GRAINS RESEARCH UPDATE

Jamestown

Thursday 25th July

9.00am to 1.00pm

Jamestown Memorial Hall,
73 Ayr Street

#GRDCUpdates

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Contents

TOP 10 TIPS

FOR REDUCING SPRAY DRIFT

01 **Choose all products in the tank mix carefully**, which includes the choice of active ingredient, the formulation type and the adjuvant used.

02 **Understand** how product uptake and translocation may impact on coverage requirements for the target. Read the label and technical literature for guidance on spray quality, buffer (no-spray) zones and wind speed requirements.

03 **Select the coarsest** spray quality that will provide an acceptable level of control. Be prepared to increase application volumes when coarser spray qualities are used, or when the delta T value approaches 10 to 12. Use water-sensitive paper and the Snapcard app to assess the impact of coarser spray qualities on coverage at the target.

04 **Always expect** that surface temperature inversions will form later in the day, as sunset approaches, and that they are likely to persist overnight and beyond sunrise on many occasions. If the spray operator cannot determine that an inversion is not present, spraying should NOT occur.

05 **Use weather forecasting** information to plan the application. BoM meteograms and forecasting websites can provide information on likely wind speed and direction for 5 to 7 days in advance of the intended day of spraying. Indications of the likely presence of a hazardous surface inversion include: variation between maximum and minimum daily temperatures are greater than 5°C, delta T values are below 2 and low overnight wind speeds (less than 11km/h).

06 **Only start spraying** after the sun has risen more than 20 degrees above the horizon and the wind speed has been above 4 to 5km/h for more than 20 to 30 minutes, with a clear direction that is away from adjacent sensitive areas.

07 **Higher booms increase drift**. Set the boom height to achieve double overlap of the spray pattern, with a 110-degree nozzle using a 50cm nozzle spacing (this is 50cm above the top of the stubble or crop canopy). Boom height and stability are critical. Use height control systems for wider booms or reduce the spraying speed to maintain boom height. An increase in boom height from 50 to 70cm above the target can increase drift fourfold.

08 **Avoid high spraying speeds**, particularly when ground cover is minimal. Spraying speeds more than 16 to 18km/h with trailing rigs and more than 20 to 22km/h with self-propelled sprayers greatly increase losses due to effects at the nozzle and the aerodynamics of the machine.

09 **Be prepared** to leave unsprayed buffers when the label requires, or when the wind direction is towards sensitive areas. Always refer to the spray drift restraints on the product label.

10 **Continually monitor** the conditions at the site of application. Where wind direction is a concern move operations to another paddock. Always stop spraying if the weather conditions become unfavourable. Always record the date, start and finish times, wind direction and speed, temperature and relative humidity, product(s) and rate(s), nozzle details and spray system pressure for every tank load. Plus any additional record keeping requirements according to the label.

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Program

9.00 am	**Announcements and GRDC welcome**	***GRDC representative***
9.15 am	**Unlocking the value of lentils**	***Dylan Bruce,*** *SARDI*
9.55 am	**The value of protein maps in variable paddocks**	***Sam Trengove,*** *Trengove Consulting*
10.35 am	**Morning tea**	
11.05 am	**Emerging pests and the risks to farming systems**	***Maarten Van Helden,*** *SARDI*
11.45 am	**Overcoming a shifting seasonal break**	***Kenton Porker,*** *CSIRO*
12.25 pm	**Fleabane and Feathertop Rhodes grass management**	***Chris Davey,*** *Next Level Agronomy*
1.05 pm	**Close and evaluations**	***GRDC representative***
1.10 pm	**Lunch**	

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Early sowing opportunities in low to medium rainfall environments

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Keywords

- Time of sowing, phenology, yield, pulses, opportunistic.

Key Points

- Grain yield increases up to 0.43 t/ha and 0.75 t/ha were achieved through early sowing lentil and faba bean, respectively compared to a traditional sowing time.
- Favourable results of early sown pulses in 2023, a low-rainfall year with a tight finish, were attributed to good starting sub-soil moisture coupled with an early-seasonal break and low frost incidence.
- As initiation of reproductive development occurs earlier in the season using this strategy, it may be less favourable during above average seasons with softer finishes, and in higher frost risk environments.

Background

The traditional sowing window for lentil and faba bean is well researched for the low to medium rainfall zone of the southern growing region, falling within mid to late May (GRDC, 2018b, GRDC, 2018a). Conventionally, the sowing of most pulse crops is delayed to avoid the potential of high disease pressure associated with large canopies, and flowering and podding during periods of increased frost risk. However, delayed sowing often results in reduced yield due to less growth and dry matter production, and flowering and pod fill occurring during periods of increased temperature and moisture stress. Unlike cereal crops, where flowering and reproductive development occur within a narrow window, pulses are indeterminate in their growth pattern, meaning that vegetative and reproductive growth occur concurrently. Flowering and podding often occur over an extended period, where developing flowers and pods are subjected to a broader range of climatic conditions than those experienced by a cereal crop. Negative conditions, such as frost occurrence during this time can result in flower and pod abortion, however, this can be compensated for by the continuation and later development of flowers and pods. It is this indeterminacy and adaptability in growth habits of pulses that has potential for exploitation to overcome environmental constraints. Early sowing offers the opportunity to extend the growing season and maximise yield potential, compared to traditional sowing times in lower rainfall environments.

Methodology

A field experiment was undertaken at Warnertown, South Australia (Mid North) in 2023, to investigate the opportunistic early sowing of lentil and faba bean compared to a traditional sowing time. The first time of sowing (ToS) was completed on the 14th of March, followed by the 4th of April and 1st of May. Supplementary irrigation equivalent to 20 mm of rainfall was applied via in-furrow drippers post-first and second ToS and pre-third ToS, to best simulate a singular rainfall event that could trigger sufficient germination and establishment. Three varieties of faba bean and lentil were selected based on known differences in phenological characteristics of flowering time and crop maturity (Table 1). The experiment was sown in a split-plot design, with crop type and ToS randomly assigned to the main-plot and variety randomly assigned to the sub-plot to ensure each crop received appropriate agronomic management. Harvest was conducted on the 17th of October. Data was analysed in Genstat 23rd edition using mixed model (REML).

Table 1. Phenological characteristics of lentil and faba bean varieties sown at Warnertown, 2023.

Crop	Variety	Flowering Time	Maturity Time
Lentil	PBA Highland XT$^{\phi}$	Early	Early
	GIA Leader$^{\phi}$	Mid-late	Mid-late
	GIA Metro$^{\phi}$	Late	Mid-late
Faba Bean	PBA Marne$^{\phi}$	Early	Early-mid
	PBA Bendoc$^{\phi}$	Mid	Early-mid
	PBA Samira$^{\phi}$	Mid	Early-mid

Results and Discussion

Seasonal rainfall at Warnertown in 2023 was below average, with growing season rainfall (GSR [Mar-Oct]) of 217 mm, compared to a long-term average GSR of 283 mm (Table 2). An early break was received during April with 26 mm falling over the site across the 14th and 15th, totalling 39 mm for the month. Only April and June recorded above average rainfall across the growing season. Air temperatures immediately following the first ToS were high with 8 days exceeding 30°C across the remainder of March. More high temperature events were recorded during the Spring months of September and October, including a 34.9°C event on the 17th of September, forcing a tight finish to the season. A few frost events were also recorded during late winter/early spring. This resulted in some flower and pod abortion in the earlier ToS, and more notably in the early maturing lentil and faba bean varieties (Figure 1).

Table 2. Monthly rainfall (mm) across the growing season for Warnertown, 2023, against the long-term average, and number of days where temperatures reached equal to or less than 0°C and equal to or above 30°C across the growing season.

Month	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
2023 GSR	13	39	27	73	13	22	21	10	217
Long-term Average GSR	19	28	37	45	39	37	42	36	283
No. Days ≤0°C 2023	0	0	0	0	1	2	1	0	4
No. Days ≥30°C 2023	13	2	0	0	0	0	5	4	24

Figure 1: Stages of frost damage exhibited on Mar-14 sown PBA Highland XT$^{\phi}$ pods from 0°C event on 17th of July, left image taken on 24th July, right image taken on 7th August.

Phenological development in both lentil and faba bean differed in response to ToS (Figure 2). Mid-March sown lentil reached mid flowering (50% of plants with open flowers) between the last week of May and the first week in June. The duration of flowering from the earliest sowing time lasted up to 106 days for GIA Leader$^{\phi}$, with all varieties flowering up to early to mid-September. Pod formation began during early-June for all varieties. A two-week delay in sowing time caused lentil to flower approximately two months later, thereby increasing the duration of vegetative growth and reducing the duration of reproductive development. Sowing an additional month later in early-May reduced the duration of both vegetative and reproductive development in all lentil varieties. The reproductive phase was shortened due to a lack of Spring rainfall and several heat stress events during September.

Faba bean exhibited a greater level of stability within the duration of vegetative and reproductive development across each ToS compared to lentil. Like the earliest sown lentil, mid-March sown faba bean reached mid-flowering between the last week of May and the first week of June. Flowering continued through to late August/early September. Pod formation began during the first week of June for PBA Marne$^{\phi}$, approximately 75 days post-emergence, while later maturing PBA Bendoc$^{\phi}$ and PBA Samira$^{\phi}$ commenced pod formation around the end of July. The phenological development of early-April sown PBA Marne$^{\phi}$ was earlier than both PBA Bendoc$^{\phi}$ and PBA Samira$^{\phi}$ by two weeks. In contrast, PBA Marne$^{\phi}$ had very similar phenological timings to PBA Bendoc$^{\phi}$ and PBA Samira$^{\phi}$, when sown in mid-March. The time between emergence to 50% flowering, 50% flowering to end of flowering and pod development to >50% senescence shortened from the mid-March to the early-April sowing times. A further delay in sowing time from early-April to early-May saw little difference in duration of vegetative growth, but noticeable differences in reproductive development duration.

Grain yield results indicated varied responses to ToS, depending on maturity characteristics in both lentil and faba bean (Figure 3). For faba bean, mid-March and early-April sown PBA Marne$^{\phi}$ achieved the highest grain yields at the site yielding 4.39 and 4.31 t/ha, respectively. All faba bean varieties benefitted from pre-May sowing, with PBA Bendoc$^{\phi}$ yielding 3.83 t/ha when sown mid-March and PBA Samira$^{\phi}$ yielding 3.67 t/ha when sown early-April. For lentil, PBA Highland XT$^{\phi}$ sown early-April was the highest yielding at 2.97 t/ha. The yield of PBA Highland XT$^{\phi}$ was the same as GIA Leader$^{\phi}$ at all other ToS. All three lentil varieties had the lowest yields when sown early-May. GIA Metro$^{\phi}$ across every ToS yielded less than other varieties. The greatest yield of GIA Metro$^{\phi}$ was achieved when sown mid-March, yielding 2.33 t/ha, with declines in yield progressively thereafter for later sown dates.

