

Engaging the soil at seeding with a single disc opener

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Purpose:	To demonstrate the effect of seeder type and operation on the efficacy and safety of pre-emergent herbicides in barley.
Location:	Beacon
Soil Type:	Red brown sandy loam
Soil Results:	pH 6
Rotation:	2008 wheat; 2007 wheat; 2006 chemical fallow
GSR:	approx. 170mm (based on weather station)

BACKGROUND SUMMARY

Broadacre growers have shown an increased interest in disc seeders because they allow for easy stubble management, faster planting and improved soil structure via stubble retention and reduced disturbance. However, concerns about effective weed management have been one of the greatest limitations to adoption of disc seeding systems. The way soil is engaged at seeding is highly dependent upon the type of seeder used and speed of operation. This trial was designed to explore the way soil is handled at various sowing speeds and to test the efficiency of pre-emergent herbicide mixes in terms of weed control and crop safety.

TRIAL DESIGN

This non-replicated demonstration comprising of 24 plots (two seeding machines by three herbicide rates (plus a nil treatment) by three sowing speeds) was undertaken using farm scale machinery (Table 1). To calculate treatment averages measurements were replicated three times across the plot.

The demonstration, located in Beacon, was sprayed with strips of different pre-emergent herbicide treatments (IBS) and sown in the opposite direction to Mundah barley on the 18th of May 2009. The disc seeder used was a 12m wide NDF single disc seeder on 38cm row spacing. The tyne machine used was a 12m wide Flexicoil maxi point (blade 13mm wide) with 25cm row spacing. The boom widths were 36.6m for all sprayed plots and 18.3m for the control plots.

Agronomic details are specified in Table 2. Barley was inter-row sown into ungrazed, tall (>300mm) standing wheat stubble (approximately 3.8t/ha stubble load).

Table 1. Treatments Procedure

Factor 1: Seeding machine	Factor 2: Sowing speed	Factor 3: Herbicides
Flexicoil (tyne machine)	8 km/h	Nil (control)
NDF (single disc machine)	10 km/h	Trifluralin 1.5L/ha
	14 km/h	Trifluralin 1.5L/ha + Lexone® 150g/ha
		Boxer Gold® 2L/ha

Table 2. Agronomic details

Date	Operation	Notes	Input Applied	Rate (/ha)
Pre sowing	Spray	Knockdown all treatments		
18 May 2009	Spray	IBS, 1-2 hours before sowing	As per treatments	As per treatments
18 May 2009	Seeding		Barley (Mundah)	50kg/ha
18 May 2009	Fertiliser	At seeding	Agflow®	50kg/ha
30 July 2009	Fertiliser	By boom spray	Flexi N®	25L/ha

RESULTS

Sowing depth: Sowing depth was reduced with increasing speeds for both seeding systems (see Table 3). Barley seeds however were observed on the soil surface at 8km/h and 10km/h for the tyne machine and at 14km/h for the disc machine. These seeds were excluded from the average seeding depth. Unburied seed was probably due to the tynes deflecting backward from their optimal operating position, while high speeds may have reduced penetration and induced seed entrainment (change of seed trajectory) for the single discs.

Table 3. Sowing depth (mm) recorded on the 15th June 2009.

SOWING METHOD	SOWING SPEED		
	8km/h	10km/h	14km/h
Disc	17	15	12
Tyne	17	15	13

Plant count: For sprayed treatments, barley seedlings counted 28 days after sowing (DAS) were generally lowest for the tyne machine at 8km/h (<200 seedling/m²) and highest for the single disc seeder at 10km/h (Table 4). Fluorescent dye was applied to the ground at the front of the control plots and after sowing with the tyne at 8km/h, unincorporated dye was observed along the side of the furrow. With approximately 30mm of rain falling 4 DAS, it is likely that herbicide washed back into the bottom of the furrow, hindering crop emergence. Comparing matching speeds only, the crop counts overall were greatest for disc sown plots. The 10km/hr treatment generally had the greatest plant establishment due to soil being thrown from the furrow. At the 14km/hr speed, this benefit was moderated by a reduction in seeding depth.

