Maintaining profitability in retained stubble systems on upper Eyre Peninsula

A joint EPARF and GRDC funded project.

Guideline 14: Economic analysis of sowing position on non-wetting sands

How was it done?

The brome grass version of the RIM model[1] was used to look at the inclusion of near-row compared to inter-row sowing over a 10-year crop sequence. This sequence was three cereal crops followed by a legume break. The first cereal crop was a Clearfield variety with the use of Intervix herbicide.

Near-row or on-row sowing aims to leave the previous year's row as undisturbed as possible, but you are aiming to put the new row in close proximity in order to harvest the resources and benefits of the previous row.

The two most recent trials had a reduction in brome grass numbers by 70%, but other trials are closer to 40%. When using the RIM model, a conservative 40% brome grass reduction was used for near-row sowing.

The rotation used in the RIM model was four years of CL wheat, wheat, barley, legume. The RIM model requires an input on brome grass control for each herbicide (Table 1).

The rotation of CL wheat/wheat/ barley/legume was run over eight years, followed by two non-Clearfield wheats. The starting brome grass numbers were set at 10 plants/m², which is in the low to medium range.

What happened?

Over the 10 year sequence the following brome grass numbers per square metre and seeds in the soil next autumn per square metre were predicted, comparing near-row and inter-row sowing (Tables 2 & 3, Figures 1 & 2). Gross margins were also completed for each year.

KEY MESSAGES

- It has been shown that establishing cereal crops on last year's row has given an improved germination on non-wetting soils. However, this improved germination has not translated through to yield.
- The main advantage to the near-row sowing in non-wetting sands has been the reduction of brome grass numbers by up to 70%. This occurred at both trials on the Eyre Peninsula and Karoonda in the Murray Mallee. This reduction of brome grass is due to the majority of seeds being shed into last year's row. With the better crop germination with near-row sowing the crop competition is greater.
- On other soil types where non-wetting is not the issue there has been a yield advantage for inter-row sowing compared to near-row sowing. This yield reduction in near-row sowing has been put down to root diseases such as Take-all, CCN and Crown rot.
- The advantage of near-row sowing is confined to the non-wetting soils.
- The ability for seeding equipment to sow near-row and inter-row requires accurate GPS coupled with a unit like a Pro Trakker, which has a GPS unit on the bar as well as the tractor to keep the bar accurately aligned. There are other systems available to align the bar and tractor for the accuracy required.
- With the high likelihood of brome grass developing resistance to Intervix, the addition of near-row sowing reduces the requirements for its use in a crop sequence.

Table 1. Expected percentage reduction in brome grass weeds using specific herbicides.

Herbicide	Brome grass weed control used in RIM (%)
Trifluralin	30
Trifluralin/Metrabuzin	45
Sakura	60
Sakura/Avadex	75
Intervix	98

Table 2. Near-row sowing RIM simulation over 10 years.

Year	1	2	3	4	5	6	7	8	9	10
Crop type	CL Wheat	Wheat	Barley	Legume	CL Wheat	Wheat	Barley	Legume	Wheat	Wheat
Weed control 1	Trifluralin	Trfluralin	Trifluralin Metrab.	Clethodim	Trifluralin	Trfluralin	Triflualin Metrab.	Clethodim	Trifluralin	Trifluralin
Weed control 2	Intervix			Crop top	Intervix			Crop top		
Plants/ m²	7	16	20	3	1	2	3	0	1	2
Seeds/ m²	116	173	193	51	15	23	26	7	18	27
Gross margin ($/ha)	131	165	140	212	257	222	152	221	278	221
Average gross margin for near-row sowing ($/ha)									200	