The ratio of grain to total shoot dry matter, or harvest index (HI), was measured to determine the reproductive efficiency of lentil and faba bean grown at Warnertown (Figure 4). Mid-March sown PBA Marne$^{\phi}$ recorded the highest HI (0.42) out of the faba beans, while mid-maturing varieties PBA Bendoc$^{\phi}$ and PBA Samira$^{\phi}$ recorded their highest HI when sown early-May. This result indicates that early maturity during a tight finish has delivered greater yield potential with greater efficiency in the partitioning of assimilated photosynthates. PBA Highland XT$^{\phi}$ and GIA Leader$^{\phi}$ exhibited their highest HI when sown early-May, recording 0.44 and 0.36, respectively.

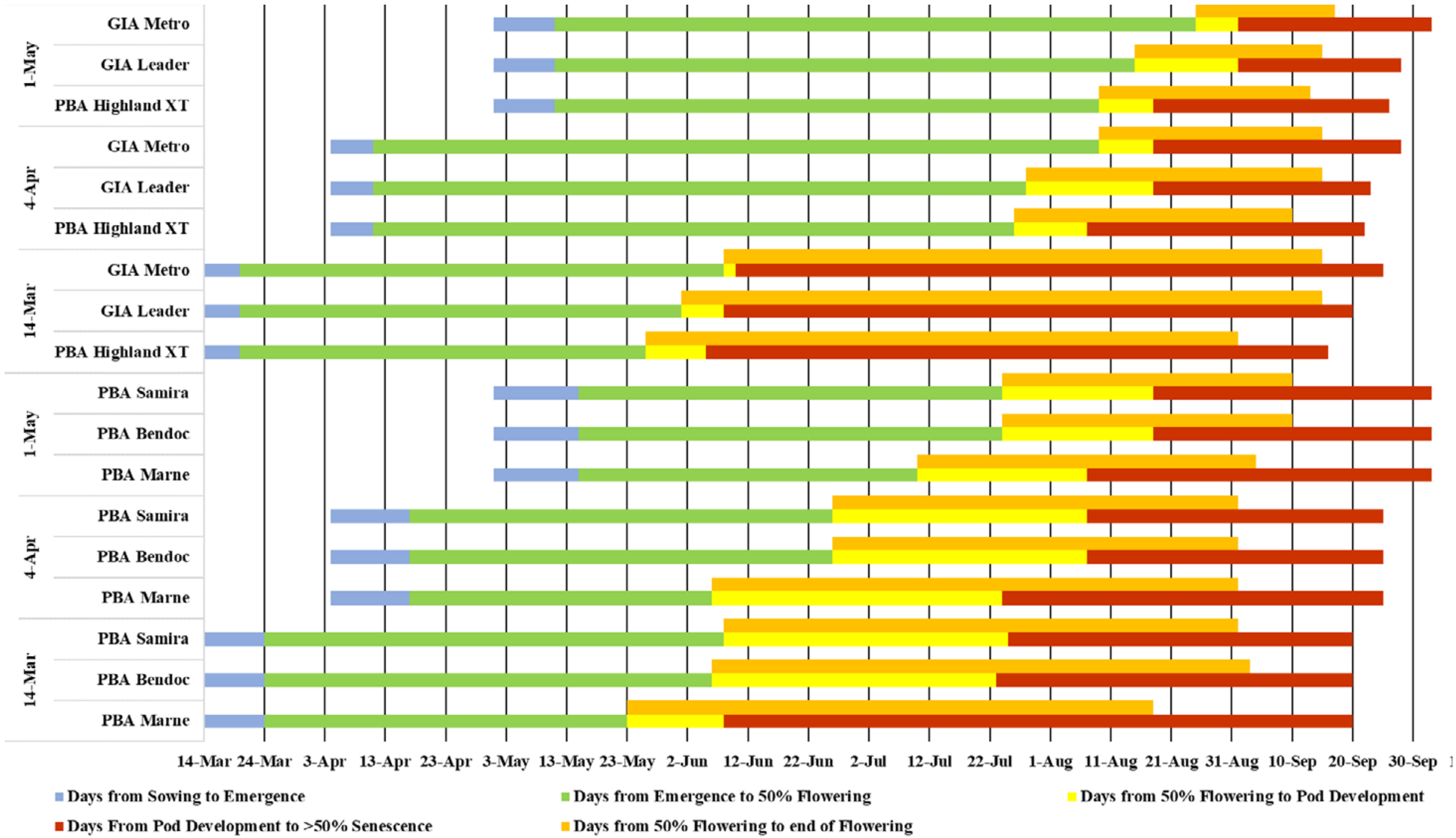

Figure 2. Observed phenological characteristics of faba bean and lentil varieties sown at different times at Warnertown, 2023. Note: phenological assessments presented in this figure were taken at one-to-two-week intervals. The data provides only an approximate guide to differentiate between crop types and their phenological progression when sown at different times.

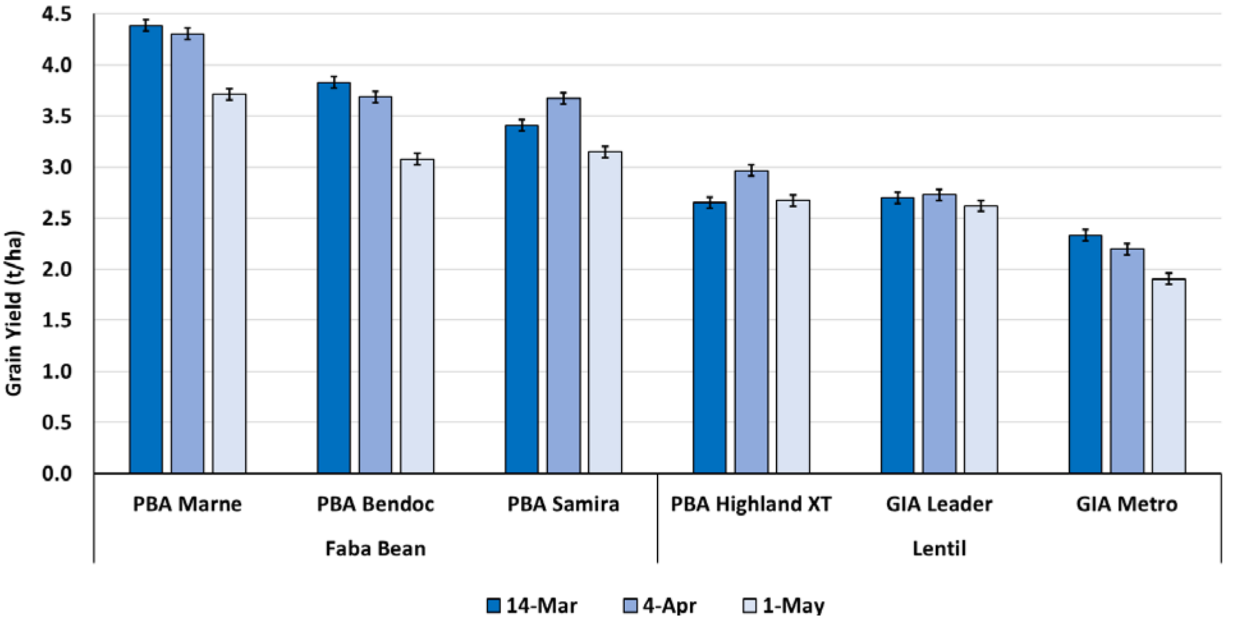

Figure 3. Grain yield (t/ha) response of lentil and faba bean to different times of sowing at Warnertown, 2023. Error bars represent standard error (P<0.05).

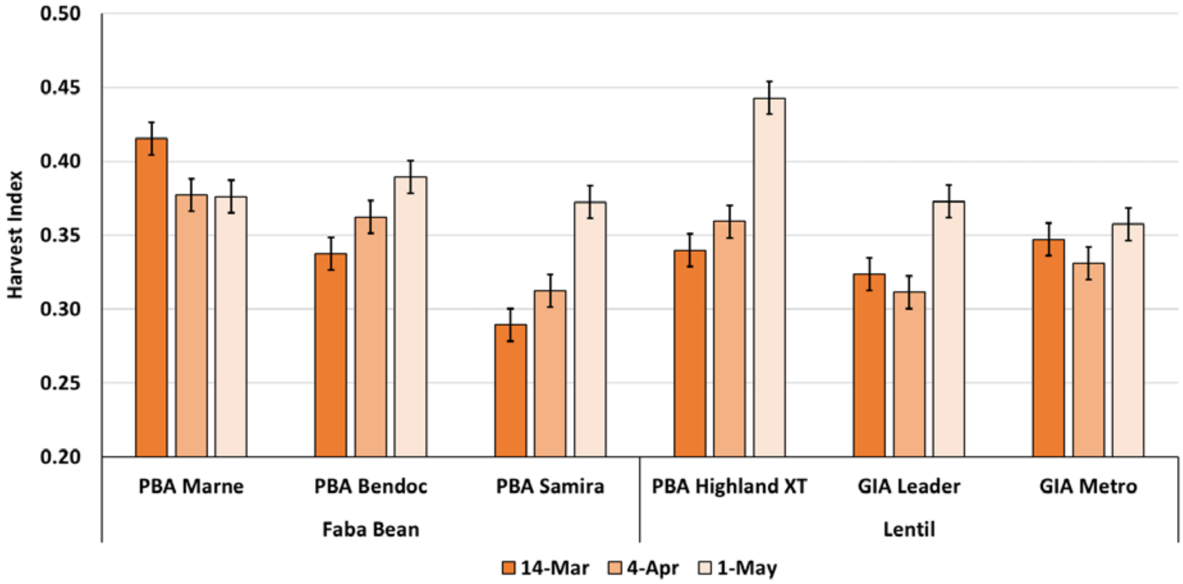

Figure 4. Harvest Index response of lentil and faba bean to different times of sowing at Warnertown, 2023. Error bars represent standard error (P<0.05).

