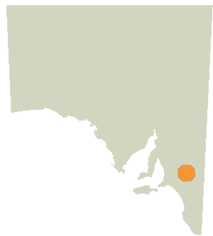
Sowing Strategies to Improve Productivity on Sandy Mallee Soils

Therese McBeath[1], Bill Davoren[1], Vadakattu Gupta[1], Rick Llewellyn[1]

[1]CSIRO Agriculture Flagship, Waite Campus, Adelaide.

Peer review: Sarah Noack, Hart Field-Site Group, Clare, South Australia



Why was the trial/project done?

Variable productivity on Mallee soil types has been linked to poor crop establishment. In turn this poor crop establishment has been related to the availability of water to the emerging crop, the management and positional availability of nutrients, disease pressure in the early phase of crop establishment and competition with grass weeds. As growers move towards earlier sowing dates, crops are often being sown on marginal early soil moisture. This trial looks at whether the potential benefits of sowing on last year's crop row to harvest any extra water and nutrition can outweigh risks of increased disease pressure and lead to better crop performance on Mallee soil types.

How was the trial/project done?

Trials were established at Karoonda (Lowaldie) to test the effects of a combination of sowing date and row position (on the previous crop row compared to between previous crop rows) treatments on the availability of water and nutrients, the density of weeds, the presence of disease, crop establishment and productivity on contrasting Mallee soil types (swale compared with dune).

Key Messages

- There were no measurable differences in 2014 wheat yield in response to two different sowing dates and sowing on-row vs. inter-row.
- On the sandy soil type, there was more plant available water (PAW) in the top 10cm when sowing on-row.
- Rhizoctonia inoculum was higher with on-row compared to inter-row sowing but this did not carry through to an effect on rhizoctonia infection in the crop.
- In a season where the profile PAW was similar for the two sowing dates (April 30 and May 14) crop establishment was better with the earlier time of sowing but ryegrass pressure on the swale was also higher with the earlier time of sowing.

About the trial

The trial was established in 2014 on a paddock that had been under continuous cereal for several years. Treatments were repeated on the sandy dunes soil and the heavier swale type soil. Corack wheat was sown at 70 kg/ha with 50 kg/ha DAP and 24 kg/ha Urea applied below the seed. In addition 33 kg/ha of potassium sulfate was applied pre-seeding to avoid deficiencies of potassium or sulfur and a trace element spray including zinc, copper and manganese was applied at early tillering. The trial consisted of four treatments as described in Table 1 that were replicated four times and on two soil types (dune and swale). All crop row spacings were 28 cm.

Table 1. *Treatments for the Sowing Strategies trial*

Treat	Time of Sowing	Row Position
1	30th April	On –row
2	30th April	Inter-row
3	14th May	On –row
4	14th May	Inter-row

The collection of data at the trial site (not all reported in this article) included;

- Proximal sensing with EM 38
- Pre-sowing soil tests-plant available N and plant available water (PAW)
- Assessment of weed and panicle density
- Disease inoculum and infection
- Crop establishment
- Plant biomass at first node and anthesis
- NDVI at late tillering/jointing
- Harvest Index, grain yield and protein

Results

Nutrition and Water

Soil mineral N measured in late April was not significantly different when sampled on-row compared to inter-row. However, as shown in Table 2 there was a high level of variation about the values measured both in the top 0.1m and for mineral N summed over the top m of the soil profile.

Table 2. *Pre-seeding 2014 mineral nitrogen (kg/ha) ± standard error from soil cores taken on last year's crop rows (on-row) and between last year's crop rows (inter-row).*

Soil	Row Position	Mineral N (kg/ha/0.1m)	Mineral N (kg/ha/m)
Dune	On-row	11±2	44±1
	Inter-row	8±2	34±6
Swale	On-row	32±5	125±15
	Inter-row	27±7	118±8

Profile PAW was measured prior to the sowing dates in late April and mid-May. Conditions were quite similar for the two sowing dates and the only significant difference was in the dune at the time of the April sowing where there was significantly more PAW in the top 0.1m on-row compared to inter-row ($P<0.05$, LSD 1.5, Table 3).