The tall height of the stubble may have attributed to poor seed placement of tyne sown plots as the tyne machine tended to deflect backward due to the additional load of dragged stubble that caused some clumping within the frame.

The application of treatments containing metribuzin showed little improved safety with additional speed in the disc treatments, whereas crop safety was improved in the tyne treatments with speed as soil throw was greater.

Table 4 Barley counts per metre squared for all treatments recorded on the 15th June 2009.

HERBICIDE TRT	SINGLE DISC			TYNE MACHINE		
	8km/h	10km/h	14km/h	8km/h	10km/h	14km/h
Nil	197	263	316	209	207	175
Boxer Gold 2L/ha	210	286	193	186	233	153
Trifluralin 1.5L/ha	201	246	246	140	190	242
Trifluralin 1.5L/ha + Lexone 150g/ha	222	218	222	158	176	225

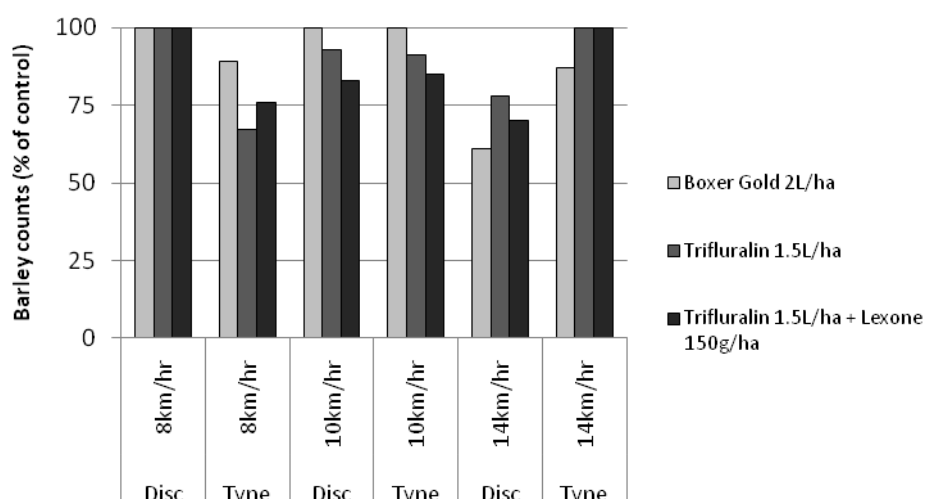


Figure 1 Barley seedlings as a percentage of the control demonstrating crop safety of pre-emergent herbicides at various sowing speeds.

Crop safety (as a function of plant establishment presented as a % of nil control) was lowest for the following treatments; Boxer Gold® x 14km/h x disc and Trifluralin x 8km/h x tyne, 61% and 67% of the control, respectively (Figure 1). Trifluralin caused less damage to the barley seedlings than Trifluralin+Lexone® at higher sowing speeds for both seeder types. With speed crop safety generally decreased for disc sown plots, while it generally increased for tyne sown plots.

Annual ryegrass control: Ryegrass counts on unreplicated trials are inevitably variable, but some findings can be made. Within the nil treatments, it was found that there was a significant increase in ryegrass establishment with increased speed and disturbance in the disc sown treatments. In the tyne treatments, ryegrass establishment was greater and did not correlate to speed due to the inherent, high disturbance of the seeding system. Within the applied herbicide treatments, it was found that in general a high level of herbicide efficacy was experienced (except for the 8km/hr disc treatment which had a low nil control for comparison).

Table 5 Ryegrass counts per metre squared for all treatments recorded on the 15th June 2009.

