De-risking the seeding program

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Location
Rudall
Rainfall
Av. Annual: 353.8 mm
Av. GSR: 250.8 mm
2024 Total: 221 mm
2024 GSR: 153 mm
Paddock history
2024: Calibre wheat
2023: Medic pasture
Soil type
Calcareous loam over clay
Trial design
RCBD
Plot size
12 m x 2 m x 3 reps x 2 blocks

Location
Port Kenny
Rainfall
Av. Annual: 425.8 mm
Av. GSR: 349.7 mm
2024 Total: 189 mm
2024 GSR: 160 mm
Paddock history
2024: Calibre wheat
2023: Medic pasture
Soil type
Grey calcareous sand
Trial design
RCBD
Plot size
12 m x 2 m x 3 reps x 2 blocks

Key messages

- **Deep seeding reduced crop establishment but did not cause any yield penalties at two sites compared to shallow sown crops.**
- **Yields were the same for all early season grass weed control herbicide treatments. This is likely due to water availability being more if a prominent factor influencing grain yield in the dry conditions of 2024.**

Why do this trial?

More farmers in the western and southern region of Australia are dry sowing a larger percentage of their cropping program, due to increased farm size and more variable breaks to the season. In the 2024 season, most farming regions in Southern Australia recorded well below average autumn rainfall. Many farmers seeded a large portion, or even their whole program several weeks before the rainfall break that occurred at the end of May. However, early dry sown crops can be more susceptible to water and nutrient deficiencies, higher soil temperature and pre-emergent herbicide toxicity, which may lead to patchy crop establishment.

There have been numerous studies on optimising early sowing opportunities funded and delivered by organisations across Australia such as a past SAGIT investment "Improving the early management of dry sown cereal crops" (S419) by Amanda Cook. In 2022, the SAGIT trial at Minnipa found that better plant establishment was achieved by separating fertiliser (especially urea) to 3 cm below the seed, which achieved similar germination to using nil fertiliser at seeding. In addition, if fertiliser separation cannot be achieved in the seeding operation, then using MAP (10:22) with the seed is a safer option than DAP (18:20). Also consider applying urea pre or post seeding by broadcasting.

In 2023, the South Australian Drought Resilience Adoption and Innovation Hub (SA Drought Hub) funded demonstration sites to engage with farmers and increase awareness of options to improve early plant establishment and to show the impacts of fertiliser toxicity on seed germination and emergence. The project finished with the following findings:

- Poor crop establishment in an early sown crop did not reduce grain yield in the 2023 season.
- 55 kg/ha MAP + 5 kg/ha urea applied with the seed resulted in the highest final yield at both Cowell and Penong compared to other treatments.
- Seed priming increased early crop establishment in Calibre wheat at Penong, but this did not increase grain yield.

The 2024 De-risking the seeding project aims to align with the regional priorities of the SA Drought Hub to increase the efficiency and success of dry and early sown cereal crops during times of drought. The focus of this demonstration is to further fill the knowledge gap in dry sowing by investigating the effects of sowing depth and early grass-control herbicides on crop establishment and yield of Calibre wheat on Eyre Peninsula (EP).

Table 1. Early season herbicide treatments at Rudall, Elliston and Port Kenny in 2024 on Calibre wheat.

Herbicide Treatments	
1	Nil Control
2	Sakura 118 g/ha IBS
3	Overwatch 1.25 L/ha IBS
4	Boxer Gold 2.5 L/ha IBS
5	Mateno Complete 1 L/ha IBS
6	Mateno Complete 1 L/ha EPE (GS13)
7	Trifluralin 1.8 L/ha + Metribuzin 100g/ha IBS
8	Trifluralin 1.8 L/ha + Avadex (a.i.500g) 1.6 L/ha + Sakura 118 g/ha IBS

