Ryegrass Competition

Blake Gontar[1], Andrew Ware[1], Brian Purdie[1], Ashley Flint[1]
[1]SARDI, Port Lincoln

Key messages

- **Early sowing of barley may be an effective way of controlling ryegrass growth and limiting seed set**
- **Results in wheat are more variable than for barley: at Wanilla, mid-May seemed the optimal time of sowing to reduce ryegrass with less effect obvious at Yeelanna**
- **Higher seeding rates also followed the same trend, with little ryegrass suppression benefit seen in wheat but a benefit evident in barley**
- **Increasing seeding rate did not improve wheat yields significantly however barley (Fleet) did seem to benefit from higher seeding rates when sown late (mid-June)**

Why do these trials?

These trials are associated with the GRDC Stubble Retention Project seeking to develop management guidelines for stubble retained farming systems on the Lower Eyre Peninsula (LEP). Historical dependence on herbicides for control of weeds in reduced-till/stubble-retained farming systems has resulted in populations of ryegrass found in these farming systems exhibiting increasing resistance to many known herbicides, thus increasing reliance on newer, more expensive herbicides. This reliance on a small selection of expensive herbicides is both expensive and is also likely to lead to further herbicide resistance and, ultimately, fewer herbicide options available to farmers. The aim of these trials is to investigate proactive non-herbicidal management strategies for reducing ryegrass seed set and so 'run down' the seed bank.

How was it done?

Two trials were established in 2014 – one at Yeelanna and another at Wanilla. Trial site selection reflected two common soil types on the LEP as well as historical ryegrass infestation. In each trial, three wheat varieties (Mace, Emu Rock and Wyalkatchem) and one barley variety (Fleet) were sown, each at two rates of sowing (150 & 250 plants/m^2) and at three different times of sowing. Sowing dates were 5th May, 16th May and 11th June.

Plots were sown using a six-row tined plot seeder set to a depth of 4 cm, with row spacing of 22.5 cm. Seeding was preceded by application of glyphosate and pyroxasulphane (as 118 g/ha Sakura), per normal farmer practice. Each plot received the equivalent of 100 kg/ha of 18:20 N:P fertiliser, treated with fungicide (Impact @ 400mL/ha).

Data on crop emergence, ryegrass emergence and late season ryegrass abundance were all collected by randomly sampling each plot. Ryegrass sampling consisted of counting plants within a 0.1 m^2 quadrat, whereas crop sampling consisted of counting plants along both sides of a 50 cm ruler placed between rows. Sampling was replicated three times within each plot and plant densities were calculated from these measurements. Emergence counts were conducted approximately 2 weeks after each time of sowing while late season ryegrass counts were conducted in October for all plots.

What happened?

Plots sown in the final time of sowing (11th June) at both trials were affected by heavy rain around this period. This is the explanation for the statistically significant influence of time of sowing (TOS) on crop yield seen in both trials. The strong correlation between crop emergence and yield (R = 70.1 & 70.8 at Wanilla and Yeelanna respectively) throughout the whole trial together with the use of knockdown herbicides prior to seeding suggest substantial yield losses in the third time of sowing were likely caused by poor establishment due to the direct effects of waterlogging, rather than being related indirectly to competition from ryegrass (as it is unlikely under these circumstances that ryegrass emergence would have reduced crop establishment). Rather, it seems likely that ryegrass has flourished in the absence of a vigorous crop, or perhaps even just due to a preference for moist soil conditions. Tables 1 and 2 (below) summarise the mean yields for all combinations of variety and sowing rate, across all times of sowing at Wanilla and Yeelanna, demonstrating the extent of yield losses in the third time of sowing.

