

Farming Systems

Best practice for early sowing opportunities

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Location

Penong

Rainfall

Av. Annual: 317 mm

Av. GSR: 240 mm

2022 Total: 404 mm

2022 GSR: 331 mm

Paddock History

2021: Legume pasture

2020: Wheat

2019: Wheat

Soil type

Sandy loam pH(CaCl₂): 7.7

Plot size

10 m x 1.5 m x 3 reps x 25.4 cm row spacing

Location

Cowell

Rainfall

Av. Annual: 260 mm

Av. GSR: 125 mm

2022 Total: 510 mm

2022 GSR: 235 mm

Paddock History

2021: Pasture (ploughed with offset in November)

2020: Barley

2019: Wheat

Soil type

Sandy loam pH(CaCl₂): 7.4

Plot size

10 m x 1.5 m x 3 reps x 25.4 cm row spacing

Key messages

- **Early sowing did not mean dry sowing in 2022 due to available soil water.**
- **Urea placed with the seed lowered plant establishment at Cowell when combined with both DAP and MAP, but only reduced early dry matter when placed with DAP.**
- **Fertiliser type and placement did not influence grain yield at either site.**
- **Seed priming did not improve crop establishment or grain yield.**
- **Calibre long coleoptile wheat did not improve crop establishment but gave the highest yield at Cowell of 3.0 t/ha.**

Why do the trial?

A workshop held in Wudinna by the South Australian Drought Resilience Adoption and Innovation Hub (SA Drought Hub) in August 2021 identified early sowing as a priority topic for the Hub's Minnipa Node, which covers the upper Eyre Peninsula (EP). The workshop was attended by growers, industry organisations, farmer groups, researchers and community members.

As a result, the 'Best practice for early sowing opportunities' project, led by AIR EP and delivered by SARDI Minnipa Agricultural Centre, was developed to extend the results of the SAGIT investment into "Improving the early management of dry sown cereal crops" (EPFS Summary 2021, p. 76).

The key findings from the SAGIT research project (2019-2021) were:

- Greater plant establishment was achieved with fertiliser placed 3 cm below the seed.
- Lower plant establishment occurred when urea was placed with the seed.
- If fertiliser separation cannot be achieved due to seeding systems, then MAP (10:22) with the seed is a safer option than DAP (18:20) with the seed.
- New long coleoptile wheats may provide another option for early plant establishment and vigour in areas where soil moisture is available up to 10 cm deep.
- It is important to sow seed at a depth sufficient for utilising soil moisture for germination.

How was it done?

Demonstration sites were established in low-rainfall farming systems to:

1. Showcase practices to reduce fertiliser toxicity and increase plant establishment in early sowing situations.
2. Determine if seeding opportunities and crop establishment can be improved by using newly developed long coleoptile wheat varieties and/or seed priming.
3. Determine if early sowing offers other measurable benefits to the farming system, such as biomass production (for livestock feed), weed control or yield.

Sites were sown on 22 April 2022 at Penong (Cade Drummond) on a calcareous red sandy loam, and on 23 April 2022 at Cowell (Tyler Kaden) on a sandy loam. Either Scepter wheat @ 72 kg/ha and 3.5 cm deep or Calibre wheat @ 72 kg/ha at a depth of 6 cm was seeded. Penong was sprayed with Trifluralin @ 1.5 L/ha, LI700 @ 500 ml/100 L, Weedmaster

DST @ 3 L/ha and Hammer @ 80 ml/ha. Cowell was sprayed with Weedmaster DST @ 2 L/ha, LI700 @ 400 ml/100 L, Hammer @ 80 ml/ha and Estericide xtra 680 @ 400 ml/ha. The Cowell site was also sprayed with Lorsban @ 2L/ha to target grasshoppers and both sites were treated with mouse bait.

Fertiliser rates were the district practice of 60 kg/ha DAP, or MAP sown at 55 kg/ha plus 5 kg N/ha as urea (sown 3 cm below the seed) to provide the same amount of nitrogen as with DAP. In addition, 25 kg/ha of urea was applied either with the seed or 3 cm below, depending on the treatment.