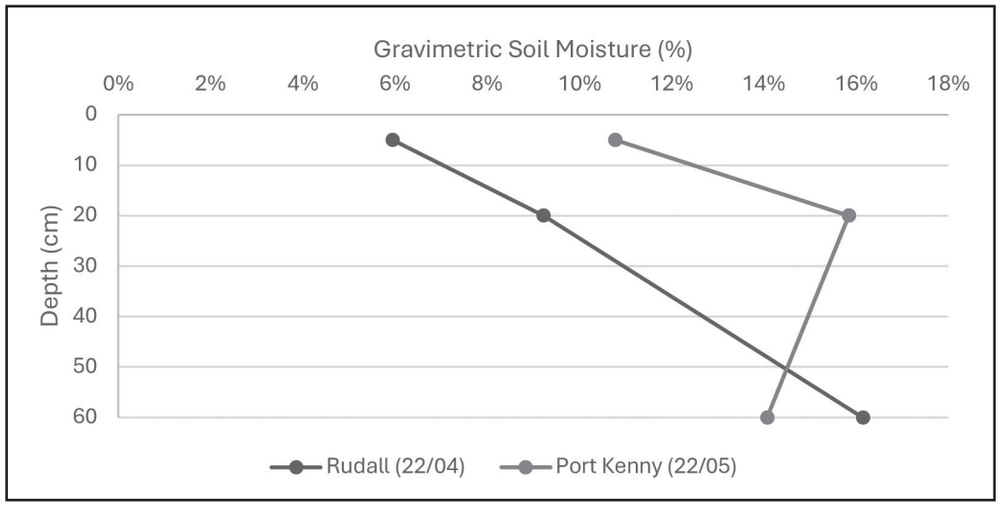

Figure 1. Pre-sowing soil moisture content of the Rudall and Port Kenny sites from 0-60 cm.

How was it done?

In 2024, two demonstration sites of split-plot design were initially conducted at Rudall (calcareous loam, medic pasture in 2023) and Elliston (calcareous sand, barley in 2023). However, due to Cape Barren Geese damage early in the season at Elliston, the site was abandoned, and another demonstration site was sown at Port Kenny (calcareous sand, pasture in 2023). Topsoils (0-10 cm) at all sites were very moisture limited prior to seeding and the overall moistures down to 60 cm were low (Figure 1). Sowing with Primary Sales split system and press wheels took place at Elliston on 18 April, Rudall on 22 April and Port Kenny on 22 May at two depths (3-4 cm or 8-9 cm) with 75 kg/ha of Calibre wheat and 75 kg/ha of MAP banded below the seed. All sites were sown dry. Incorporated by seeding (IBS) herbicide treatments (Table 1) for early grass weed control were applied immediately prior to sowing. Treatment 6 was applied when all plants reached 3 leaves (Z13).

Plant establishment and weed numbers were assessed at numerous times for each site (Rudall - 7 May, 14 May, 11 June and 27 June; Port Kenny - 6 June, 20 June and 4 July). Treatment 6 was applied at Rudall on 27 June and at Port Kenny on 4 July. NDVI assessments were conducted on 30 July at Rudall and 5 August at Port Kenny. Late biomass was measured on 13 September at Port Kenny and 20 September at Rudall. Harvest took place on 15 November at Rudall and 29 November for Port Kenny.

What happened?

The season break occurred on 30 May with 5-9 mm, and with the growing season only being a decile 1. At Rudall, the deep sown crops emerged early, whereas the shallow sown ones only emerged after the break. However, the establishment rate of shallow sown crops quickly overtook the deep sown crops (Figure 2). By the end of the sampling period (27 June), shallow sown crops' establishment rate exceeded the deep sown crops by almost 40 plants/m^2 (Figure 2). At Port Kenny, both deep sown and shallow sown crop emerged after the season break. The deep sown crops had more establishment than shallow sown crops. By the end of the sampling period, shallow sown crops had a density of 140 plants/m^2 and deep sown crops had a density of 134 plants/m^2 (Figure 3).

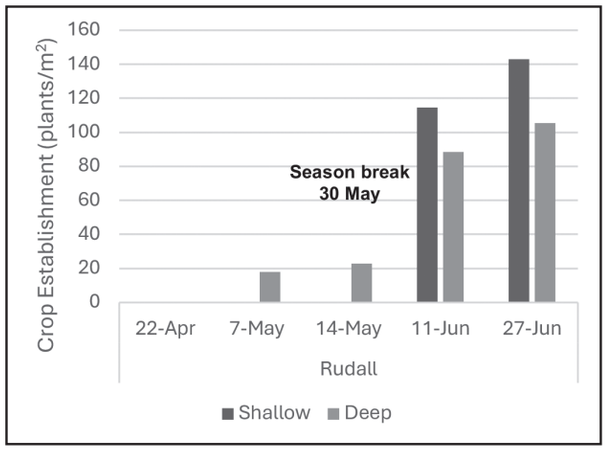

Figure 2. Crop establishment of both shallow sown and deep sown crops at Rudall during the sampling period.