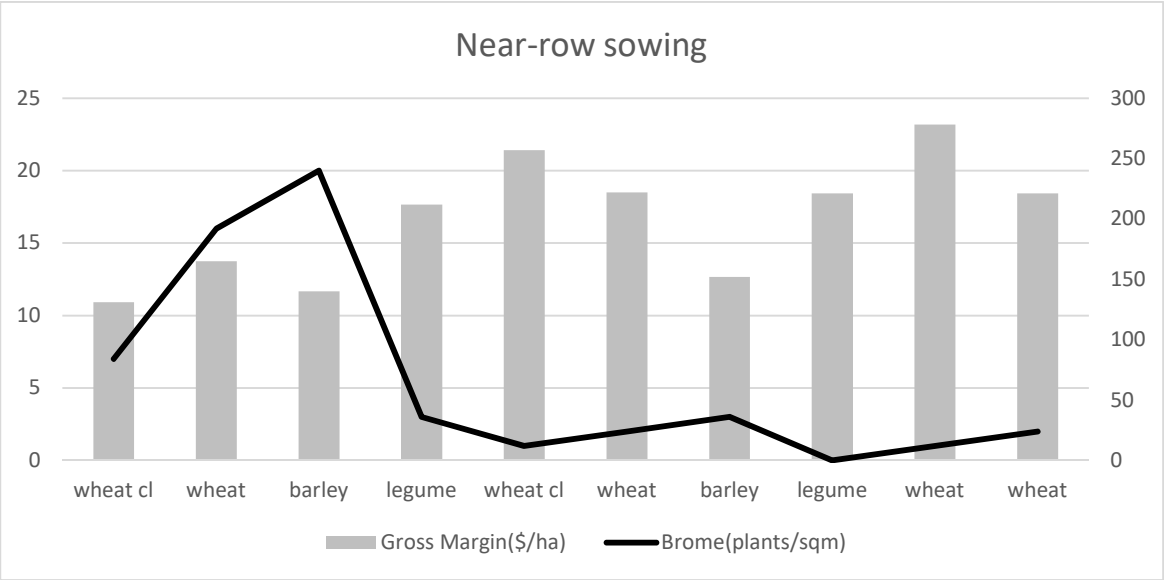

Figure 1. Number of brome grass plants/m² over the 10-year sequence (line) and gross margins ($/ha) for each crop type (block) in the near-row sowing scenario.

Table 3. Inter-row sowing RIM simulation over 10 years.

Year	1	2	3	4	5	6	7	8	9	10
Crop type	CL Wheat	Wheat	Barley	Legume	CL wheat	Wheat	Barley	Legume	Wheat	Wheat
Weed control 1	Triflurali n	Trflurali n	Triflurali n Metrab	Clethodi m	Triflurali n	Trflurali n	Triflual in Metra b	Clethodi m	Triflurali n	Triflurali n
Weed control 2	Intervix			Crop top	Intervix			Crop top		
Plants/ m²	10	25	48	7	3	7	15	2	9	22
Seeds/ m²	124	292	>300	129	37	92	165	44	108	257
Gross margin ($/ha)	129	159	129	192	247	216	147	207	261	200
Average gross margin for inter-row sowing ($/ha)									189	

