SA Drought Hub Technical Report:

Improving the Management of Dry or Early Sown Crops

PROJECT LEAD: Northern Sustainable Sand Hills

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Project Summary

Dry sowing and early sowing are increasingly being used across the Northern Yorke Peninsula and Mid North to maximise growing season length and improve crop water use efficiency. However, these systems can increase the risk of crop establishment issues associated with fertiliser toxicity, pre-emergent herbicide crop safety and herbicide residue carryover into following crops.

To address these challenges, four demonstration activities were conducted during 2025. These included a fertiliser toxicity trial investigating fertiliser type, placement and rate under dry sowing conditions, two herbicide residue demonstrations assessing impacts on lentil production following the dry 2024 season, and a barley seeding systems demonstration investigating interactions between opener design, sowing speed and crop safety with pre-emergent herbicides.

The project generated locally relevant information to assist growers and advisers in managing the risks associated with dry and early sowing systems. Key findings included the importance of separating urea from the seed under marginal moisture conditions, the influence of seeding system design on herbicide crop safety, and the need to consider herbicide plant-back requirements following low rainfall seasons. Project findings were extended through field days, crop walks, adviser visits and technical reports, providing practical recommendations to support grower decision making.

Executive Summary

The Improved Management of Dry or Early Sown Crops project was undertaken to improve grower confidence and decision making around dry sowing and early sowing systems in the Northern Yorke Peninsula and Mid North. These systems are increasingly important for maximising growing season length and improving water use efficiency, however they can expose crops to greater risks associated with fertiliser toxicity, herbicide crop safety and herbicide residue carryover.

The project successfully delivered four demonstration activities addressing key establishment risks in dry and early sown cropping systems. Demonstrations focused on fertiliser toxicity under dry sowing conditions, herbicide residue carryover into lentils following the dry 2024 season, and the interaction between seeding system design, sowing speed and pre-emergent herbicide crop safety in barley.

Several important findings emerged from the project. Results demonstrated that high rates of DAP could be safely applied at seeding on responsive calcareous soils, while applying urea with the seed reduced crop establishment and grain yield under marginal moisture conditions. Separating urea from the seed substantially reduced this risk. Herbicide residue demonstrations highlighted the importance of adhering to plant-back requirements, particularly following low rainfall seasons where herbicide breakdown may be delayed. The seeding system demonstrations showed that opener design can influence crop tolerance to pre-emergent herbicides with a narrow margin of selectivity, while sowing speed had little impact on crop establishment or yield under the conditions experienced.

The project generated strong interest from growers, advisers and industry stakeholders. Demonstration sites were showcased through extension activities including the Northern Sustainable Soils Group Winter Crop Walk, the Hart Winter Walk and adviser visits. These activities provided opportunities for participants to observe treatments firsthand, discuss results and consider how findings could be applied within their own farming systems.

All project objectives were achieved and the project delivered practical, locally relevant information that can be readily adopted by growers. The findings provide increased confidence around fertiliser placement strategies, herbicide use and seeding system design when implementing dry sowing and early sowing programs. The outcomes will continue to be extended through technical reports, grower networks and

future demonstration activities, contributing to more resilient and productive farming systems across South Australia.

Project Background and Objectives

Dry sowing and early sowing have become increasingly common practices across the Northern Yorke Peninsula and Mid North. Growers are increasingly looking to maximise growing season length and improve water use efficiency by sowing crops ahead of opening rainfall events. While these systems can provide significant yield benefits, they also increase the risk of crop establishment issues associated with fertiliser toxicity, pre-emergent herbicide crop safety and herbicide residue carryover into following crops.

The 2024 season highlighted many of these risks. Below average rainfall resulted in concerns regarding the persistence of residual herbicides and whether plant-back requirements would be achieved prior to sowing lentils in 2025. At the same time, increasing adoption of variable rate fertiliser technology has resulted in some growers applying substantially higher fertiliser rates at seeding than would have traditionally been used. In dry sowing situations, these higher fertiliser rates have the potential to negatively impact crop establishment if products are not appropriately separated from the seed.

The project was developed to provide local growers and advisers with practical information regarding the management of these risks. The original project scope involved the establishment and extension of demonstration activities focused on improving the management of dry or early sown crops.

The key objectives of the project were:

1. Improve understanding of fertiliser toxicity risks associated with higher fertiliser rates applied at seeding under dry sowing conditions.
2. Investigate the interaction between seeding system design and crop safety when using pre-emergent herbicides with a narrow margin of selectivity.
3. Assess the impact of herbicide residues on lentil establishment and production following the dry 2024 season.
4. Extend project findings to growers, advisers and industry stakeholders through demonstration sites, field days and written reports.