Table 1 – Mean yields of all entries across all times of sowing at Wanilla

	Yield (t/ha)		
Variety x Sow Rate	**TOS 1**	**TOS 2**	**TOS 3**
Fleet @ 150	3.53	2.87	1.63
Fleet @ 250	3.23	3.24	2.42
Mace @ 150	3.93	3.70	1.94
Mace @ 250	2.85	3.10	2.77
Emu Rock @ 150	3.52	3.48	1.97
Emu Rock @ 250	3.16	3.20	1.76
Wyalkatchem @ 150	3.80	3.77	2.21
Wyalkatchem @ 250	3.45	3.07	2.07
P < 0.05		**LSD 1.11**	

Table 2 – Mean yields of all entries across all times of sowing at Yeelanna

	Yield (t/ha)		
Variety x Sow Rate	**TOS 1**	**TOS 2**	**TOS 3**
Fleet @ 150	3.07	3.44	1.53
Fleet @ 250	3.37	*3.62*	2.43
Mace @ 150	3.18	2.86	1.68
Mace @ 250	3.08	2.83	2.45
Emu Rock @ 150	3.15	2.80	1.66
Emu Rock @ 250	3.12	2.81	2.13
Wyalkatchem @ 150	3.20	3.02	2.28
Wyalkatchem @ 250	3.41	2.64	2.00
P < 0.05		**LSD 0.96**	

At either site, no significant differences were found between mean yields of the four varieties taken across all times of sowing. This being the case, the effect of time of sowing and sowing rate on ryegrass control was considered independent of the varieties.

At Yeelanna, the interaction of TOS with sow rate had no significant effect on ryegrass emergence (P = 0.7613) Furthermore, the same interaction had no significant effect on ryegrass plant abundance later in the season (P = 0.1059). Ryegrass density at late season sampling is presented in Table 3 (below).

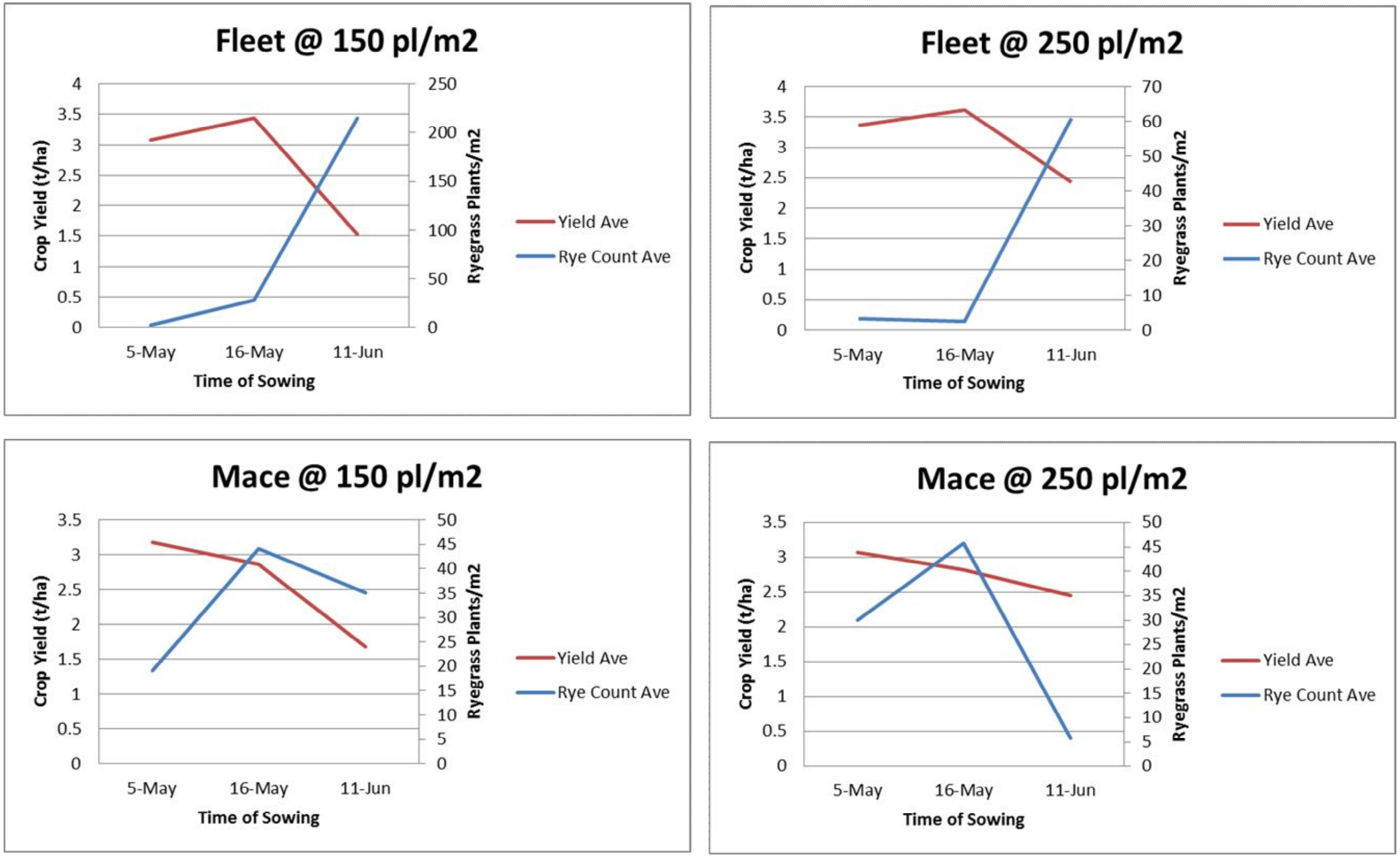
Table 3 – Ryegrass plant density at Yeelanna