Table 3. *Pre-seeding 2014 plant available water (PAW) ± standard error from soil cores taken on last year's crop rows (on-row) and between last year's crop rows (inter-row).*

		April Sowing		May Sowing	
Soil	Row Position	PAW (mm/0.1 m)	PAW (mm/m)	PAW (mm/0.1 m)	PAW (mm/m)
Dune	On-row	4.1±0.6	87.0±12.7	4.5±1.2	85.1±10.2
	Inter-row	1.7±0.5	70.5±10.8	1.1±0.4	81.1±7.1
Swale	On-row	17.5±2.3	91.8±27.9	12.1±1.6	127.8±33.9
	Inter-row	18.2±2.2	110.7±41.3	11.9±1.3	87.8±20.5

Disease

Inoculum levels for soil borne pathogens (Takeall (Ggt) and Fusarium) at seeding were generally higher on-row compared to inter-row (Figure 1 and Table 4). Rhizoctonia inoculum (*Rhizoctonia solani* AG8) levels were not different between on-row and inter-row as it forms hyphal networks whereas the other diseases are more closely associated with decomposing stubble material.

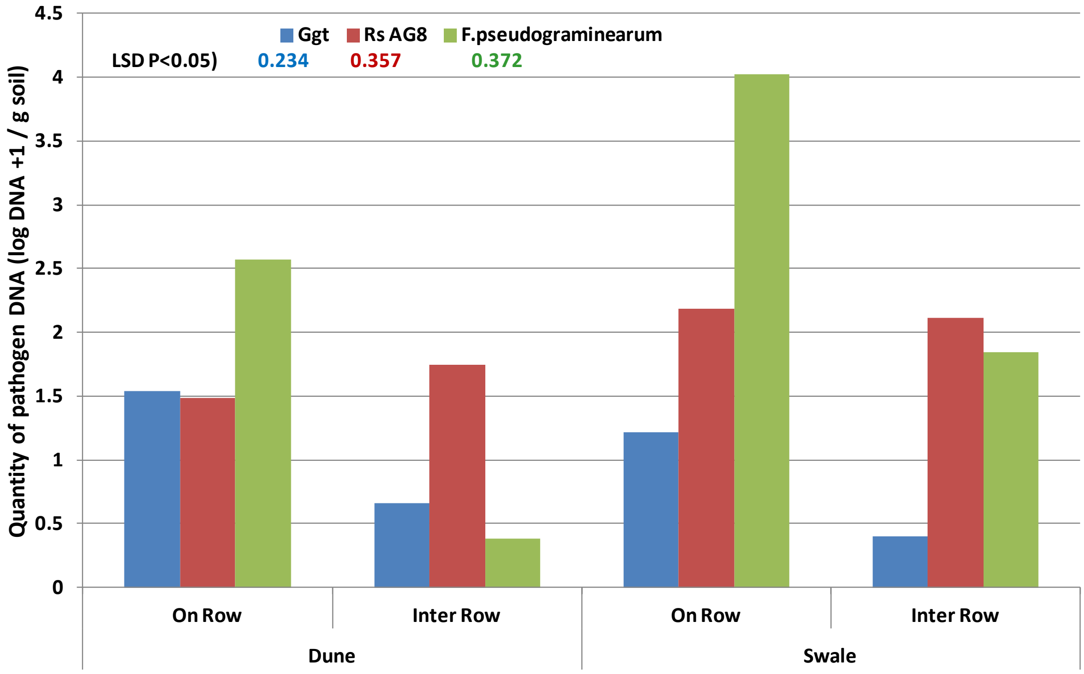


Figure 1. *Disease inoculum levels for Takeall (Ggt), Fusarium (F. pseudograminearum) and Rhizoctonia (RsAG8) in soil on last year's crop rows and in the inter-row.*