All project objectives were successfully achieved. Four demonstration activities were established during 2025, including a fertiliser toxicity trial, a seeding system and herbicide interaction trial, and two herbicide residue demonstrations at the Hart Field Site. Findings from these demonstrations were extended through grower events, including the Northern Sustainable Soils Group Winter Crop Walk and the Hart Winter Walk, as well as through the preparation of individual technical reports for each demonstration.

Originally the project scope included three demonstration activities. However, an opportunity arose to utilise two existing demonstration sites at the Hart Field Site to investigate herbicide residue carryover following the dry 2024 season. As a result, four demonstration activities were ultimately delivered under the project.

There were some limitations associated with the seasonal conditions experienced during the project. In particular, the low rainfall and generally favourable crop establishment conditions resulted in fewer visible treatment differences than originally anticipated in some demonstrations. This reduced the value of conducting field inspections at all sites during the growing season. Despite this, sufficient data and observations were collected to meet the project objectives and generate practical recommendations for growers and advisers.

Overall, the project successfully delivered locally relevant information to assist growers in managing the risks associated with dry sowing and early sowing systems while maintaining the flexibility required to capture early sowing opportunities.

Methodology

The project was delivered through four demonstration activities established across the Northern Yorke Peninsula and Mid North during 2025. Demonstrations were selected to address key risks associated with dry sowing and early sowing systems identified by local growers and advisers.

Demonstration activities included:

1. A fertiliser toxicity trial at Barunga Gap investigating the impact of fertiliser type, placement and application rate on barley establishment, crop vigour and grain yield.
2. A barley herbicide safety demonstration near Port Broughton investigating interactions between seeding opener design and pre-emergent herbicide crop safety.
3. A companion demonstration at Port Broughton investigating the impact of sowing speed on crop establishment and grain yield when using paired-row openers in conjunction with pre-emergent herbicides.
4. Two herbicide residue demonstrations at the Hart Field Site assessing the impact of residual herbicides on lentil performance following the dry 2024 season.

The demonstrations utilised a combination of replicated small plot trials and demonstration-scale assessments. Replicated trials were established using randomised complete block designs and analysed using appropriate statistical techniques including analysis of variance (ANOVA) and mixed linear models where applicable.

Measurements collected throughout the project included crop establishment counts, crop vigour assessments, GreenSeeker NDVI measurements, herbicide symptom ratings, grain yield and grain quality. Soil test information and seasonal rainfall data were also used to assist interpretation of results.

The project placed a strong emphasis on extension and adoption. Demonstration sites were used as focal points for discussion during field days, crop walks and adviser visits throughout the season. Results were communicated through verbal presentations, discussion groups and individual demonstration reports prepared following harvest.

Project outcomes were assessed through participant engagement, discussion at events and the development of practical recommendations that could be readily adopted by growers.

Detailed methodologies for each demonstration activity are included in the subsequent reports.

Maintaining barley establishment and yield under narrow-margin pre-emergent herbicides: the role of opener design and sowing speed

In 2025, two replicated small plot trials were established at Port Broughton, SA to investigate how opener design and sowing speed influence barley tolerance to pre-emergent herbicides.

The first trial evaluated two commonly used seeding opener types for their ability to separate herbicide-treated soil from the seed and maintain plant establishment and yield when using pre-emergent herbicides in barley that have a narrow safety margin on sands.

The second trial built on the first trial and examined the effect of sowing speed on crop safety, when using a pre-emergent herbicide combination with a known narrow safety margin prior to sowing barley on a sandy soil.

Trial report by Stefan Schmitt, Agricultural Consulting and Research

Site Details

Location: Port Broughton, SA
Soil type: Neutral pH red sandy loam
Sowing date: 27 April 2025
Crop: Commodus barley
Fertiliser: 80 kg/ha MAP applied at seeding
Trial design: Randomised complete block design (RCBD) with three replicates
Statistical analysis: Data was analysed using ANOVA, with treatment means separated using Fisher's LSD at P = 0.05

Trial 1 – Seeder Opener × Herbicide Interaction

What was done?

This trial compared two opener types, Root Boot and Atom Jet, for their ability to establish barley and their performance under both a standard and a "hot" pre-emergent herbicide mix.

Root Boot openers are popular within the district and create some under-seed tilth, placing seed on a ledge in paired rows approximately 50 mm apart. This configuration can help separate seed from herbicide-treated soil.