Conclusion

The success of this opportunistic early sowing strategy is highly dependent on the arrival of emerging rains and/or the presence of subsoil moisture. How much starting subsoil moisture is needed to assist with risk management decisions requires further investigation. Agronomic decisions also need careful consideration with adoption of early sowing. Paddock and variety selection will be key as paddocks with a low weed burden along with improved herbicide tolerant varieties should be chosen, as the pre-sowing window for an effective herbicide knockdown is restricted. However, as the crops are emerging during warmer daily temperatures, they are more vigorous and competitive with weeds earlier on. The excessive early growth from early sowing, while favouring disease pressure and intensity, can increase harvestability. Disease management is crucial in pulses, especially during above average seasons.

How disease pressure is managed in these bulky canopies through fungicide application timing, frequency, product selection and the flow on effect of these decisions on gross margins are unknown. Sowing time can have a profound effect on phenological timing, and environmental frost risk should be assessed for the targeted environment. The difference between mid-March and early-April sowing times may only be two weeks, however, up to an eight-week difference has been seen in the flowering time between these two ToS in pulses, suggesting there is a threshold for sowing early to target maximum yield potential while avoiding potential frost risk. Whilst this practice shows great potential, it has not been validated in frost prone environments and still requires significant research efforts to understand and develop suitable management packages for early sowing in the low rainfall zone.

Acknowledgements

The research undertaken was made possible by the significant contribution of UNFS and growers through both trial cooperation and the support of UNFS and SARDI, and the authors would like to thank them for their continued support. The continued assistance in trial management from the SARDI Agronomy team at the Clare Research Centre is gratefully acknowledged and appreciated.

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Notes

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Can we use grain protein maps to refine nitrogen fertiliser inputs?

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Trengove Consulting

Key words

- grain protein maps, nitrogen fertiliser, paddock variability

Key messages

- 2022 wheat grain protein showed a moderate correlation with soil available N pre-seeding in the following season at Bute and Redhill.
- The 2022 grain protein was able to predict the in-paddock variability in fertiliser N requirement for the following crop in both paddocks. However, there was a large variation between the paddocks despite having similar yield potentials. At 10% protein in 2022, the N fertiliser rate required to maximise partial gross margin (PGM) at Redhill was 125 kg N/ha compared to 61 kg N/ha at Bute.
- Crop N removal (combination of grain yield and protein) in 2022 had a strong relationship with N fertiliser rate to optimise PGM in 2023 at both Redhill and Bute.

Background

In paddocks with significant spatial variation there is an opportunity to utilise data layers that can provide information at the site-specific level and aid nitrogen (N) decision making. The use of on combine protein analysers is becoming more common among grain growers. At harvest, this technology allows growers to blend and segregate different grades of grain based on protein. However, the resulting grain protein maps also have the potential to assist N decision making by showing the spatial variation in protein (and therefore N) across a paddock. This variation can be used to assign zones and produce variable rate fertiliser maps.

The aims of this project are to increase the profitability derived from N fertiliser applications by:

- Examining the relationship between soil mineral N pre-seeding with grain yield and protein maps from the previous season;
- Examining the relationship between historical grain yield and protein maps, and the spatial variability of N response across paddocks in the Mid North and Yorke Peninsula; and
- Providing information towards the potential for protein maps to create variable rate N application maps.

How was it done?

Paddock and trial site information

Two growers using standard yield monitors and retrofitted CropScan 3000H grain analysers were identified at Bute and Redhill. Wheat grain yield and protein maps from 2022 were analysed and one paddock per grower was selected for small scale field trials (Figures 1 and 2).

Four sites per paddock were identified based on the 2022 data layers for small plot trials (Table 1). Each of the sites was predicted to have a different level of N fertiliser response based on historical crop performance. The 2022 grain yield and protein data from each of the selected trial sites are shown in Table 1. Grain N removal was also calculated for each site as yield (kg/ha) x protein%/100 x 0.175. Soil available N (ammonium + nitrate) for the Redhill site ranged from 38 – 56 kg N/ha and at Bute ranged from 31 – 56 kg N/ha. Organic carbon levels in both trial paddocks were low (0.9-1% at Bute) to moderate (1.2-1.4% at Redhill). There were no other constraints identified in the soil properties tested.

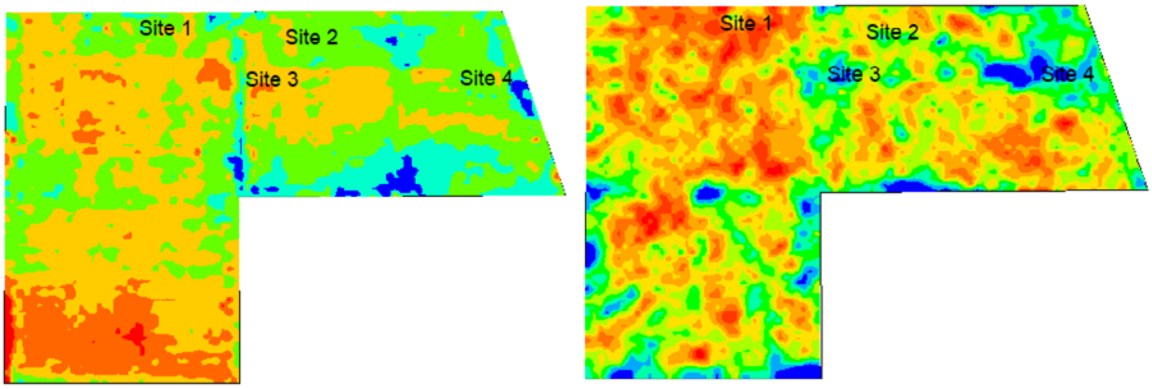

Figure 1. The 2022 Redhill paddock wheat yield map (left) and protein map (right). The shading shows the variation in grain yield and protein recorded across the paddock.

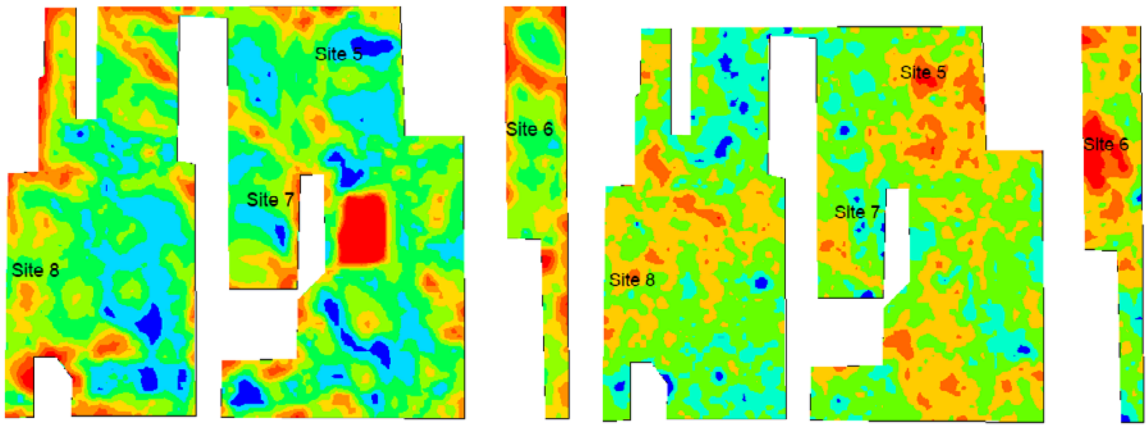

Figure 2. The 2022 Bute paddock wheat yield data (left) and protein map (right). The shading shows the variation in grain yield and protein recorded across the paddock

Table 1. Grain yield and protein (2022 growing season), soil available N and organic carbon (sampled March 2023) for the small-scale plot trial locations.

N trial site	Location	Description*	2022 Wheat grain yield (t/ha)	2022 Protein (%)	Soil available N (0-100 cm)	Organic carbon (%)
1	Redhill	MYLP	5.6	9.8	38	1.3
2		MYMP	5.7	11.1	38	1.4
3		MYHP	5.3	11.3	49	1.3
4		HYHP	5.8	11.8	56	1.2
5	Bute	HYLP	7.9	9.7	31	0.9
6		MYLP	7.2	9.3	48	0.9
7		MYHP	7.0	11.3	56	1.0
8		MYMP	7.0	10.2	38	1.0

**Example MYLP = Medium yield, low protein*

Nitrogen fertiliser rate plot trials

The trials were randomised complete block designs with three replicates. Plot dimensions were 1.5 m x 10 m. The N fertiliser response at each trial site was assessed with fertiliser rates of 0, 25, 50, 75, 100, 150 and 200 kg N/ha applied as urea early post emergent. Trial management details for the individual sites are shown in Table 2.

Table 2. Agronomic information for trial sites at Redhill and Bute in 2023.		
Site	**Redhill**	**Bute**
Seeding date	15th May	16th May
Variety (Seeding rate)	Beast barley 80 kg/ha	Commodus CL barley 75 kg/ha
Starting fertiliser	MAP 100 kg/ha	MAP 100 kg/ha
N applications (Growth stage)	26th June (Z14)	26th June (Z14)
Harvest date	31st October	2nd November

Nitrogen response curves were fit to the yield data for each site as a polynomial function. Predicted grain yield was then used to conduct PGM analysis to find the N rate at maximum PGM for each site.

All plots were harvested for grain yield and grain quality was assessed. Prices used in the partial gross margin (PGM) analysis were $700/t for urea and $270/t for BAR1 barley. All treatments met and were assessed as BAR1 grade, despite some treatments reaching malt classification standards (at the time of analysis Beast and Commodus CL were pending malt accreditation).

Results and discussion

Exploring the relationship between historical data layers and pre-seeding soil available N

Grain protein from the previous season had a moderate correlation to pre-seeding soil available N (Figure 3). At both the Redhill and Bute sites, as 2022 grain protein increased, soil available N measured in March the following season also increased. The rate of increase was similar for both sites at an average of 7.5 kg N/ha for each percent protein increase. The Bute sites were more variable and as a result had a weaker correlation compared to Redhill.

The 2022 grain yield and the combination of 2022 grain yield and protein (shown as N removal) did not have the same relationship between sites (Figure 3). At the Bute sites grain yield had a moderate correlation with soil available N compared to no relationship at Redhill. The opposite was observed between the two sites for N removal. This data suggests grain protein can better describe the variation in soil available N compared to grain yield or N removal.