Table 4. *Disease risk ratings Takeall (Ggt), Fusarium (F. pseudograminearum) and Rhizoctonia (RsAG8) in soil on last year's crop rows and in the inter-row.*

Location		***Ggt***	***Rs-AG8***	***F.pseudograminearum***
Dune	***On Row***	*Medium*	*Medium*	*Med-High*
	Inter Row	*BDL*	*Medium*	*BDL*
Swale	***On Row***	*Medium*	*High*	*High*
	Inter Row	*BDL*	*High*	*Low*

*BDL = Below Detection Level

Root disease scores for rhizoctonia at 8 weeks after seeding were significantly higher on the dune compared with the swale but no significant difference between on row and inter-row were found (Figure 2).

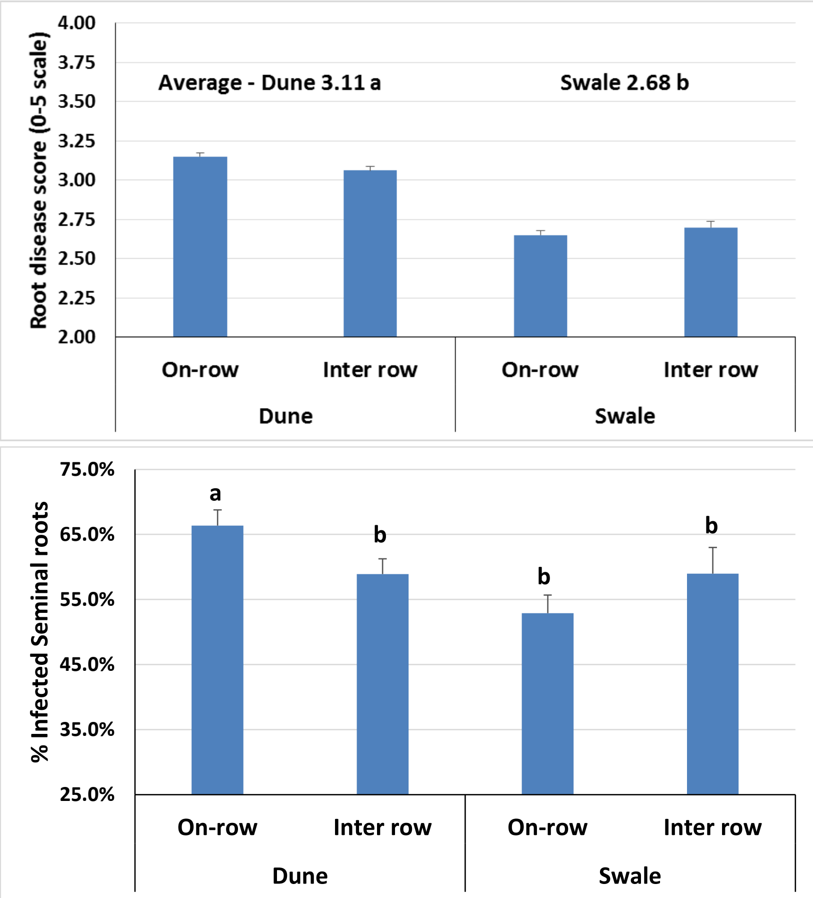


Figure 2. *Rhizoctonia root rot incidence for wheat plants sown on last year's crop rows and between last year's crop rows. The higher the score the greater the level of disease impact on crop roots; Treatments followed by different letters are significantly different at LSD P<0.05.*

Crop Establishment

Crop emergence was significantly better following the April sowing date compared with May on both soil types, while there was no difference between the sowing row positions (Table5).