Atom Jet openers place seed at the base of the furrow in a "skid-seed" configuration. They are often praised for their simplicity and consistent seed placement, but do not provide under-seed tilth or place seed on a ledge.

Two herbicides were applied across the treatments. Overwatch was applied at label rates, while Sakura was applied at the full wheat label rate. Sakura is not registered prior to sowing barley and was included to test crop safety of both opener systems under a higher-risk herbicide scenario.

Results

Crop Establishment Results

Emergence counts were taken as the average of two 50 cm row sections per plot. The table below shows the average crop establishment for the different opener type and herbicide combinations.

Table 1. Crop establishment by seeder type and herbicide

Seeder Type	Herbicide	Emergence (plants m2)	LSD Group
Root Boot	Overwatch	93.6	a
Root Boot	Nil	89.6	a
Atom Jet	Nil	87.4	a
Root Boot	Sakura	84.8	a
Atom Jet	Sakura	83.4	a
Atom Jet	Overwatch	81.0	a

Means sharing a common letter do not differ significantly at P = 0.05 (Fisher's LSD).

Interpretation

Crop establishment was not significantly affected by opener type or pre-emergent herbicide treatment, with no significant differences observed in emergence counts between treatments.

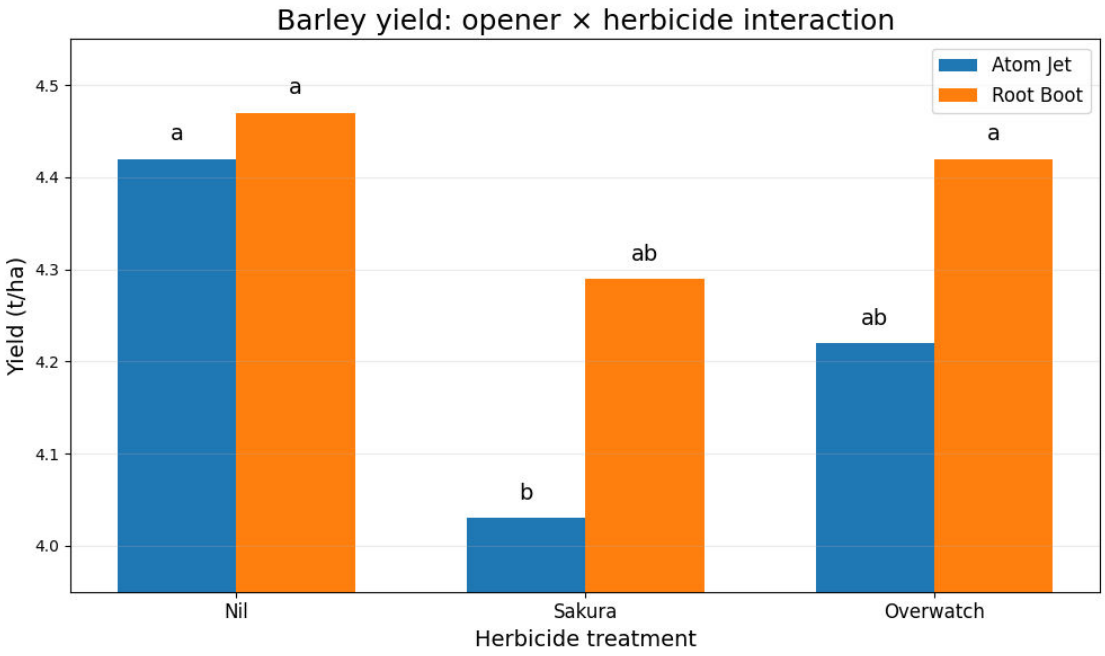


Figure 1: Mean treatment yield by pre-emergent herbicide (yellow = Root Boot) (blue = Atom Jet)

Barley yield was similar between opener types in the absence of herbicide (Nil treatment), indicating no inherent advantage under low-risk conditions. As herbicide pressure increased, differences between opener systems became more evident. Under the higher-risk Sakura treatment, yield of the Atom Jet

opener was significantly reduced, while the Root Boot opener-maintained yield comparable to other treatments.

Discussion

Crop establishment was not significantly affected by opener type or herbicide treatment. However, clear differences in yield emerged under herbicide stress.

Under the Sakura treatment, the Atom Jet opener experienced a significant yield reduction of 8.8% or .39t/ha, while the Root Boot opener-maintained yield comparable to the Nil and Overwatch treatments. This indicates that opener design can influence crop safety under narrow-margin pre-emergent herbicide use.