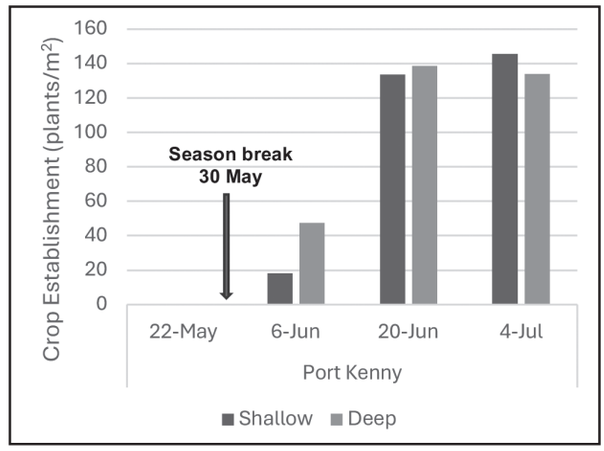

Figure 3. Crop establishment of both shallow sown and deep sown crops at Port Kenny during the sampling period.

Table 2. Wheat establishment (plants/m²) in herbicide treatments from both shallow and deep sowing treatments from the last sampling event at Rudall (27 June) and Port Kenny (4 July) in 2024.

Treatment		Rudall		Port Kenny	
		Shallow	Deep	Shallow	Deep
1	Nil Control	141	110 ab	146	132
2	Sakura IBS	162	96 b	133	127
3	Overwatch IBS	146	100 b	138	135
4	Boxer Gold IBS	134	110 ab	138	142
5	Mateno Complete IBS	138	104 ab	134	130
6	Mateno Complete EPE (GS13)	132	100 b	142	132
7	Trifluralin + Metribuzin IBS	148	100 b	143	138
8	Trifluralin + Avadex + Sakura IBS	141	128 a	144	136
LSD (P = 0.05)		*ns*	*13*	*ns*	*ns*

Table 3. Grass weeds early in the season (plants/m²) in herbicide treatments from both shallow and deep sowing treatments taken at Rudall (27 June) and Port Kenny (4 July) in 2024.

Treatment		Rudall		Port Kenny	
		Shallow	Deep	Shallow	Deep
1	Nil Control	1	0	0	0
2.	Sakura IBS	1	1	1	0
3	Overwatch IBS	2	1	3	0
4	Boxer Gold IBS	0	1	0	0
5	Mateno Complete IBS	0	1	4	0
6	Mateno Complete EPE (GS13)	2	1	1	0
7	Trifluralin + Metribuzin IBS	1	0	1	0
8	Trifluralin + Avadex + Sakura IBS	1	1	3	1
LSD (P = 0.05)		*ns*	*ns*	*ns*	*ns*
SE		1.3	0.7	0.5	0.2
Average (weeds/m²)		1	1	2	0

Table 4. Early NDVI (30 June at Rudall and 4 July at Port Kenny) and late biomass (t/ha) (20 September at Rudall and 13 September at Port Kenny) of wheat in herbicide treatments from both shallow and deep sowing at Rudall and Port Kenny in 2024. Treatment 6 was applied on 27 June at Rudall and 4 July at Port Kenny.

Treatment		Early NDVI				Late biomass (t/ha)			
		Rudall		Port Kenny		Rudall		Port Kenny	
		Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep
1	Nil Control	0.72 a	0.74	0.27 a	0.24	6.0	6.2	2.3	1.8
2	Sakura IBS	0.69 ab	0.7	0.25 ab	0.21	6.4	5.6	2.1	1.6
3	Overwatch IBS	0.7 ab	0.76	0.25 ab	0.22	5.9	7.3	2.2	1.9
4	Boxer Gold IBS	0.71 ab	0.73	0.25 ab	0.23	6.4	6.5	2.3	1.7
5	Mateno Complete IBS	0.65 b	0.68	0.22 ab	0.19	6.5	6.9	2.4	1.9
6	Mateno Complete EPE (GS13)	0.59 c	0.64	0.21 b	0.25	6.1	6.5	2.1	1.9
7	Trifluralin + Metribuzin IBS	0.73 a	0.7	0.22 ab	0.21	6.5	7.2	2.3	1.9
8	Trifluralin + Avadex + Sakura IBS	0.68 ab	0.66	0.23 ab	0.2	6.5	5.3	2.4	1.9
LSD (P = 0.05)		*0.04*	*ns*	*0.03*	*ns*	*ns*	*ns*	*ns*	*ns*
SE		0.01	0.01	0.01	0.01				
Average		0.68	0.7	0.24	0.2	6.3	6.4	2.3	1.8

Table 5. Grain yield (t/ha) and protein (%) of wheat in herbicide treatments from both shallow and deep sowing at Port Kenny and Rudall in 2024.