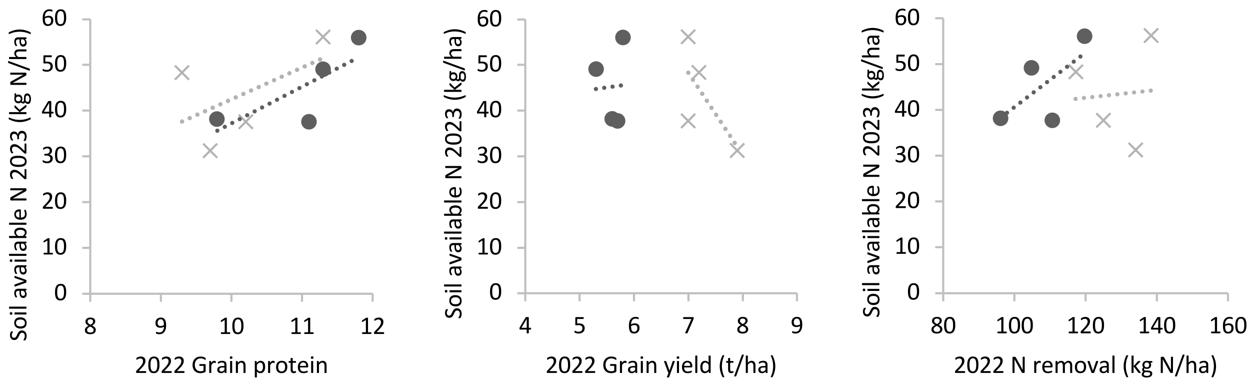

Figure 3. The relationship between 2022 protein (left), grain yield (centre) and N removal (right) and soil available N sampled March 2023 for the four sites at Redhill (circle) and Bute (cross).

Protein – Redhill; y = 8.01x - 42.89, R^2 = 0.59, Bute; y = 6.94x - 26.91, R^2 = 0.30
Grain yield – Redhill; y = 1.67x + 35.91, R^2 = 0.001, Bute, y = -18.00x + 174.37, R^2 = 0.49,
N removal – Redhill; y = 0.5952x - 18.909, R^2 = 0.4456, Bute; y = 0.0855x + 32.393, R^2 = 0.0054.

Crop performance across the paddocks in 2023

Redhill grain yields were highly responsive to N at all sites, with responses ranging from 1.2 t/ha at site 4 HYHP to 1.8 t/ha at site 1 MYLP, where maximum yield is compared with nil N applied (Figure 4). Maximum barley grain yields were achieved with 75 kg N/ha or 100 kg N/ha across the four trial sites at Redhill. Grain quality was excellent with all samples having less than 1.0% screenings.

Maximum grain yields at Bute were slightly lower than at Redhill (Figure 4). The maximum yield at Redhill averaged 5.3 t/ha compared with 4.7 t/ha at Bute. Responses to N were also slightly lower, ranging from 0.3 t/ha at site 7 MYHP to 1.1 t/ha at site 5 HYLP. However, at Bute maximum grain yields were achieved from N fertiliser rates between 50 to 100 kg N/ha depending on the site. The low rainfall in September and October lead to moisture stress and haying off at some sites at high N rates. This resulted in reduced grain yields and increased screenings at the highest N rates.

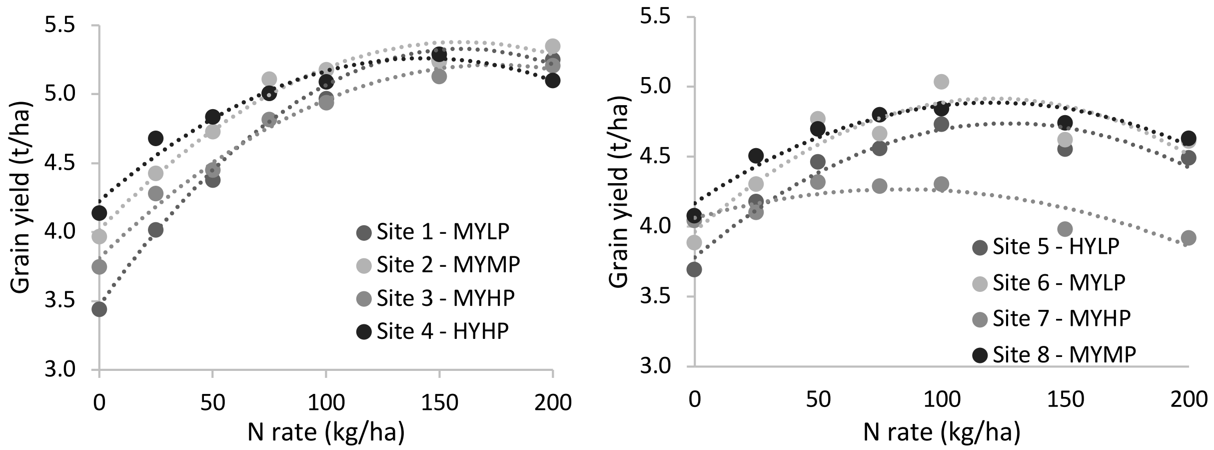

Figure 4. Grain yield response to N fertiliser rates for sites located at Redhill (left) and Bute (right).

Redhill LSD (P≤0.05) site 1 = 0.29, site 2 = 0.23, site 3 = 0.42 and site 4 = 0.23
Bute LSD (P≤0.05) site 5 = 0.20, site 6 = 0.21, site 7 = 0.26 and site 8 = 0.15

Historical protein to predict crop N response

From the first season of results, there is evidence that historical protein can be used to indicate the variability in N demand for the current crop in a given paddock (Figure 5). At Redhill, as the 2022 protein increased the N rate to maximise PGM in 2023 reduced at a rate of 16 kg N/ha for each 1% protein increase. The response was steeper at Bute, where the N rate to maximise PGM reduced by 43 kg N/ha for every 1% increase in historical grain protein.

The absolute N requirement for a given historical protein varied between the two paddocks in 2023. At 10% protein in 2022 the N fertiliser rate required to maximise PGM at Redhill was 125 kg N/ha compared to 61 kg N/ha at Bute. The specific reason for the large difference in optimum N rates remains unclear from one season of results.

Fertiliser N requirements are affected by many factors including;

- Grain yield potential, both sites were predicted to have similar barley yield potentials and N requirements of 4.3 t/ha and 153 kg N/ha for Redhill and 4.8 t/ha and 163 kg N/ha for Bute.
- Soil available N pre-seeding was on average, slightly higher at Redhill (38 – 56 kg N/ha) compared to Bute (31 – 56 kg N/ha).
- Soil organic carbon levels (0-10 cm) were generally moderate to low in both paddocks. The Bute paddock is a sandy textured soil with organic carbon levels ranging from 0.9 – 1.0% indicating low potential for soil N mineralisation. At the Redhill paddock, the soil texture is loam to clay loam and the organic carbon values were higher ranging from 1.2 – 1.4% and therefore a higher potential for N mineralisation.

Based on these factors the Redhill site should have had more available N in the soil compared to Bute and therefore a lower N fertiliser requirement. However, the opposite was observed in the field and further investigation is required.

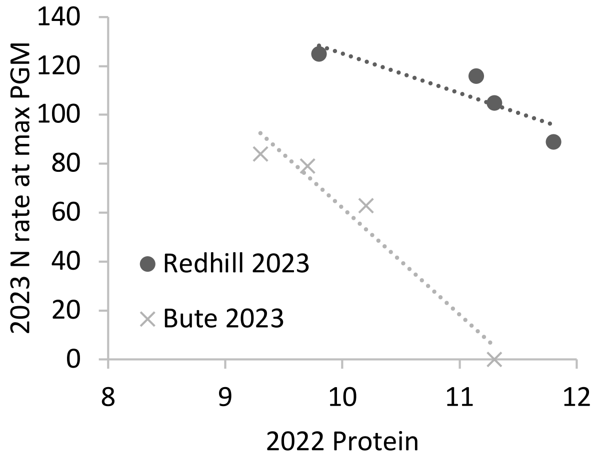

Figure 5. The 2022 grain protein and N fertiliser rate required to maximise PGM in 2023 for Redhill and Bute.

Historical N removal to predict crop N response

Using historical yield and protein data the crop N removal from 2022 was calculated for each trial site. The first season of trials show there is a strong relationship between the 2022 crop N removal and the 2023 fertiliser N requirement (Figure 6) and this relationship was similar for both the Redhill and Bute sites. As 2022 N removal increases, the N demand to achieve maximum PGM in 2023 was reduced. Where 2022 N removal reached 154 kg N/ha, no fertiliser N was required in the 2023 season to maximise PGM. In this instance all N from the following crop is being mined from soil reserves, which over time is expected to deplete soil organic matter reserves. When N removal reached 107 kg N/ha in 2022, N fertiliser rates that equal replacement were required to maximise PGM in the following season (Figure 6). Below this level of N removal, it was necessary to apply N fertiliser rates higher than removal to achieve maximum PGM. It is also expected applying higher fertiliser N rates than removal will result in an increase in soil available N going forward, as per the rationale behind N banking.

Using this methodology in practice suggests higher N fertiliser rates are required on low protein/low yielding areas of the paddock which may also increase the soil N bank. However, in high yielding/high protein areas of the paddock, soil N will be mined. If this strategy is used long-term it will result in a more spatially even N requirement across the paddock.

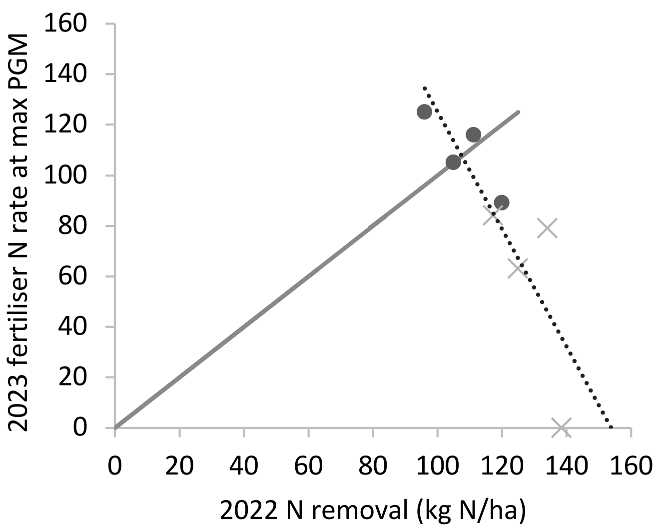

Figure 6. Crop N removal 2022 and N fertiliser rate at maximum PGM 2023 for each of the four trials sites at Redhill (circle) and Bute (cross). The solid line shows where N removal = N applied

Conclusions

Grain yield and protein maps collected in 2022 provided useful insights for understanding the variability in crop N response in the 2023 season. Protein data was more consistent at predicting soil available N and was useful in describing the variability in fertiliser N response in the following crop. The combination of 2022 yield and protein data into N removal produced a similar relationship with fertiliser N requirements for both paddocks. Further research is required across more paddocks and seasons to see if these relationships are maintained across a larger data set.