The lack of differences in establishment, combined with emerging differences in yield, suggests that sub-lethal herbicide effects after emergence were likely responsible for the observed yield response. The paired row Root Boot system likely improved separation between seed and herbicide-treated soil, reducing early crop stress and allowing the crop to maintain yield under higher herbicide pressure.

It is important to note that this was a single site and season, and responses may vary depending on soil type, seasonal conditions, and herbicide use patterns.

Trial 2 – Paired Row Openers x Speed Evaluation

Crop Emergence Response to Sowing Speed

This trial examined the impact of sowing speed on crop establishment and yield when using paired row openers. The hypothesis was that because paired row openers tuck seed under the furrow wall, onto a firm seed bed, away from direct throw of herbicide treated soil. That establishment and yield would be maintained at higher operating speeds.

What was done?

Commodus barley was sown using a plot seeder at the optimum speed for the seeders tyne spacing and opener type (8 km/hr) and at two higher speeds 10 km/hr and 12km/hr to explore the impact on higher than optimum sowing speeds on crop establishment and vigour.

Overwatch herbicide plus Callisto (1.25L/ha + 200mls/ha) were applied prior to the sowing pass to replicate a registered pre-emergent herbicide mix that has a narrow safety margin on sands.

Plots were assessed for establishment and harvested with a small plot harvester.

Results

Table 1. Crop emergence by sowing speed

Sowing speed (km/h)	Emergence (plants m2)
12 km/h	106.7 a
10 km/h	101.7 a
8 km/h	86.0 a

Means sharing a common letter do not differ significantly at P = 0.05 (Fisher's LSD).

Trial statistics

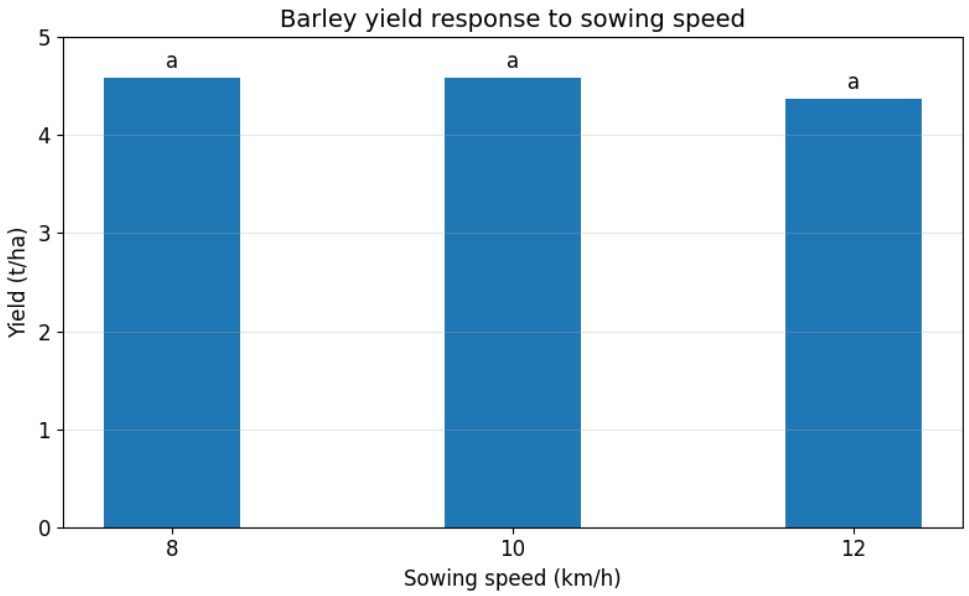
Mean emergence: 98.1 plants m2

Coefficient of variation (CV): 15.1%

Fisher's LSD (P = 0.05): 25.6 plants m2

Sowing speed (km/h)	Yield (t/ha)
8	4.58 a
10	4.58 a
12	4.38 a

Means sharing a common letter do not differ significantly at P = 0.05 (Fisher's LSD).



Barley yield was not significantly affected by increasing sowing speed above the ‘optimum speed’ for the 10-inch row spacing which was 8km/hr. Although there was a small numerical decline in yield at the highest sowing speed (12 km/h), this difference was not statistically significant.

Discussion

In this trial, sowing speed had no significant impact on crop establishment or yield when using paired row openers in combination with a pre-emergent combination with a relatively narrow safety margin.