Treatment		Yield (t/ha)				Protein (%)			
		Rudall		Port Kenny		Rudall		Port Kenny	
		Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep
1	Nil Control	3.1 b	3 ab	1.1	1.4	12.4 a	12.4	11.2	11.2
2	Sakura IBS	3.3 ab	3 ab	1.4	1.2	12 b	12.3	11.1	11.5
3	Overwatch IBS	3.1 ab	3.2 ab	1.3	1.3	12.2 ab	12.5	11.2	11.3
4	Boxer Gold IBS	3.1 ab	3.1 ab	1.3	1.1	12.5 a	12.5	11.3	11.6
5	Mateno Complete IBS	3.1 b	3.2 ab	1.5	1.3	12.5 a	12.3	11.1	11.5
6	Mateno Complete EPE (GS13)	3.4 a	3.1 ab	1.4	1.2	12 b	12.6	11.2	11.5
7	Trifluralin + Metribuzin IBS	3.1 ab	3.2 a	1.3	1.3	12.5 a	12.4	11.3	11.6
8	Trifluralin + Avadex + Sakura IBS	3.1 ab	2.9 b	1.4	1.3	12.2 ab	12.7	11.0	11.5
LSD (P = 0.05)		*0.2*	*0.2*	*ns*	*ns*	*0.4*	*ns*	*ns*	*ns*
Average		3.1	3.1	1.3	1.3	12.3	12.5	11.2	11.5

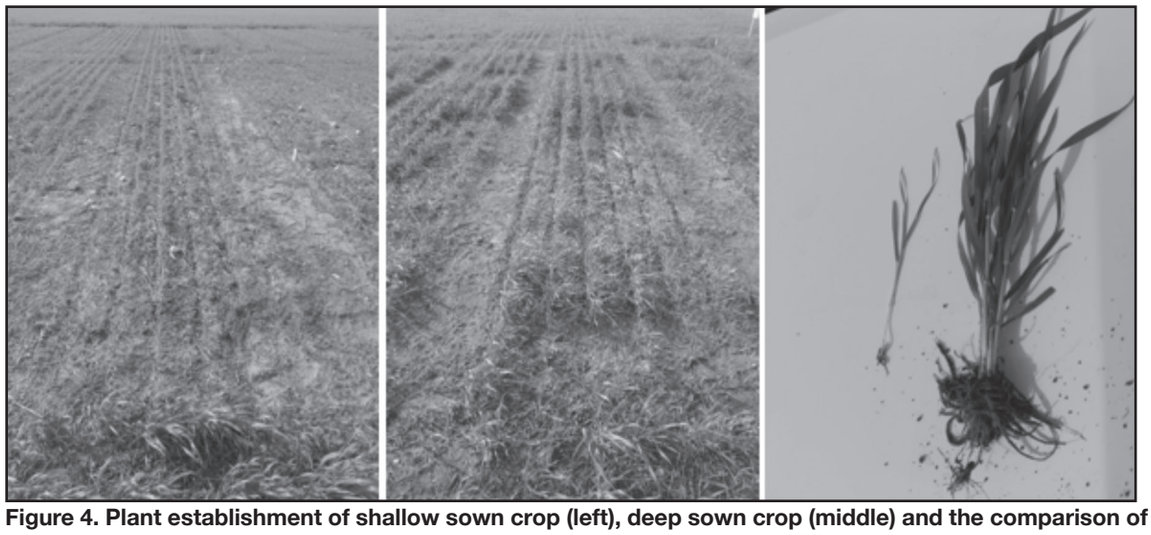

Figure 4. Plant establishment of shallow sown crop (left), deep sown crop (middle) and the comparison of Zadoks growth stage of crops from the same deep sown plot (right) at Rudall, 2024.

What does this mean?

The 2024 season had a late and dry start to the season and prolonged drought conditions with little rainfall. Most of the in-season rainfall occurred in June and July with scattered, small rainfall events from August to October. The results of the Elliston trial are not published due to geese damage, but similar trends were observed.

The general trend for establishment was that shallow sowing resulted in higher establishment than deep sowing, even though deeper sown crops had higher establishment at the beginning. This is most likely due to higher subsoil moisture present deeper in the profile (Figure 1). In addition, patchy establishment was observed in deep sown crops at Rudall due to uneven soil moisture, but not at Port Kenny. However, the low crop establishment rate and its patchiness did not seem to affect its final yield.

In terms of herbicide treatments, despite some differences in field assessments, this year's data did not show a consistent impact on any yield-indicating parameters and final yield across the sites. In terms of weed control, the effect of herbicides was insignificant due to low weed burden in each paddock.

In 2024, the differences in crop establishment caused by sowing depth did not result in a yield difference at either site. Even though different herbicide treatments can affect the early yield-indicating parameters such as crop establishment and early NDVI, these differences did not translate into differences in final yield due to water availability being the more important yield limiting factor in 2024.

Acknowledgement

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