SAGIT

Acknowledgements

The authors gratefully acknowledge the financial support from SAGIT (TCO 02423) 'Using grain protein maps to optimise nitrogen fertiliser to paddock scale nitrogen variability' to conduct this research. We also acknowledge the following growers Linden & Rob Price and Bill Trengove for hosting the field trials this season.

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Notes

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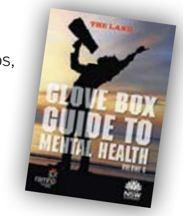

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Emerging pests and the risk to farming systems

Maarten van Helden[1,2], Tom Heddle[2] and Melina Miles[3].

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GRDC project code:

Keywords

- fall army worm, green bridge, Russian wheat aphid, threshold.

Take home messages:

- Russian wheat aphid (RWA) risk is largely dependent on an early break allowing its main wild host barley grass to complete a growth cycle before crops are sown.
- The RWA threshold calculator assists in deciding if control is required.
- No substantial outbreaks of RWA have been documented over the last 8 years.
- Fall army worm (FAW) has not been detected in South Australia so far.
- FAW migrants will reach SA but are unlikely to establish without suitable summer hosts and cold winters.
- Please keep reporting any suspected cases.

Background

Two potentially devastating worldwide pest insects of grains have established in Australia in the last 10 years.

Russian wheat aphid

The Russian wheat aphid (RWA, *Diuraphis noxia*) was first detected in 2016 in South Australia but was already present over large parts of the south-eastern grain belt. It has, in the meantime, spread to New South Wales, Tasmania and Western Australia. Though potentially able to do extensive damage to barley and wheat, the actual impact is much lower than feared.

The research done through GRDC investments (2016–2019) has allowed an IPM strategy for RWA to be established. The research showed that damage by RWA is dependent on the percentage of tillers with RWA at growth stage (GS) 40 (flag leaf out), with 0.28% of yield loss per percent of tillers infested. It also established the likely increase of tiller infestation between GS30 (end of tillering) and GS40, allowing development of an intervention threshold calculator, available online.

Growers and agronomists can do a simple, fast observation of the percentage of tillers with aphids (usually a fraction of the tillers with symptoms) around GS30 and enter the results in the calculator to see if an intervention is economically justified. If required, an insecticide application can then be combined with another (fungicide or herbicide) application to reduce costs.

After GS40, plants are much less attractive to RWA, and little new infestation of tillers will occur. However, if the plants are severely stressed, their defence weakens and RWA can increase its population even in the later growth stages.

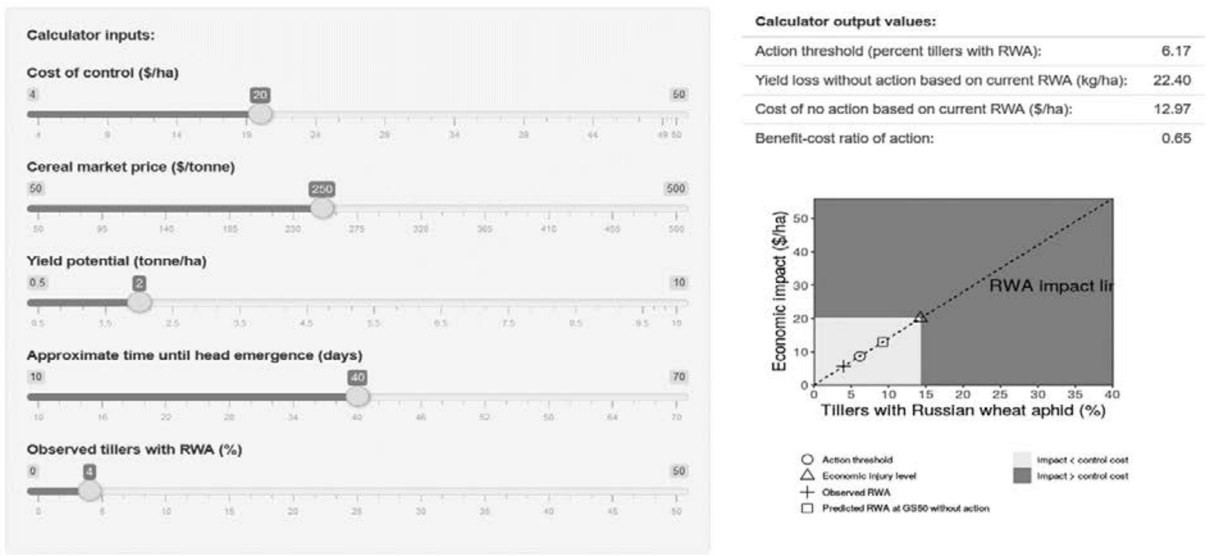

Figure 1. Screenshot examples of RWA intervention threshold calculator.

Green bridge effect

Studies into the over-summering of RWA showed that, while it can survive on many grasses, especially when these are growing new shoots, the population levels in summer are very low. The only grass species on which substantial populations can develop are barley grass species (*Hordeum glaucum*, *Hordeum leporinum*). In a paddock with cereals, it is worth checking the barley grass for RWA presence, as they prefer barley grass over the cereals.

For RWA to be a risk in an autumn sown crop, there needs to be a big enough population of aphids building up on barley grass before the crop is sown. This requires an early break (around February) followed by regular rainfalls, as only then will barley grass germinate and grow, and RWA can build up. If that RWA infested barley grass then matures around crop sowing (May), the aphids will leave the drying barley grass and migrate, so the risk of RWA migrating to the crop will be high. However, these conditions will rarely occur.

High infestation levels of RWA or symptoms have not been observed or reported over the last few years in Australia. We consider that this is a very clear indication that the conditions are rarely combined to allow high levels of RWA to build up on wild hosts before the growing season and then migrating to the crops. This is very similar to what is reported for the North American situation, with almost over 40 years of records.

As insecticide seed treatments have become a routine application in the last decade, this might have contributed to reducing the aphid survival during the first weeks of the crop. Unfortunately, the absence of monitoring to compare plots with and without seed treatment make it difficult to have a clear view on that aspect. Insecticide seed treatments are non-specific and will also affect beneficial populations.

Fall armyworm

The fall armyworm (FAW, *Spodoptera frugiperda*) is a moth species originating from Africa, where it is a well-known pest. It attacks corn and sorghum crops and, when food sources run out, will migrate as caterpillar 'armies' to find new food sources. Like other armyworms, the adults can migrate over large distances.

Since 2016, it has shown a surprising expansion of its range through Africa, India, China and south-east Asia, doing extensive damage. It was first detected in 2020 in northern Queensland (January), in March in northern WA, then in September in NSW and, later that year, in Gippsland, Victoria. FAW has not been reported from South Australia. Damaging established populations are reported regularly from Queensland, NT (Kununurra), northern NSW and Northern WA (north of Broome) on corn and sorghum, and occasionally other crops, such as rice and sugarcane. Impact of FAW is still increasing, with reports of winter cereal crops being attacked by leftover FAW populations from summer crops (M. Miles pers. comm.).

Females lay egg masses of several hundreds of eggs on food plants (corn and sorghum are the preferred hosts) and the caterpillars will ingest large amounts of leaf material. When the initial food plant runs out, they will migrate as caterpillars and attack many other plant species, including pulses, cotton, rice, sugarcane, cereals and many others. Most damage is observed on corn and sorghum, with caterpillars eating leaves, attacking maturing seeds, and tunnelling cobs.

Detections of FAW adults in pheromone traps in the WA grain belt (Northam) and Gippsland, Victoria show that this species can migrate long distances. However, in these more temperate 'southern' areas of Victoria, Southern NSW and Mid and Southern WA, it seems that they have not been able to establish, let alone develop damaging populations. Therefore, we can expect that adults have already migrated to South Australia, and this will occur more often, especially if populations elsewhere build up in tropical areas. But we do not expect these migrants to initiate pest populations.

In fact, climate modelling shows that the southern half of Australia is not a suitable climate for FAW in winter (May–September) due to low temperatures. Moreover, in summer, when temperatures are potentially suitable, summer crop hosts are very rare, as rainfall is simply too low, and no crops are grown.

Only if corn or sorghum would be cropped in summer in the higher rainfall areas (south-east of SA) or elsewhere using irrigation, or maybe in a very wet summer that allows some suitable grasses to flourish, could we one day see FAW larvae in SA, but again, we would not expect these to survive the winter.

Conclusion

These two relatively new pests seem to not cause any major risk in our state, mainly due to the absence of suitable summer hosts. This does not mean that agronomists and growers should ignore them as a possible threat. In rare cases, of exceptionally early breaks and wet summers, there might be a higher risk. For RWA, an IPM approach can be used and spraying around GS40 can efficiently reduce yield loss. In the case of FAW, we are not sure if summer populations could occur and might persist into autumn and attack crops, but they are not expected to maintain over winter.

Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support. Special thanks to Melina Miles for slides of the FAW presentation part, and Melina Miles and Dusty Severtson for providing advice and updated information on FAW. Thanks also to Tom Heddle (University of Adelaide) and James Maino (CESAR Australia) for the collaboration on the RWA trials and analysis.

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Russian wheat aphid action threshold calculator (https://pir.sa.gov.au/research/services/rwa_action_threshold_calculator)

FAW:

The Beatsheet – Fall armyworm (https://thebeatsheet.com.au/key-pests/fall-armyworm/)

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Reducing risks to canola establishment under marginal conditions– defining the fundamentals

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GRDC project codes: CSP2212-005RTX,CSP1907-001RTX

Keywords

- Canola, germination, emergence, establishment.