Seed was primed by soaking for 4 hours in water or in potassium sulphate solution and then air-dried before sowing (Table 1).

Early dry matter (DM) cuts were taken on 22 June at Penong and 23 June 2023 at Cowell. Late DM cuts were taken on 13 September at Penong and 5 October 2022 at Cowell.

Wheat was harvested at Penong on 24 November and Cowell on 17 November 2022.

What happened?

Early sowing in 2022 did not mean dry sowing at these sites with Penong having adequate soil moisture and Cowell very wet soil on the day of seeding. Crop establishment averaged 142 plants/m² at Penong and 124 plants/m² at Cowell, both well below the target of 180 plants/m². Seed priming did not improve crop establishment at either site, which is not surprising given that seedbeds were moist for both trials (Table 2). At Penong, Calibre had the highest plant counts, but was similar to several other treatments sown at the normal seeding depth (Table 2). Potassium sulphate in furrow did not improve crop establishment in this one season.

Wheat sown with DAP, MAP or no fertiliser all had similar crop establishment due to the ideal seeding conditions experienced at the two sites (Table 2). Plant establishment at Cowell was poorer when NP fertiliser and urea were placed with the seed, compared to when it was placed below the seed.

Table 1. Early sowing treatments at Penong and Cowell in 2022. Scepter was used in all treatments except for first two (Calibre was used).

Treatment	Seeding strategy
Calibre, primed	Sown at 6 cm with 55 kg/ha MAP + 5 kg/ha urea
Calibre, unprimed	
DAP + urea below seed	60 kg/ha DAP + 25 kg/ha urea applied 3 cm below seed
DAP + urea with the seed	60 kg/ha DAP + 25 kg/ha urea applied with the seed
DAP with seed	60 kg/ha DAP applied with seed
MAP + urea below seed	55 kg/ha MAP + 30 kg/ha urea applied 3 cm below seed
MAP + urea with the seed	55 kg/ha MAP + 30 kg/ha urea applied with the seed
MAP with seed	55 kg/ha MAP + 5 kg/ha urea applied with the seed
Nil fertiliser	No fertiliser
Primed with K ₂ SO ₄ normal depth	55 kg/ha MAP + 5 kg/ha urea applied with seed primed in K ₂ SO ₄ for 4 hours
Unprimed, K ₂ SO ₄ fluid, normal depth (control)	55 kg/ha MAP + 5 kg/ha urea applied with the seed, K ₂ SO ₄ solution with seed
Primed, normal depth (4 hours)	55 kg/ha MAP + 5 kg/ha urea applied with the seed primed in water for 4 hours
Unprimed, normal depth (control)	55 kg/ha MAP + 5 kg/ha urea applied with the seed

Table 2. Crop establishment at Penong and Cowell with different seeding strategies in 2022 (plants/m²). Scepter was used in all treatments except for first two (Calibre was used).

Treatment	Penong (plants /m ²)	Cowell (plants /m ²)
Calibre long coleoptile primed (4 hours)	155 a	131 a
Calibre long coleoptile unprimed	166 a	132 a
DAP + urea below seed	148 ab	137 a
DAP + urea with the seed	114 b	85 b
DAP with seed	127 b	118 ab
MAP + urea below seed	146 ab	147 a
MAP + urea with the seed	113 b	95 b
MAP with seed	146 ab	119 ab
Nil fertiliser	151 ab	138 a
Primed K ₂ SO ₄ seed normal depth (4 hours)	126 b	138 a
Unprimed seed K ₂ SO ₄ fluid normal depth (control)	144 ab	126 a
Primed seed normal depth (4 hours)	152 ab	126 a
Unprimed seed normal depth (control)	154 a	119 ab
LSD (P = 0.05)	27	30

Unprimed Calibre had the highest early dry matter (DM) at Penong and visually appeared to be growing the most vigorously (Table 3). At Cowell, early DM production of Calibre was similar to most of the Scepter treatments. At Cowell, DAP and urea placed with the seed resulted in lower early DM than when the fertiliser was placed below the seed (Table

3). When MAP fertiliser was used, there was no reduction in DM when urea was placed with the seed at either site. Wheat without fertiliser (Nil fertiliser) resulted in the least vigorous growth and DM at both sites of all treatments and comparable to DAP + urea with the seed at Penong.