HERBICIDE TRT	SINGLE DISC			TYNE MACHINE		
	8km/h	10km/h	14km/h	8km/h	10km/h	14km/h
Nil (no pre-emergent herbicide)	1	28	58	35	12	80
Boxer Gold 2L/ha	0	6	9	5	4	1
Trifluralin 1.5L/ha	4	6	2	4	0	3
Trifluralin 1.5L/ha + Lexone 150g/ha	1	1	5	0	2	15

Little incorporation of pre-emergent herbicides by the disc seeder travelling at 8km/h led to no control of ryegrass by highly volatile pre-emergent herbicides (eg. Trifluralin). All other treatments, apart from tyne x 10km/h x Boxer Gold® gave more than 75% annual ryegrass control (Figure 2). Generally the Boxer Gold® offered the least control of ryegrass.

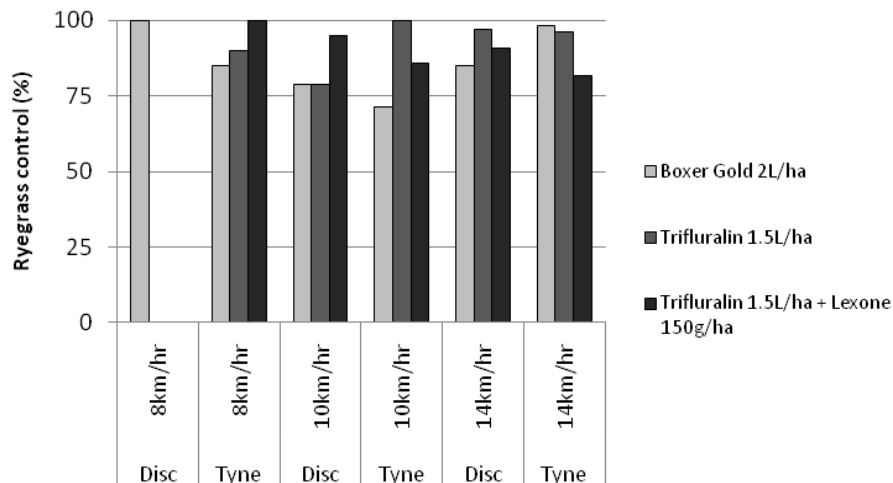


Figure 2 Percentage ryegrass control (compared to the nil control) provided by the pre-emergent herbicides (28 DAS), incorporated by sowing at 8km/h, 10km/h and 14km/h with a disc seeder and a tyne machine.

Crop yields: When comparing sowing speeds, all disc barley yields were higher than the tyne barley yields, though were more variable between sowing speeds. Tyne yields were fairly consistent, except for wheat sown into the Trifluralin+Lexone® sprayed plot at 14km/h.

Table 6 Barley yields (t/ha) for all treatments

HERBICIDE TRT	SINGLE DISC			TYNE MACHINE		
	8km/h	10km/h	14km/h	8km/h	10km/h	14km/h
Nil	3.1	3.7	2.6	2.1	2.2	2.6
Boxer Gold 2L/ha	3.1	2.8	2.7	2.2	2.0	2.4
Trifluralin 1.5L/ha	2.8	2.6	2.5	2.3	2.2	2.3
Trifluralin 1.5L/ha + Lexone 150g/ha	2.6	2.4	2.2	2.2	2.3	1.3

DISCUSSION

- High operational speed reduced sowing depth of both disc and tyne openers.
- Counts of unsprayed (nil) annual ryegrass were greater for the tyne machine than the disc seeder at 8km/h and 14km/h.
- Within the applied herbicide treatments herbicide efficacy was fairly high.
- Tall standing stubble and poor seed placement at 8km/h and 10km/h by the tyne machine severely affected crop establishment.
- At 14km/h the discs ability to penetrate the soil was greatly reduced, impacting sowing depth.
- Barley yields were higher for the disc sown treatments than the tyne sown treatments.

This work was unreplicated and was done as an initial scoping study for further detailed research. More work needs to be conducted to improve the crop safety of disc seeding systems at high sowing speeds with single disc seeders in an array of environments. In this case a sowing speed of 12km/h may have been more suitable than 14km/h to improve seed placement and crop safety.

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