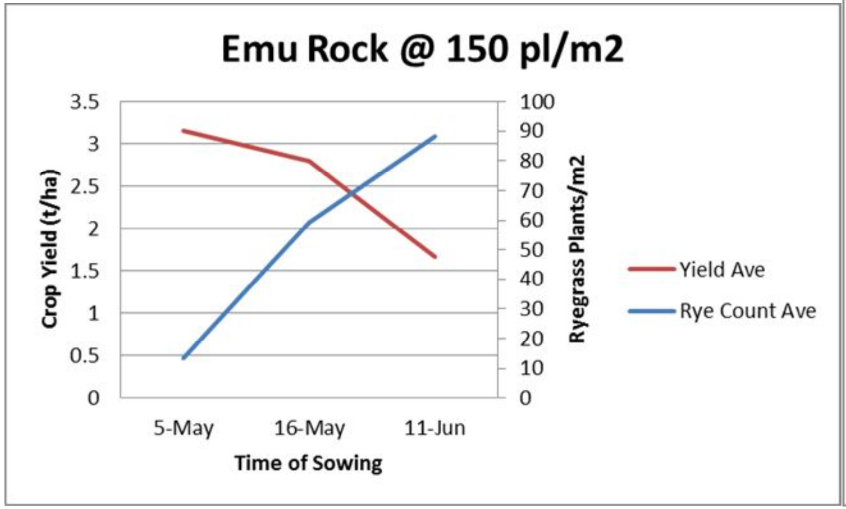
	Ryegrass (plants/m2)		
Variety x Rate	**TOS1**	**TOS2**	**TOS3**
Fleet @ 150	2.50	27.50	215.00
Fleet @ 250	3.33	2.50	60.83
Mace @ 150	19.17	44.17	35.00
Mace @ 250	30.00	45.83	5.83
Emu Rock @ 150	13.33	59.17	88.33
Emu Rock @ 250	25.83	60.00	0.83
Wyalkatchem @ 150	20.83	20.00	25.00
Wyalkatchem @ 250	16.67	14.17	5.00