Grain yields were lowest with the nil fertiliser treatment at both sites, however at Penong this yield was still similar to five of the other treatments, including the MAP with seed treatment. At Cowell, unprimed Calibre yielded better than all the other treatments (Table 4). Fertiliser type and placement did not influence grain protein at either site but at Penong proteins were higher with extra urea.

Table 3. Early dry matter (t/ha) and with different seeding strategies at Penong and Cowell, 2022.

Treatment	Penong Early DM (t/ha)	Cowell Early DM (t/ha)
Calibre long coleoptile primed (4 hours)	1.00 ab	1.57 ab
Calibre long coleoptile unprimed	1.17 a	1.44 ab
DAP + urea below seed	0.69 bc	1.66 a
DAP + urea with the seed	0.60 c	1.30 b
DAP with seed	0.67 bc	1.43 ab
MAP + urea below seed	0.75 bc	1.52 ab
MAP + urea with the seed	0.81 bc	1.49 ab
MAP with seed	0.94 ab	1.25 b
Nil fertiliser	0.56 c	0.94 c
Primed K ₂ SO ₄ seed normal depth (4 hours)	0.88 b	1.30 b
Unprimed seed K ₂ SO ₄ fluid normal depth (control)	1.08 ab	1.32 b
Primed seed normal depth (4 hours)	0.84 bc	1.45 ab
Unprimed seed normal depth (control)	1.15 a	1.29 b
LSD (P = 0.05)	0.25	0.29

Table 4. Wheat grain yield (t/ha) and protein (%) with different seeding strategies at Penong and Cowell, 2022.

Treatment	Penong Grain Yield (t/ha)	Penong Grain Protein (%)	Cowell Grain Yield (t/ha)	Cowell Grain Protein (%)
Calibre long coleoptile primed (4 hours)	1.68 bc	9.0 b	2.82 b	10.9
Calibre long coleoptile unprimed	1.74 b	9.2 b	3.02 a	11.2
DAP + urea below seed	2.03 ab	10.4 a	2.73 bc	10.8
DAP + urea with the seed	1.57 bc	10.3 a	2.56 c	10.7
DAP with seed	1.86 ab	10.0 ab	2.59 c	10.9
MAP + urea below seed	1.86 ab	10.1 ab	2.59 c	10.8
MAP + urea with the seed	1.86 ab	10.3 a	2.51 c	11.2
MAP with seed	1.59 bc	9.3 b	2.57 c	10.8
Nil fertiliser	1.36 c	8.8 b	2.20 d	11.3
Primed K ₂ SO ₄ seed normal depth (4 hours)	1.67 bc	8.5 b	2.54 c	11.2
Unprimed seed K ₂ SO ₄ fluid normal depth (control)	1.78 b	9.4 b	2.58 c	10.9
Primed seed normal depth (4 hours)	1.81 ab	9.4 b	2.59 c	10.8
Unprimed seed normal depth (control)	2.13 a	9.5 b	2.50 c	10.8
LSD (<i>P</i> = 0.05)	0.33	0.7	0.18	NS

What does this mean?

With wet seeding conditions and above average growing season rainfall across the upper EP, this was a demonstration of early sowing practices rather than dry sowing practices.

Urea placed with the seed lowered plant establishment at Cowell when combined with either DAP or MAP, demonstrating that better crop establishment can still be achieved by placing urea 3 cm below the seed, even in wet seeding conditions. Urea with the seed only reduced early DM when placed with DAP. MAP is preferred to DAP in situations where fertiliser is being placed in seed rows.

However, reduced crop establishment from urea in the seed row did not decrease grain yield or quality in these results of one season only.

Seed priming did not improve crop establishment or grain yield as all the seeds had access to good soil moisture at germination. Potassium sulphate solution applied in furrow at seeding also did not improve crop establishment in this one season.

As the wet seed beds negated any advantage to better access sub-soil moisture for seed germination, Calibre did not improve plant establishment but still performed very well compared to Scepter.

This demonstration trial will be continued in 2023 to allow another year for comparison of findings.

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