

Demonstrating adaptive cropping systems to improve crop competition

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Location

Lock
A & J and T & E Polkinghorne

Rainfall

Av. Annual: 336 mm
Av GSR: 250 mm
2021 Total: 352 mm
2021 GSR: 242 mm

Soil type

Red loam flats and sand hills

Demonstration size

8 rows of splitter boot x 4 measurements on each soil type. Disc seeder, 12 m width x 4 measurements

Location

Minnipa
B & K Heddle

Rainfall

Av. Annual: 324 mm
Av GSR: 241 mm
2021 Total: 406 mm
2021 GSR: 248 mm

Soil type

Red sandy loam and grey loam rise

Plot size

27 m wide paddock seeder strips x 4 measurements

Key messages

- **Crop establishment in 2021 was better in a no-row cropping system in a poor production zone at Minnipa.**
- **At Lock in 2021 cereal establishment was better using Stiletto splitter boots in 30 cm row spacings and also better using a single disc system with 25 cm row spacing, compared to a single boot 30 cm system.**

- **In 2021 ryegrass populations were the same for all seeding systems but there were higher weed populations in the poorer soil zones.**
- **In both seasons at Lock, splitter boots resulted in better wheat establishment in the sandy soil which may be an important management tool for light fragile soils.**

Why do the trial?

A NLP2 Smart Farms grant (4-BA9KBX5) was received in October 2019 through EPARF, now AIR EP, to demonstrate different cropping systems which increase crop competition with weeds, including splitter boots and narrower row spacings. Two demonstration sites were established in both 2020 and 2021 to evaluate seeding systems with increased seed 'spread' using splitter boots for the prospect of better weed competition and better cover for fragile soils.

How was it done?

Two farmer implemented demonstrations were undertaken in 2021.

The sites and treatments were:

- Minnipa (Bruce Heddle); 30 cm tine spacings with splitter boots resulting in 25 cm row spacings, and a no-row spacing seeding system. The no-row system was chosen to control woody weeds at seeding and increase crop competition against grass weeds.
- Lock (Andrew and Tim Polkinghorne); Seedhawk[®] on 30 cm tine spacings, either with Stiletto[®] splitter

boots (resulting in 25 cm row spacings) or with 30 cm single narrow boots, or a Bourgault[®] single disc system on 25 cm row spacings.

The demonstration at each site was conducted over two soil types, a red loam and a sandier rise. The rise was a grey loam at Minnipa and a white sand at Lock. The demonstration strips were managed the same as the whole paddock by the grower using current best practice.

Crop establishment, grass weed numbers (early and late), dry matter (early and late), grain yield and grain quality were assessed.

What happened?

Late opening rains were received in late May/early June 2021 at both sites which resulted in seeding later than the ideal sowing window in the upper EP environment. June and July had above average rainfall resulting in good crop growth until August, but little rainfall in September resulted in crop stress at the critical timing of flowering and seed fill. Late October rainfall was too late to have a positive impact on earlier sown crops in the region but had some benefit on later crops.

Table 1: Wheat performance and grass weed numbers in two seeding systems on two soil types at Minnipa, 2021.

Soil type	Seeding system	Wheat establishment (plants/m ²)	Early ryegrass (plants/m ²)	Early wheat biomass (t/ha)	Late ryegrass (plants/m ²)	Late wheat biomass (t/ha)	Yield (t/ha)	Protein (%)	
Red Loam	Splitter boots	121 b	25	0.34	17	7.2	2.0 c	14.2	
	No rows	124 b	10	0.40	7	6.5	2.9 a	11.2	
Grey Loam	Splitter boots	167 a	17	0.13	37	5.6	1.9 c	10.8	
	No rows	102 b	16	0.12	34	5.4	2.3 b	10.5	
<i>Seeding system x Soil type</i>		<i>LSD (P=0.05)</i>	<i>27</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>ns</i>	<i>0.2</i>	<i>-</i>

Table 2: Wheat performance and grass weed numbers on two soil types at Minnipa, 2021 (averaged over both seeding systems).

Soil type	Wheat establishment (plants/m ²)	Early ryegrass (plants/m ²)	Early wheat biomass (t/ha)	Late ryegrass (plants/m ²)	Late wheat biomass (t/ha)	Yield (t/ha)	Protein (%)	
Red Loam	122	17	0.37	12	6.9	2.44	12.7	
Grey Loam	134	16	0.13	36	5.5	2.09	10.7	
<i>LSD (P=0.05)</i>		<i>ns</i>	<i>ns</i>	<i>0.9</i>	<i>11.4</i>	<i>0.9</i>	<i>0.12</i>	<i>-</i>

Table 3. Wheat performance and grass weeds in seeding systems and soil types at Lock, 2021.