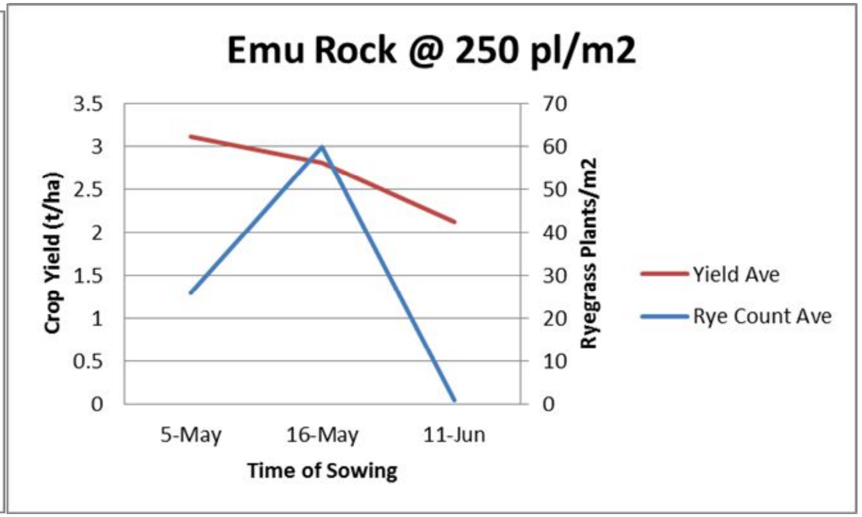
Results from the Wanilla trial proved similar, however were less significant and more variable.

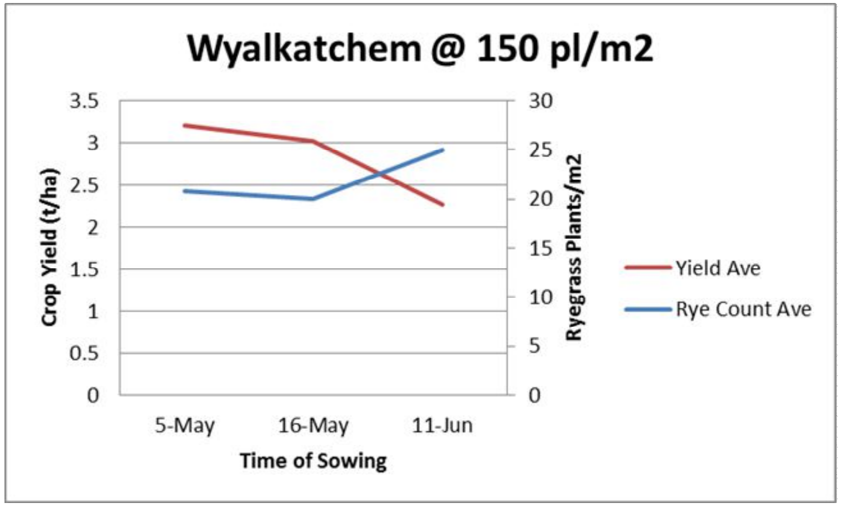
It is clear that there are marked differences in ryegrass densities, however, the variability of ryegrass density within each treatment means differences between treatments are insignificant. Because of the extreme variability in ryegrass numbers throughout the trial, only general trends were observable, with these best illustrated in the graphs below.

Figure 1 – Ryegrass and yield results over times of sowing at Yeelanna




Emu Rock @ 150 pl/m2
Crop Yield (t/ha)
Ryegrass Plants/m2
Yield Ave
Rye Count Ave
5-May
16-May
11-Jun
Time of Sowing


Emu Rock @ 250 pl/m2
Crop Yield (t/ha)
Ryegrass Plants/m2
Yield Ave
Rye Count Ave
5-May
16-May
11-Jun
Time of Sowing


Wyalkatchem @ 150 pl/m2
Crop Yield (t/ha)
Ryegrass Plants/m2
Yield Ave
Rye Count Ave
5-May
16-May
11-Jun
Time of Sowing