These results suggest that paired row opener systems are relatively robust to increases in sowing speed under the conditions experienced in this trial. The ability of the opener to place seed on a firm seedbed, tucked under the furrow wall and away from herbicide-treated soil, likely contributed to consistent establishment across speeds. This configuration may reduce direct herbicide contact with the germinating seed, helping maintain crop safety even when soil throw and disturbance increase at higher operating speeds.

From a practical perspective, these findings suggest that paired row openers may be able to operate at higher sowing speeds than traditional benchmarks without compromising crop establishment or early vigour on sandy soils.

However, this response is unlikely to be universal. On heavier or tightly packed soils, increasing sowing speed may lead to greater tyne movement, resulting in uneven or shallow seed placement and reduced establishment.

It is also important to note that this was a single site, single season result on a sandy soil type. The interaction between sowing speed, soil type, moisture conditions, and herbicide behaviour is complex, and responses may differ under wetter conditions, heavier soils, or with different herbicide mixes.

Further work across multiple seasons and soil types is required to confirm the consistency and broader applicability of these findings.

Key Finding and Conclusion

Dry sowing and early sowing systems can provide significant benefits to growers by increasing flexibility and allowing greater utilisation of available growing season rainfall. However, these systems also increase the importance of managing establishment risks associated with fertiliser placement, herbicide crop safety and herbicide residue carryover.

The fertiliser toxicity demonstration showed that high rates of DAP can be safely applied at seeding, even under dry sowing conditions. This provides confidence for growers applying higher phosphorus rates on responsive calcareous soils. In contrast, applying urea with the seed reduced crop establishment and grain yield, particularly under marginal moisture conditions. Separating urea from the seed significantly reduced this risk and improved crop performance.

The herbicide residue demonstrations highlighted the importance of understanding plant-back requirements and the impact of seasonal conditions on herbicide persistence. While most herbicides evaluated caused little impact on lentil performance following the dry 2024 season, some treatments resulted in reduced crop vigour where rainfall requirements had not been met. Clopyralid residues continued to demonstrate a significant risk to lentil establishment and development.

The seeding system demonstrations showed that opener design can influence crop safety when using pre-emergent herbicides with a narrow margin of selectivity. Under the conditions experienced in 2025, paired-row opener systems maintained crop performance under greater herbicide pressure. Sowing speed had little influence on crop establishment or grain yield within the range evaluated.

Collectively, these demonstrations reinforce that successful dry sowing systems rely on an integrated approach that considers fertiliser placement, herbicide selection, plant-back requirements and seeding system design.

Benefits to Industry

The project has generated locally relevant information that can be directly applied by growers and advisers across the Northern Yorke Peninsula, Mid North and other low rainfall cropping regions.

The work has improved understanding of how fertiliser placement influences crop safety under dry sowing conditions and has provided practical guidance around the use of higher fertiliser rates at seeding. It has also increased awareness of herbicide residue risks following low rainfall seasons and highlighted situations where additional caution may be required when planning crop rotations.

Importantly, the demonstrations have provided growers with confidence that many of the risks associated with dry sowing can be effectively managed through informed decision making. The findings contribute to improved risk management, more robust crop establishment and greater confidence in adopting dry sowing and early sowing strategies.

The project has also strengthened collaboration between growers, advisers, researchers and industry organisations through the use of demonstration sites and extension activities.

Future Adoption Opportunities

The findings from this project can be adopted immediately by growers planning fertiliser programs, herbicide strategies and seeding operations.

There is opportunity to continue extending project outcomes through grower meetings, field days, adviser networks and the Northern Sustainable Soils Group trial results booklet. The herbicide residue demonstrations generated significant interest from growers and advisers and highlight the value of continuing to investigate herbicide persistence and plant-back requirements under a range of seasonal conditions.

Future work could further investigate interactions between seeding system design and herbicide crop safety across a wider range of soil types and seasonal conditions. Additional work examining herbicide stacking and cumulative residue effects would also assist growers in managing increasingly complex weed control programs.

Overall, the project successfully met its objectives and has delivered practical outcomes that will assist growers to better manage the risks associated with dry sowing and early sowing systems while maintaining the flexibility required to maximise productivity in variable seasons.

	Attendees to the Hart Winter Crop Walk in 2025 assessing the pre-emergent herbicide residue trial.
	Attendees to the NSS Winter Crop Walk in June 26 listening to Sam Trengove and Jordan Bruce present the results of the fertiliser toxicity work from 2025.

	The Port Broughton seeding opener demonstration just prior to harvest.
	The Hart Herbicide Matrix from 2024 oversown with lentils in 2025.

Acknowledgements

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