Take home messages

- A new project is undertaking research to determine the critical environmental conditions for successful canola establishment.
- Canola has the same fundamental requirements in all growing regions; moisture, temperature, seed soil contact and soil strength. These factors can all be influenced by management and environment.
- Timing of establishment is generally more important than plant density for achieving grain yield potential.
- Wet soil is cool soil - at a depth of 2.5cm within the seedbed, wet soil could be greater than 8°C cooler than wet soil.
- Consider the temperature forecast when sowing early - soil surface temperatures can be up to 20°C hotter than air temperature.
- Different moisture thresholds are required for germination, cotyledon emergence and survival to be determined by this project.
- Soil texture will influence thresholds for sowing depth - canola is more likely to emerge from deeper sowing (3 – 5cm) on sandy soil than clay soil.
- Seeder setup is likely to play a larger role in establishment from depth.

Background

Canola suffers from unreliable establishment; however early establishment is crucial for aligning crop development with the environment and maximising yield potential. Typically, only 50% of germinated seeds will successfully establish, leading to issues including reduced yield, increased weed problems and potentially costly resowing. This results in an estimated annual cost of $100M–$200M from poor establishment. Climate change and farming adaptations are expected to exacerbate this issue. For example, the desire to sow and establish canola early to maximise yield potential coincides with less favourable seedbed conditions. Seedbed conditions are often hotter and drier, and more volatile than those for other crops that can be sown later and deeper in the soil. A new national GRDC project aims to use a combination of lab and field experiments with simulation modelling to focus on the underlying processes affecting canola establishment and provide management strategies to mitigate establishment risks. Successful establishment is driven by the same fundamental requirements across all regions; moisture, temperature and seed soil contact., However, the fundamental thresholds to derive rules of thumb for establishment have not been yet established or validated.

A review focusing on management and environmental factors influencing canola establishment identified key research areas:

1. Interaction of moisture and temperature on early sowing establishment.
2. Impact of sowing depth and moisture-seeking ability.
3. Effects of crop residue/stubble on early sowing establishment.
4. Influence of soil crusting and strength on seed growth.

Defining Canola Establishment:

Canola establishment, often vaguely defined, is considered successful when a crop develops a leaf canopy and root system large enough for the plants to grow on their own when they are no relying seed reserves for growth. Emergence is noted when cotyledons appear, but establishment is achieved at the 3-4 true leaf stage. This involves coordinated processes (Figure 1) of seed germination, hypocotyl extension, and growth of leaves and roots (Nelson et al 2022).

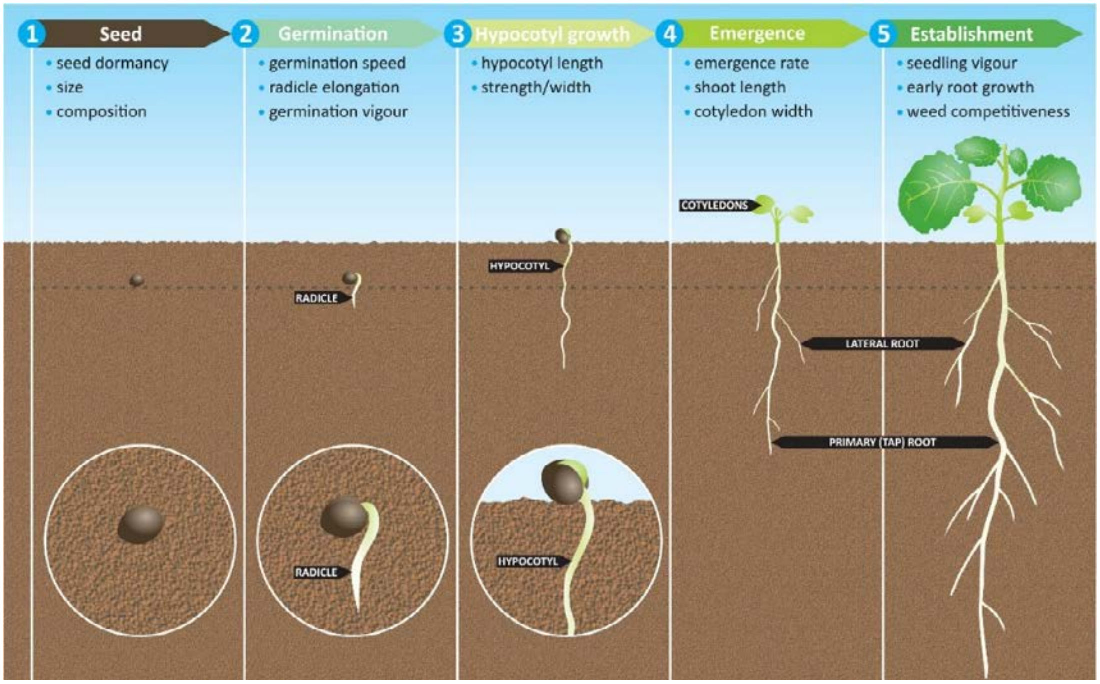

Figure 1 Growth stages between sown seed and establishment in Canola. Taken from Nelson et al. (2022).

Responses to temperature

Studies focusing on canola and related brassicas have primarily investigated germination responses to low temperatures. Optimal germination temperatures range between 25-35°C, with a base temperature of about 5°C, below which the process of germination halts. High temperatures above 35 to 40°C drastically reduce germination, often stopping it entirely. However, effects of supra-optimal temperatures remain less studied.

In 2023, field trials across Australia explored water, temperature, and soil texture gradients. These trials, including at Wynarka (sandy soil in the SA Mallee) and Ungarra (alkaline, dispersive clay on the Eyre Peninsula), involved manipulating and monitoring temperature and water at various depths in the seedbed. A significant observation was that, during April-May, surface soil temperatures in both clay and sandy soils were up to 20°C hotter than air temperatures, often exceeding accepted germination thresholds. In contrast, temperatures at 2.5cm depth in the seedbed were only up to 5°C higher than air temperatures, with the effect more pronounced in the sandy soil. This suggests that canola might have better germination prospects at cooler temperatures deeper in the soil and highlights the need to consider sowing depth in Early April when temperatures are warmer. A crucial observation from the studies is the significant cooling effect of wet soil on temperature. For instance, at Wynarka, when soil temperature was measured in the furrow late in the afternoon a day after sowing, a marked difference was noted. In sandy soil with less than 2% moisture, the temperature was 30.1°C, compared to 22.2°C in wet soil at 2.5 cm depth in the seedbed, indicating an 8°C difference. This temperature difference was less pronounced, deeper in the seed bed as both the extra layer of soil and increased moisture buffers temperature. This finding underscores the potential impact of soil moisture and depth on moderating heat stress and influencing germination timing (Figure 2).

The thermal time for canola emergence is reported to be between 90°C.d and 115°C.d. This metric can be used to estimate emergence time under optimal conditions. In southern Australian environments, this typically translates to 4-5 days under average late March to early April soil temperatures of 25°C, 7-8 days at 15°C in late April to early May, and over 12 days in May when temperatures drop below 10°C (McDonald, G., & Desbiolles, J. ,2023). This may help in understanding and predicting canola germination and emergence in varying soil moisture and temperature conditions.

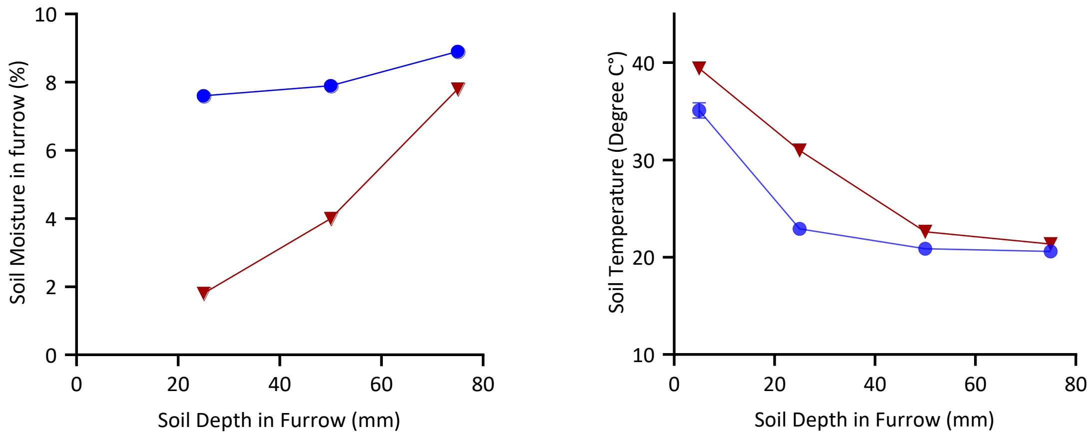

Figure 2. Soil moisture and temperature in the seed bed furrow at different depths (2.5cm, 5cm, and 7.5cm) at Wynarka in 2023 18 April under ▼ Dry conditions and ● Watered (25mm) conditions the day after sowing.

Moisture responses

The critical point in which germination is inhibited is crucial for comparisons across soil types, which exhibit different soil water release curves based on their texture. For canola, critical water potential is generally reported between -0.8 and -1.2 MPa for *germination*. However, this range might not be sufficient to guarantee *emergence* since it falls below the thresholds for any plant growth (the wilting point is at -1.5 MPa). Soil texture is a key factor, as it significantly influences soil moisture percentages and makes interpretation difficult until these numbers are converted to a known metric such as rainfall amount. For instance, the clay soil at Ungarra has a wilting point of 8%, while the sandy soil at Wynarka has a wilting point of 3.6% (as measured by suction pressure plates).

Field trials and lab experiments (with results still pending) were conducted to assess soil moisture levels both above and below the crop's lower limit. In 2023, plots were modified using tarps to exclude rainfall. A notable observation from the Wynarka sandy soil is that as little as 5mm of supplementary water applied at sowing (on 18 April) to a dry seedbed raised the soil moisture above the lower limit, leading to establishment comparable to that in soil at field capacity (figure 3). In contrast, in conditions of dry soil, emergence did not occur until 6.8mm of accumulated rainfall from 5 May to 11 May. This amount was just enough to reach the wilting point and trigger germination and emergence almost a month later than optimal, and outside the preferred sowing window for canola.