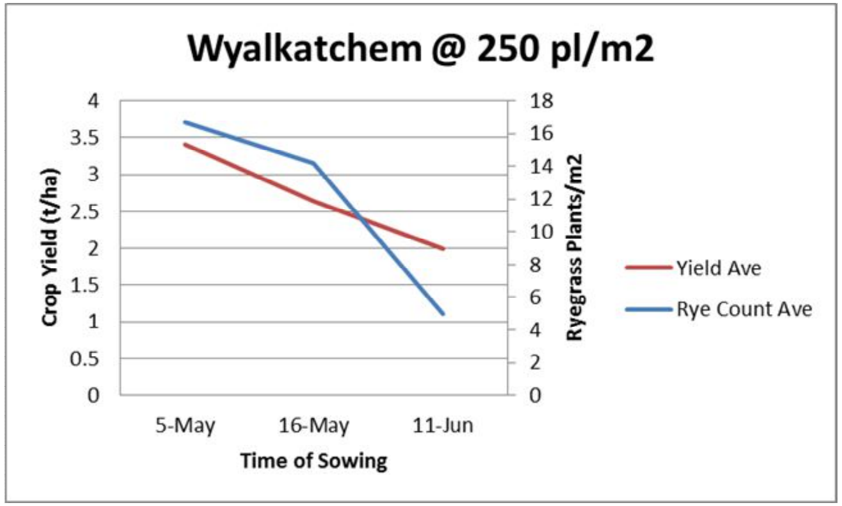
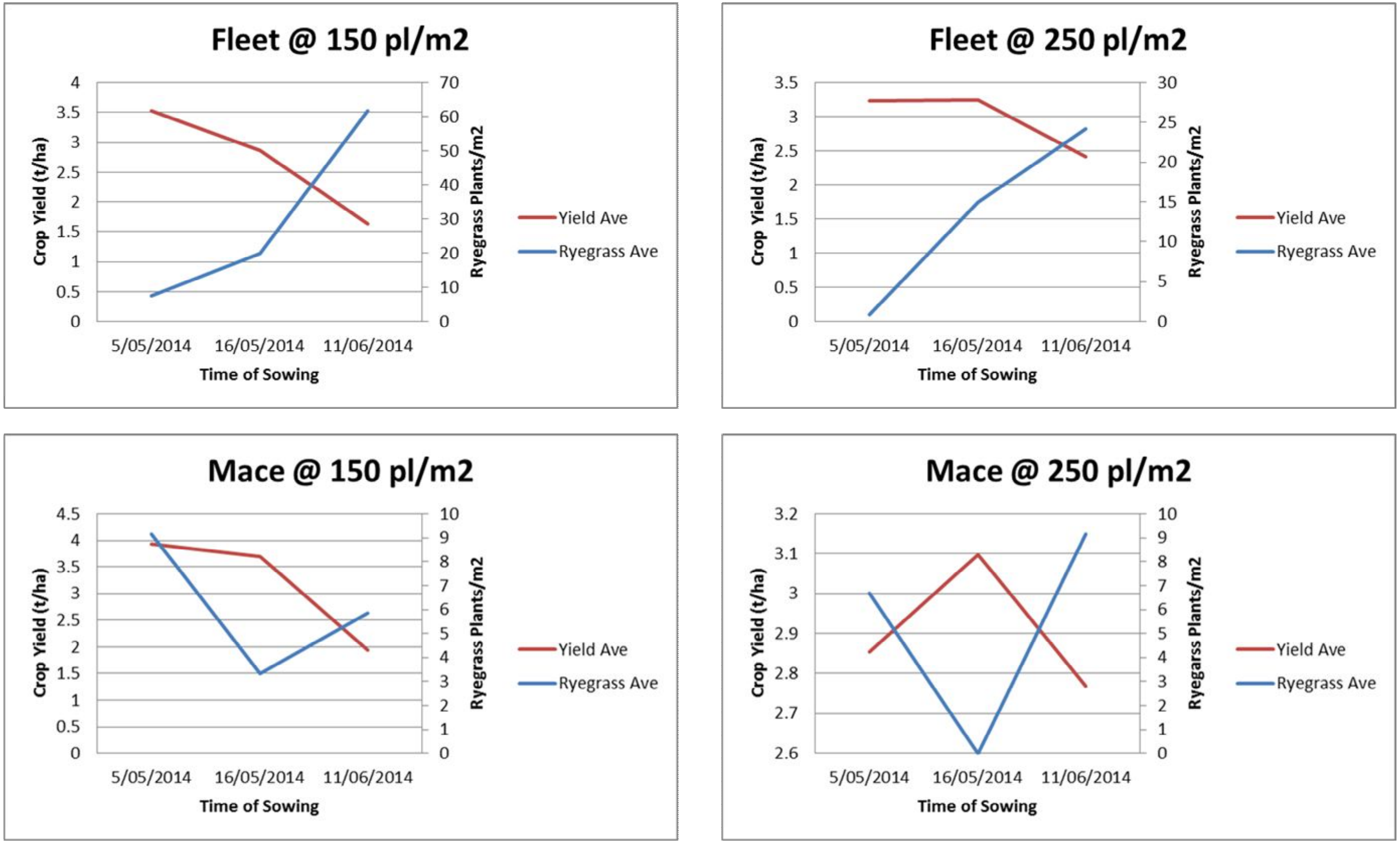
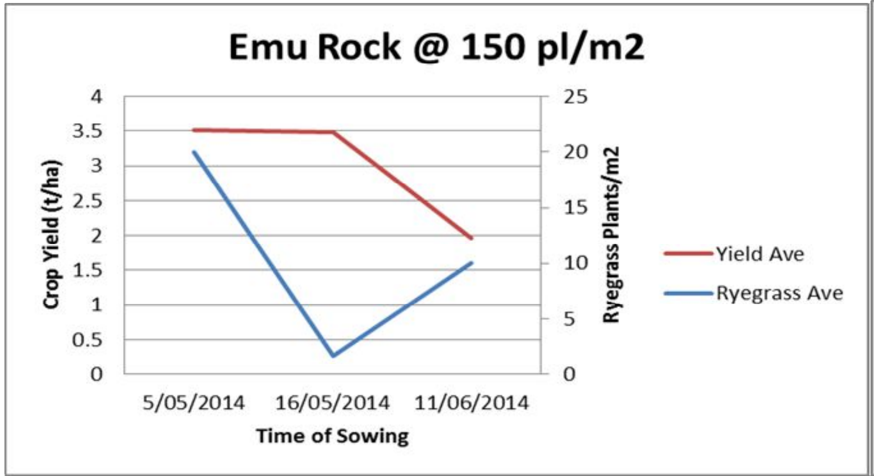