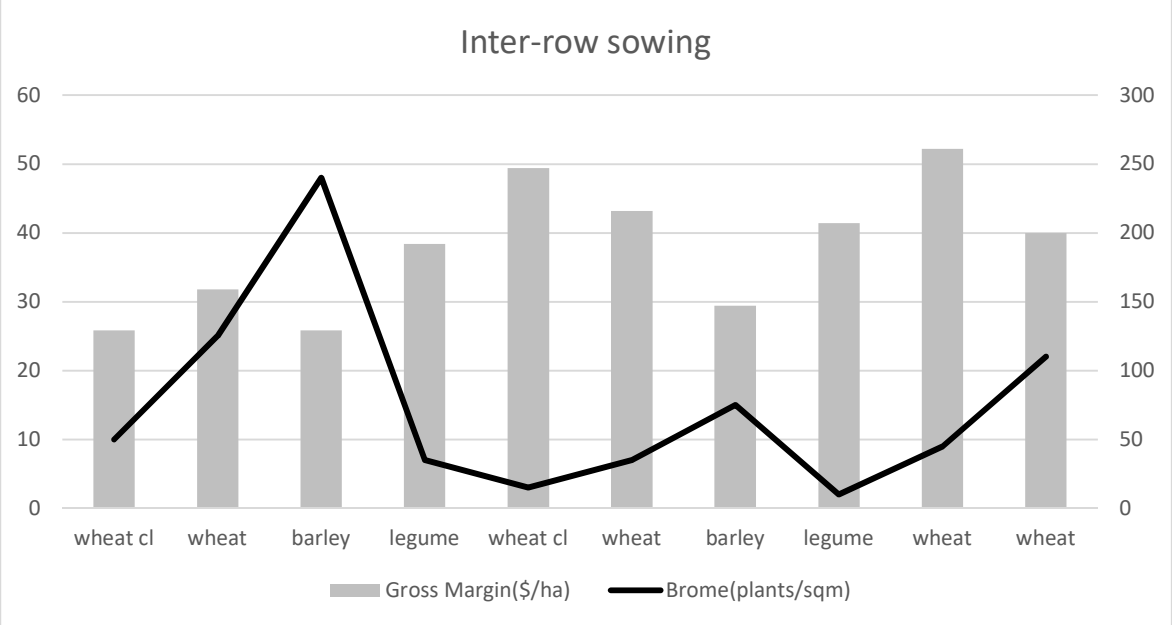

Figure 2. Number of brome grass plants/m² over the 10-year sequence (line) and gross margins ($/ha) for each crop type (block) in the inter-row sowing scenario.

Table 4. RIM model results after 10 years of simulated control.

	Average annual gross margin ($/ha)	Brome (plants/m²)	Brome (seeds in soil/m²)
Near-row	200	2	27
Inter-row	189	22	257

The gross margin difference was $11.20/ha/year in favour of near row sowing. Brome grass numbers in inter-row sowing are 22 plants/m² (near-row 2 plants/m²) and seeds/m² are 257/m² (near-row 27

seeds/m²) at the end of 10 years (Table 4). Even though Intervix has been used twice in the 10-year period for both near-row and inter-row sowing, brome grass numbers are 10 times higher in the inter-row sowing scenario.

The main concern is the longevity of Intervix to continue to have high brome grass control after multiple applications. The increase in resistance to Intervix by brome grass is expected to occur so it is important to include non-chemical control measures such as near-row sowing to aid in its effectiveness.

Cost of technology to allow near-row and inter-row sowing

The economic advantage has been shown on inter-row sowing (on wetting soils) and near-row sowing (on non-wetting soils). The increase in yields from inter-row sowing is due mainly to less root diseases. This yield increase over 7 trials was 6% (Matt McCallum et al. 2007)[2]. With near-row sowing on non-wetting soils, the advantage is reduced brome grass numbers with a smaller gross margin increase.

To be successful with near-row and inter-row sowing, Pro Trakker type of equipment is required. The Pro Trakker has a receiver on the tractor and another on the bar, both on +/– 3.8 cm accuracy. The additional cost over current GPS would be approximately $30,000. The depreciation cost plus interest on monies borrowed would be $4,800/annum, so depending on the hectares covered by the seeder, this will give a cost/ha. i.e. 2000 ha = $2.40/ha for the technology. This cost is covered by the small increase in gross margin with near-row sowing of $11.20/ha.

The inter-row sowing on other soil types with an increased average of 0.12 t/ha (6% of 2.0t/ha crop) with wheat valued at $250/t is a benefit of $30, minus the technology cost of $2.40/ha.

Some considerations for near-row and inter-row sowing:

- Your auto steer needs to record direction of travel. Not all bars are symmetrical so it is important to travel the same direction each year.
- Switching between near-row sowing (on non-wetting soils) and inter-row sowing (on the better soils) in the same paddock will be difficult. If the different soil types are large enough they can be sown as separate fields.
- Improved trash flow when inter-row sowing.
- Some legumes (especially lentils) grow taller in standing stubble to access sunlight, so they have a higher harvest height with inter row sowing.
- Less erosion risk on the non-wetting sands with quicker establishment using near-row sowing.

Produced by Ed Hunt, February 2018

Acknowledgements

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References

1. RIM: Ryegrass Integrated Management https://ahri.uwa.edu.au/research/rim/
2. Matt McCallum et al. 2007, Multiple Benefits from Inter-row Sowing with 2cm RTK GPS.

This guideline has been developed for the Eyre Peninsula Agricultural Research Foundation as part of the Maintaining profitable farming systems with retained stubble - upper Eyre Peninsula (EPF00001), funded by the Grains Research and Development Corporation (GRDC). The initiative involves farming systems groups in South Australia, Victoria, southern and central New South Wales and Tasmania collaborating with research organisations and agribusiness to explore and address issues for growers that impact the profitability of cropping systems with stubble, including pests, diseases, weeds, nutrition and the physical aspects of sowing and establishing crops in heavy residues.