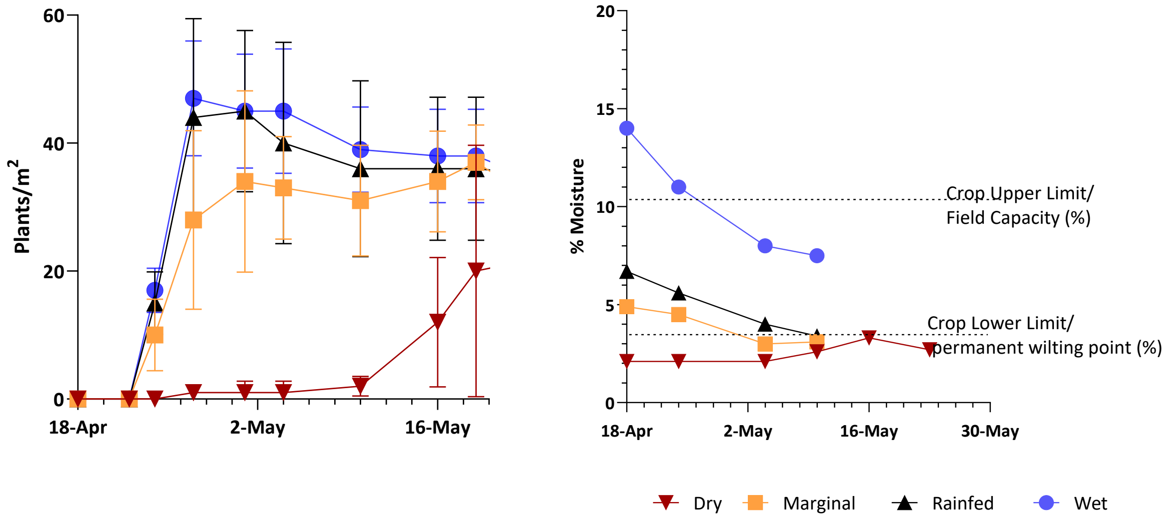

Figure 3. Plant establishment over time at 4 variable seedbed moisture profiles (2.5cm deep) at Wynarka in 2023, the cultivar was Hyola Regiment XC sown at 60 viable seeds/m^2 . Dry was tarped from the start of March until sowing to ensure dry seedbed, marginal was tarped for the same period with 5mm of water applied just prior to sowing, and wet had an additional 25mm of water at sowing.

Preliminary lab results highlight that canola's germination might occur below the wilting point, but achieving successful hypocotyl growth, cotyledon survival, and leaf emergence requires different moisture thresholds. Future research is directed towards understanding how germination inhibition relates to temperature under low moisture conditions. A key objective is to develop practical guidelines for predicting rainfall needs across various soil types, considering factors such as soil water repellence and the diversity in soil texture across different paddocks.

Implications for Yield Response

Yield responses in canola are often more closely linked to the date of emergence rather than plant density, owing to the crop's ability to compensate for reduced plant establishment. This was evident in the 2023 Wynarka trials, where early establishment correlated with higher yields. For instance, the marginal seedbed treatment that established on 23 April yielded 0.8t/ha more than crops established on 13 May under seemingly more ideal seedbed conditions (Table 1). This outcome underscores the importance of timely planting and the potential for increased yield by capitalizing on small rainfall events in April. These findings are significant for strategic farming practices, emphasizing the need for timely actions to optimize crop establishment and yield in canola farming.

Table 1. Establishment and yield response to selected treatments in the Canola cultivar Hyola Regiment XC at Wynarka on a sandy soil in 2023.

Sow Date	Treatment	Establishment Date*	Total Emergence (plants/m^2)	Grain Yield (t/ha)
17 Apr	Wet Seedbed (25mm water applied)	21 Apr	63 a	3.7 a
17 Apr	Marginal Seedbed (Dry seedbed + 5mm water)	23 Apr	30 b	3.6 a
17 Apr	Dry Seedbed	18 May	25 b	2.3 c
5 May	Wet Seedbed (25mm)	13 May	63 a	2.8 b

**Establishment date is expressed as days to achieve 20 plants/m2*

Sowing depth:

There has been renewed interest in deeper sowing as farmers sow canola increasingly early and seek moisture through deeper sowing. Research has generally shown that deeper sowing reduces canola establishment. In NSW, Brill et al. (2016) showed 30% reductions in canola emergence between 25mm and 50mm and a 70% reduction between 2.5cm and 7.5cm sowing depth on a heavier soil type. Results from the Wimmera in 2023 also found a 33% reduction in emergence from 2cm to 5cm deep on clay soil.

This was not the case on sandier soil types suggesting different thresholds with limited reduction in establishment from 2 – 5cm at Wynarka, and Kimba, however a 60, and 66% reduction in establishment respectively going from 2 – 7.5cm deep. This suggests the deep sowing threshold in sandy soils is higher than heavier textured soils with a rapid decline from 5cm rather than 2.5cm deep. Further analysis of all seedlings from the soil at Wynarka in 2023 showed establishment reduced by 10% for every 1cm deeper seed placement below 5cm at optimal moisture irrespective of soil temperature.

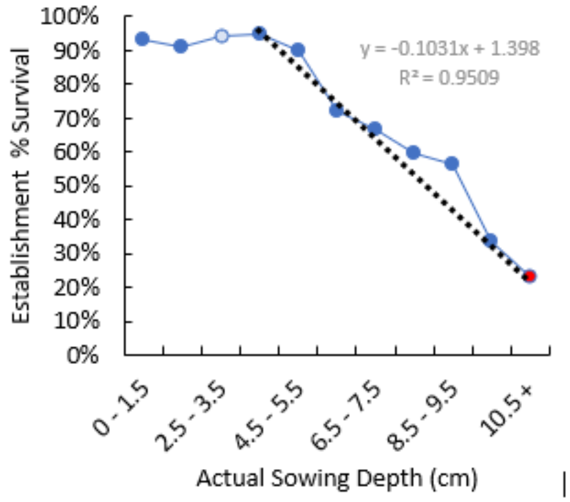

Figure 4. Relationship between seedling sowing depth and establishment survival from 5 April sowing at Wynarka sandy soil under optimal seedbed moisture conditions.

Although emergence was poor from > 5cm on these soils there were still some seeds that were able to emerge from this sowing depth and survive. This provides opportunity to exploit the interactions. Other management strategies such as cultivar type, seed size, and vigour also interact and are being explored. In a genetic study, Nelson et al. (2023) found that canola emergence at 50mm sowing depth was approximately 50% of the emergence rate at 20mm sowing depth for four common commercial cultivars across seven trials. They also tested a diverse range of genotypes from an international diversity panel and found that the best varieties from this diversity panel had emergence rates at 50mm sowing depth of up to 70% of their emergence rate when sown at 20 mm sowing depth. These cultivars originating from overseas sources, tended to be those identified as either having longer hypocotyls or high germination vigour. In contrast, Australian varieties uniformly have short-medium length hypocotyls. A new GRDC project (CSP2307-002RTX) has begun the process of introducing long hypocotyl genes from overseas varieties into Australian varieties with the aim of improving establishment potential. These are not yet commercially available. The other factor not discussed in this paper is the interaction between soil texture, compaction and soil strength which becomes more important when discussing soil depth and can be influenced by engineering and seeder setup.

Conclusion

This project will continue to work towards establishing the fundamental critical thresholds to update guidelines and reduce canola establishment failure. Key messages to date include:

- Establishment timing is more crucial for yield than plant density, with early sowing often leading to better outcomes.
- Consider the temperature forecast and soil moisture status at sowing as wet soil is cooler than dry soil, and surface soil temperatures can significantly exceed air temperatures, potential affecting seed development from shallow sowing.
- Sowing depth and soil type (ie.. sandy vs. clay) greatly influence germination and emergence thresholds and seeder setup and soil strength requires more investigation when scaling up.
- Deeper sowing typically reduces establishment, especially in heavier soils, however varietal differences, particularly in hypocotyl length and germination vigour, impact emergence, prompting efforts to incorporate beneficial traits from international varieties into Australian ones.

Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support. We would also like to acknowledge and thank all cooperating farmers technical staff and project collaborators from other regions of the national project.

Useful resources

https://grdc.com.au/resources-and-publications/all-publications/publications/2023/crop-establishment-and-precision-planting

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Notes

The WeedSmart Big 6

Weeding out herbicide resistance in winter & summer cropping systems.

The WeedSmart Big 6 provides practical ways for farmers to fight herbicide resistance.

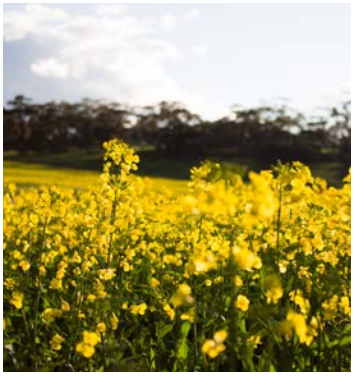
How many of the Big 6 are you doing on your farm?

We've weeded out the science into 6 simple messages which will help arm you in the war against weeds. By farming with diverse tactics, you can keep your herbicides working.

Rotate Crops & Pastures

Crop and pasture rotation is the recipe for diversity

- Use break crops and double break crops, fallow & pasture phases to drive the weed seed bank down,
- In summer cropping systems use diverse rotations of crops including cereals, pulses, cotton, oilseed crops, millets & fallows.



Mix & Rotate Herbicides

Rotating buys you time, mixing buys you shots.

- Rotate between herbicide groups,
- Mix different modes of action within the same herbicide mix or in consecutive applications,
- Always use full rates,
- In cotton systems, aim to target both grasses & broadleaf weeds using 2 non-glyphosate tactics in crop & 2 non-glyphosate tactics during the summer fallow & always remove any survivors (2 + 2 & 0).

Increase Crop Competition

Stay ahead of the pack

Adopt at least one competitive strategy (but two is better), including reduced row spacing, higher seeding rates, east-west sowing, early sowing, improving soil fertility & structure, precision seed placement, and competitive varieties.

Double Knock

Preserve glyphosate and paraquat

- Incorporate multiple modes of action in the double knock, e.g. paraquat or glyphosate followed by paraquat + Group 14 (G) + pre-emergent herbicide
- Use two different weed control tactics (herbicide or non-herbicide) to control survivors.

Stop Weed Seed Set

Take no prisoners

- Aim for 100% control of weeds and diligently monitor for survivors in all post weed control inspections,
- Crop top or pre-harvest spray in crops to manage weedy paddocks,
- Consider hay or silage production, brown manure or long fallow in high-pressure situations,
- Spray top/spray fallow pasture prior to cropping phases to ensure a clean start to any seeding operation,
- Consider shielded spraying, optical spot spraying technology (OSST), targeted tillage, inter-row cultivation, chipping or spot spraying,
- Windrow (swath) to collect early shedding weed seed.

Implement Harvest Weed Seed Control

Capture weed seed survivors

Capture weed seed survivors at harvest using chaff lining, chaff tramlining/decking, chaff carts, narrow windrow burning, bale direct or weed seed impact mills.