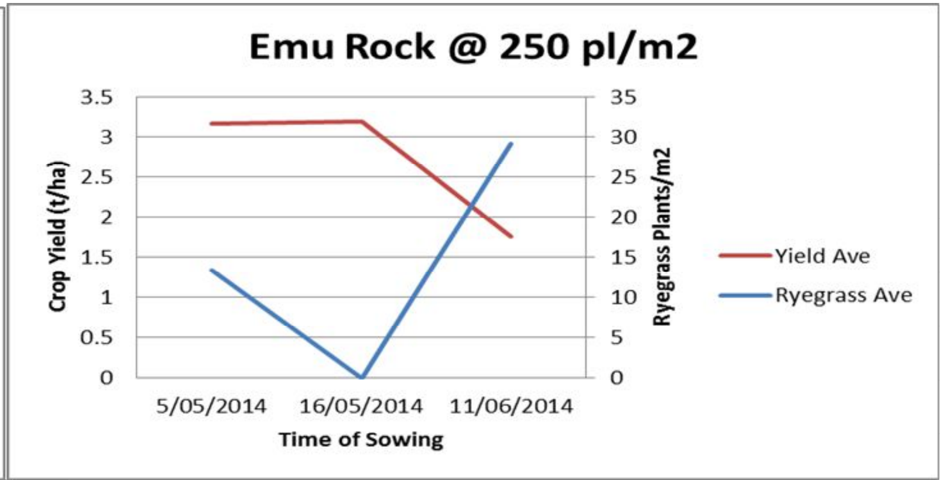
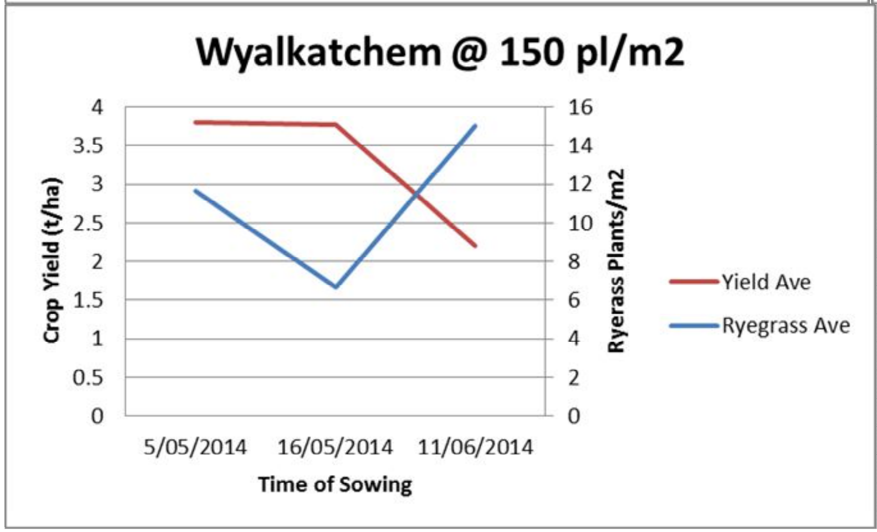