Soil type	Seeding system	Wheat (plants/m ²)	Early ryegrass (weeds/m ²)	Early wheat dry matter (t/ha)	Late ryegrass (weeds/m ²)	Late wheat dry matter (t/ha)	Yield (t/ha)	Protein (%)
Heavy Red Loam	30 cm single row	98 b	69	0.10 d	360	4.6	1.92	13.8
	30 cm Stilletto splitter boot (25 cm row spacing)	88 c	67	0.13 cd	198	5.0	2.03	14.3
Sandy rise	30 cm single row	100 b	6	0.18 b	27	7.2	3.65	10.9
	30 cm with Stilletto splitter boot (25 cm row spacing)	129 a	29	0.45 a	11	9.1	4.32	12.1
	25 cm single disc	122 a	11	0.15 bc	5	11.6	4.54	14.0
<i>Seeding system x Soil type</i>		<i>LSD (P=0.05)</i>	<i>8</i>	<i>ns</i>	<i>0.04</i>	<i>ns</i>	<i>ns</i>	<i>-</i>

Table 4: Wheat performance and grass weed numbers on two soil types at Lock, 2021.

Soil type	Wheat establishment (plants/m ²)	Early ryegrass (plants/m ²)	Early wheat biomass (t/ha)	Late ryegrass (plants/m ²)	Late wheat biomass (t/ha)	Yield (t/ha)	Protein (%)	
Heavy Red Loam	93	68	0.11	279	4.79	1.97	14.1	
Sandy rise	110	16	0.28	16	8.82	4.09	12.3	
<i>LSD (P=0.05)</i>		<i>5</i>	<i>12</i>	<i>0.03</i>	<i>78</i>	<i>1.07</i>	<i>0.52</i>	<i>-</i>



Figure 1. Three different seeding systems at Lock in 2021, (a) Lock red loam - single row (left) and splitter boot (right), (b) Lock sand - splitter boot middle eight rows (larger gap is edge of seeder run), rest is single row and (c) Lock sand - single row disc system.



Figure 2. Two different seeding systems at Minnipa in 2021. 30 cm with splitter boot system (left) and no row seeding system (right). (a) sandy rise, (b) red loam.

Minnipa

At Minnipa crop establishment was higher in the no-row system in the grey soil type (Table 1). The poor paddock zone is a greyer soil type on top of a rise and the good zone is a red sandy loam. There were no differences in early or late ryegrass numbers between the seeding systems in the two soil types at Minnipa (Table 1). The poor paddock zone had higher weed numbers than the good zone (Table 2).

There were no differences in early or late crop dry matter between seeding systems, but again the good red loam soil zone had higher late dry matter than the poorer zone (Table 1).

Grain yield at Minnipa was higher in the no-row system on the red loam. Grain protein was also higher in the good zone compared to the poor zone (Table 1).

Lock

At Lock wheat establishment was better with Stiletto splitter boots (25 cm row spacing) and the 25 cm single disc system, than the 30 cm single row (Table 3) on the sandy rise. In the heavier red loam wheat establishment was greater in the single row than with Stiletto splitter boots.

Early and late ryegrass numbers were the same for all seeding systems on each soil type at Lock (Table 3), although the heavier red

loam soil had much higher weed numbers overall than the sandy soil (Table 4).

Early crop dry matter was higher with Stiletto splitter boots on the sandy rise (Table 3) but by flowering, crop biomass was the same for all seeding systems. Crop biomass was higher at flowering on the sandy rise than on the heavy red loam flat.

Similar grain yields were produced with all seeding systems on both soil types (Table 3 and 4). Grain protein was higher on the heavier red loam (14.1%) compared to the sand (12.3%) (Table 3).

What does this mean?

The two seasons of the paddock scale demonstrations showed:

- In 2021 crop establishment was higher in the no-row system in the sandy rise at Minnipa.
- In 2021 at Lock cereal establishment was higher with Stilletto splitter boots and the 25 cm single disc system, compared to the 30 cm single row.
- In 2021 there were no differences in ryegrass populations between the seeding systems but there were differences in weed

numbers and potential weed seed set between the soil zones in the paddocks.

- In 2020 at Minnipa establishment counts were lower in the no-row system due to herbicide damage.
- At Lock in 2020 early ryegrass numbers were lower in the split row seeding system on the red loam supporting previous research that increasing crop competition is a management tool to lower grass weed numbers. Late grass weed numbers and seed set were similar in both seeding systems.

- In both seasons at Lock there was better wheat establishment in the sandy soil with the splitter boot which may be an important management tool in light fragile soils.

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Bruce Heddle, Amanda Cook and Andrew Polkinghorne speaking at Minnipa Field Day, September 2021.



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