WeedSmart Wisdom

Never cut the herbicide rate – always follow label directions
Spray well – choose correct nozzles, adjuvants, water rates and use reputable products,
Clean seed – don't seed resistant weeds,
Clean borders – avoid evolving resistance on fence lines,
Test – know your resistance levels,
'Come clean. Go clean' – don't let weeds hitch a ride with visitors & ensure good biosecurity.

www.weedsmart.org.au

Flaxleaf fleabane and Feathertop Rhodes grass management

Chris Davey

WeedSmart; Next Level Agronomy.

Keywords

- Feathertop Rhodes grass, fleabane, resistance, WeedSmart Big 6.

Take home messages

- Exclusion and eradication are the first two steps in managing these weeds.
- Flaxleaf fleabane and Feathertop Rhodes grass (FTR) have a natural tolerance to glyphosate, so are best controlled when small.
- Glyphosate and paraquat resistance in fleabane has been measured, but paraquat is still useful on FTR.
- Crop competition is a useful tool.
- Pre-harvest herbicide application, for example, registered glyphosates and 2,4-D amine, may aid in management while weeds are small.
- Residual herbicides aid in longer term control but be wary of plantback periods to the following crop.
- Burial by cultivation can work but is only a short-term fix.
- Incorporate non-selective means of management, such as chipping, spot spraying, and wiping.

Background

Some summer weeds are becoming harder to manage out of our growing season, while also starting to become problematic within the growing season (such as fleabane). Effective herbicide options are limited, while common knockdown herbicides are increasingly proving to be inefficient in their control. What have we learnt about fleabane (in 20+ years), and are learning about FTR (in <10 years), that we can maybe implement on emerging weeds like gazanias?

Discussion

Flaxleaf Fleabane

- huge seed production – can produce 100,000+ seeds with 80% viability
- surface germinating – has flourished with the adoption of no-till
- seeds easily dispersed by wind
- seeds have no dormancy, so will germinate whenever conditions are right
- loves no competition – roadsides and fencelines
- naturally glyphosate tolerant
- now glyphosate and paraquat (AP) resistant
- local avoidance of chemicals that have activity on fleabane due to rotational and resistance constraints.

Feathertop Rhodes grass

- huge seed production – can produce ~150,000 seeds/plant
- wind dispersed
- surface germinating – favoured by no-till
- loves no competition – roadsides and fencelines

- matures very quickly when stressed
- naturally glyphosate tolerant
- short dormancy period
- high retention of seed in head – HWSM.

Management

- Identification (FTR)
  - On roadsides as juveniles.
- Exclusion
  - Control it when first seen on roadsides.
  - **Do not let it set seed.**
- Eradication
  - If you find it has 'jumped the fence', do everything to control it then.
- Containment
- Management

Control

- Chemical control options are limited.
- The key is to apply herbicides to juvenile weeds.
- Optimise competition with the weeds, whether it be from the crop, or from residual stubble.
- Fleabane only needs the ground to be wet for a handful of days to stimulate germination.

Some chemical residues provide beneficial control of fleabane after harvest. Is it getting to a point that a secondary herbicide needs to be planned late in the season for some residual control?

Isoxaflutole (Balance®) is a very useful residual product, that also provides control of milk-/sow-thistle.

WeedSmart Big 6

As resistance develops in weeds like fleabane and FTR, it is crucial for all involved to protect the longevity of any new products and minimise the risk of resistance. The WeedSmart Big 6 brings together weed research data with grower experiences to create a set of practical guidelines focused on minimising the weed seedbank without compromising profit.

The WeedSmart Big 6 that are important for fleabane and FTR include:

- know your resistance status
- double knock fleabane, to preserve paraquat if possible
- test, mix and rotate herbicides (while checking re-cropping intervals)
- increase crop competition
- stop weed seed set, particularly of FTR along any paddock boundaries

In addition, incorporate the following for other weeds in the paddock:

- rotate crops and pastures
- adopt harvest weed seed control

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2023–2025 GRDC SOUTHERN REGIONAL PANEL

December 2023

ANDREW RUSSELL, PANEL CHAIR
Rutherglen, Victoria

Andrew is the managing director and a shareholder of Lilliput Ag, and a director and shareholder of the affiliated Baker Seed Co, a family owned farming and seed-cleaning business. He has served on GRDC's medium rainfall zone Regional Cropping Solutions Network and has held leadership roles with Riverine Plains Inc, Victorian Farmers Federation and the Rutherglen Group of fire brigades.

PRU COOK, DEPUTY CHAIR
Dimboola, Victoria

Raised on a mixed farm in Victoria's Wimmera region, Pru has spent her professional career working in extension for the grains industry. Starting her career at the DPI, she has worked at GRDC and the Birchip Cropping Group, managing a number of extension projects. She has recently started her own business specialising in extension, project development and project management.

TIM MCCLELLAND
Birchip, Victoria

Tim farms with his wife, father and aunt on a 6500-hectare mixed property in the southern Mallee. After completing his Bachelor of Agriculture and Commerce at the University of Melbourne in 2006, he took on work at Advisor Edge, Birchip Cropping Group (BCG) and RMCG. In 2011, he moved back to Birchip to become formally involved in the family farm and continue his role with BCG.

RUTH SOMMERVILLE
Burra, South Australia

Ruth is an agroecologist who runs a consulting business. She has a Bachelor of Science in Ecology and Master of Applied Science in Wildlife Management from the University of Sydney, and has worked in sustainable agriculture research, development and extension and property management since 2002. Ruth has been the Upper North Farming Systems Group executive officer and project manager since 2013.

ANDREW WARE
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Andrew is a research agronomist who started his career with the South Australian Research and Development Institute (SARDI) and then spent time at CSIRO in Adelaide. This was followed by 10 years away from research, managing the family farm on the Lower Eyre Peninsula, before returning to SARDI. In 2019, he started his own research company, EPAG Research, delivering applied research across the Eyre Peninsula.

MICHAEL TRELOAR
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Michael is a third-generation grain grower who produces wheat, barley, canola, beans, lupins and lentils on a range of soil types. He has been involved in a number of research organisations, including the South Australian Grain Industry Trust (of which he was chair for four years), the Lower Eyre Agricultural Development Association and the South Australian No-Till Farmers Association (both of which he has been a board member).

NEIL FISHER
Adelaide, South Australia

Neil's family grain farming legacy dates back to 1889, giving him an extensive understanding of the challenges faced by grain growers in SA and Victoria across the Mallee, Wimmera and Riverina regions. With his wife Jenny, he retains a cropping/grazing property at Bordertown, producing wheat, canola, barley, beans and hay. He has held chief executive and board roles in organisations including Sugar Research Australia, Grains Council of Australia, Grape and Wine Research and Development Corporation and Plant Health Australia. Neil has previously worked for GRDC managing a large portfolio of research projects.

PETER DAMEN
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Peter is a grower from north-western Tasmania with more than 10 years' experience growing and processing commercial grain crops. He holds a degree in agricultural science from the University of Tasmania. Peter has production, research and development experience in quinoa, oats, buckwheat, spelt, hemp, adzuki beans, wheat, barley, ryegrass and more. He is working at Tas Stockfeed, focusing on technical support, sales and grain procurement and processing. In 2017, he was recognised as the Young Farmer of the Year.

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Kathy is a strategic science leader with a strong track record in developing and leading national research programs with industry co-investment, including GRDC. Her own research background is in plant biosecurity and molecular detection of plant pathogens and she has a strong interest in capacity building and succession planning. Kathy is a former acting executive director of SARDI and a research director at Crop Sciences, covering applied research on plant biosecurity, crop improvement, climate risk management, water use efficiency and crop agronomy.

DR PATRICIA FLYNN
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Patricia is a grower in the southern Wimmera, Vic. She holds a Bachelor of Science (Honours) from the University of Western Australia and a PhD from the Australian National University. Her expertise lies in farming systems research with a specific interest in soils management and farm business profitability. Patricia is the financial manager of a family mixed cropping and Merino sheep enterprise – Kwangaloo Pastoral. She held research and development positions at the WA Department of Agriculture, CSIRO, and what was the Department of Primary Industries in Victoria.

CRAIG BAILLIE
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Craig Baillie is GRDC's general manager of applied research, development and extension. He has oversight of research areas including sustainable cropping systems (agronomy and soils) and crop protection (pests, weeds and diseases). He also has responsibility for GRDC's grower and stakeholder engagement at a national level.

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- The local GRDC Grains Research Update planning committee that includes growers, advisers and GRDC representatives.

- Partnering organisation: Upper North Farming Systems

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OR use the form on the next page – tear it out and drop at the registration desk as you leave.

Thank you!

2024 Jamestown GRDC Grains Research Update Evaluation

1. How would you describe your main role? *(choose one only)*

- ❑ Grower
- ❑ Agronomic adviser
- ❑ Farm business adviser
- ❑ Financial adviser
- ❑ Communications/extension
- ❑ Grain marketing
- ❑ Farm input/service provider
- ❑ Banking
- ❑ Accountant
- ❑ Researcher
- ❑ Student
- ❑ Other* (please specify)

Your feedback on the presentations

For each presentation you attended, please rate the content relevance and presentation quality on a scale of 0 to 10 by placing a number in the box (**10 = totally satisfactory, 0 = totally unsatisfactory**).

2. Unlocking the value of lentils: *Dylan Bruce*

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

3. The value of protein maps in variable paddocks: *Sam Trengove*

Content relevance ☐ /10 Presentation quality ☐ /10

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4. Emerging pests and the risks to farming systems: *Maarten Van Helden*

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Have you got any comments on the content or quality of the presentation?

5. Overcoming a shifting seasonal break: *Kenton Porker*

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

6. Fleabane and Feathertop Rhodes grass management: *Chris Davey*

Content relevance ☐ /10 Presentation quality ☐ /10

Have you got any comments on the content or quality of the presentation?

Your next steps

7. Please describe at least one new strategy you will undertake as a result of attending this Update event

8. What are the first steps you will take?
e.g. seek further information from a presenter, consider a new resource, talk to my network, start a trial in my business

Your feedback on the Update

9. This Update has increased my awareness and knowledge of the latest in grains research

Strongly agree	Agree	Neither agree nor Disagree	Disagree	Strongly disagree
❑	❑	❑	❑	❑

10. Do you have any comments or suggestions to improve the GRDC Update events?

Thank you for your feedback.