but we are only able to speculate on the causes at this stage. However, trials conducted in 2022 suggest that successful establishment of wheat from deeper sowing may not be as simple as adopting a variety with a longer coleoptile.

Sowing to a depth of 80 mm did not reduce grain yield as much as the deepest sowing (110 mm). This may offer growers the possibility of using a range of currently available, short coleoptile, high yielding genetics to sow into moisture at that depth when opportunities arise.

Acknowledgements

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