Table 5. *Crop emergence (plants/m^2) in response to sowing date and row position. Within a soil, emergence appended by a different letter is significantly different.*

Soil	Row Position	April Sowing	May Sowing
Dune	On-row	82	59
	Inter-row	68	51
	Mean (P<0.05, LSD 15)	75^a	55^b
Swale	On-row	110	83
	Inter-row	113	79
	Mean (P<0.05, LSD 10)	112^a	81^b

Weeds

Grass weeds were monitored at three points in the growing season using fixed monitoring points in four replicate plots for each treatment. The position of the sowing row did not have a significant effect on the population density of rye or brome grass. Early sowing in April did result in a higher rye grass population compared with May sowing on the swale at the two sampling times that occurred before application of hoegrass®(Table 6).

Table 6. *Rye and brome grass populations (plants/m²) counted at fixed sampling points at three times during the growing season. Where a mean rye count is appended by a different letter, the sowing date had a significant effect on the rye grass population (P<0.05).*

Soil	**Treatment**	**Count 1- 30DAS***		**Count 2- 45DAS**		**Count 3- 90DAS#**	
		Brome	Rye	Brome	Rye	Brome	Rye
Dune	April Sowing						
	On-row	2.7	0.2	2.7	0.2	5.8	0.0
	Inter-row	8.6	0.0	12.8	0.6	8.6	0.0
	May Sowing						
	On-row	0.2	0.0	2.5	0.0	1.6	0.0
	Inter-row	4.0	0.7	0.7	0.0	6.0	0.0
Swale	April Sowing						
	On-row	0.0	14.3	0.0	15.2	0.0	0.5
	Inter-row	0.0	11.0	0.0	15.2	0.0	0.0
	Mean		12.7[a]		15.2[a]		
	May Sowing						
	On-row	0.0	5.5	0.0	3.3	0.0	0.7
	Inter-row	0.0	4.7	0.0	6.9	0.0	1.1
	Mean		5.1[b]		5.1[b]		

*DAS, days after sowing #Post-application of hoegrass® herbicide to control ryegrass.

As there were no surviving ryegrass plants within the fixed sampling points, only brome grass was destructively harvested at crop maturity in order to measure the brome grass plant density and seed production. Both the plant density and seed production showed a response to sowing row position (P<0.05) with significantly more plants following inter-row sowing compared with on-row sowing (64 vs 14 plants/m²) and as a result significantly more seeds following inter-row sowing (1859 vs 389 seeds/m²) (Table 7).

Table 7. *Plant density (plants/m²), total seed production (seeds/m²), and plant seed production (seeds/plant) ± standard error of brome grass at maturity.*

		Plant density (plants/m²)	Seed density (seeds/m²)	Plant seed production (seeds/plant)
April sowing	On row	21±10	579±317	24±5
	Inter row	70±41	1925±1183	27±3
May sowing	On row	7±4	199±147	26±5
	Inter row	58±33	1793±1062	30±1

Crop Productivity

No differences between treatments were measured at tillering or anthesis and the data is not shown. In addition there were no treatment effects on grain yield or protein in the 2014 growing season (Table 8).

Table 8. *Mean grain yield (t/ha) and protein (%) ± standard error in response to sowing date and sowing row position.*

		April Sowing		May Sowing	
Soil	Row Position	Yield (t/ha)	Protein (%)	Yield (t/ha)	Protein (%)
Dune	On-row	1.34±0.03	9.8±0.3	1.34±0.1	9.8±0.2
	Inter-row	1.43±0.2	9.8±0.2	1.39±0.1	9.5±0.2
Swale	On-row	2.23±0.1	11.0±0.2	2.01±0.1	11.3±0.2
	Inter-row	2.07±0.1	11.0±0.3	2.05±0.1	10.9±0.2

Implications for commercial practice

- There were measurable effects of time of sowing on ryegrass populations, with earlier sowing resulting in poorer control on the swale but better crop establishment on both the dune and swale.
- There were measurable effects of sowing row position on soil moisture (more on-row in the dune), disease (more on-row) and weeds (more brome grass inter-row in the dune).
- These effects did not translate into a yield effect in 2014.

Acknowledgements

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