Wyalkatchem @ 250 pl/m2
Crop Yield (t/ha)
Ryegrass Plants/m2
Yield Ave
Rye Count Ave
5-May
16-May
11-Jun
Time of Sowing

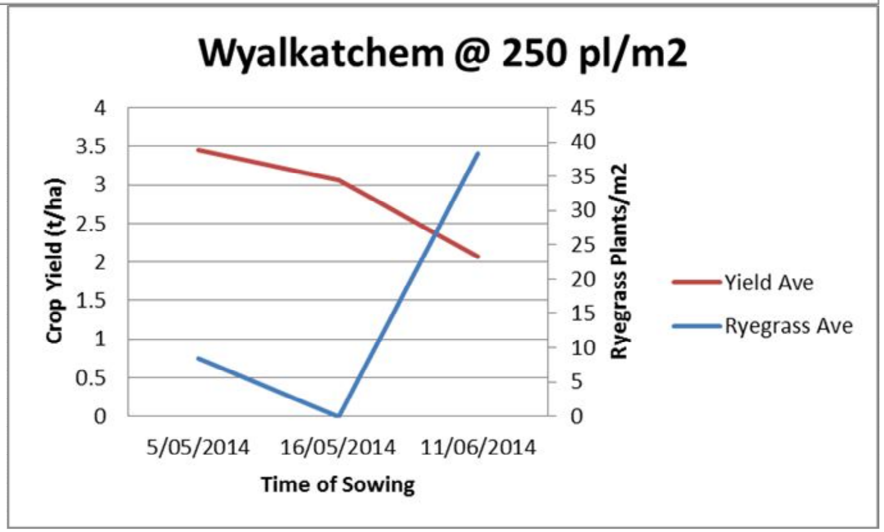
Figure 2 – Ryegrass and yield results over times of sowing at Wanilla




Emu Rock @ 150 pl/m2
Crop Yield (t/ha)
4
3.5
3
2.5
2
1.5
1
0.5
0
Ryegrass Plants/m2
25
20
15
10
5
0
5/05/2014
16/05/2014
11/06/2014
Time of Sowing
Yield Ave
Ryegrass Ave


Emu Rock @ 250 pl/m2
Crop Yield (t/ha)
3.5
3
2.5
2
1.5
1
0.5
0
Ryegrass Plants/m2
35
30
25
20
15
10
5
0
5/05/2014
16/05/2014
11/06/2014
Time of Sowing
Yield Ave
Ryegrass Ave


Wyalkatchem @ 150 pl/m2
Crop Yield (t/ha)
4
3.5
3
2.5
2
1.5
1
0.5
0
Ryerass Plants/m2
16
14
12
10
8
6
4
2
0
5/05/2014
16/05/2014
11/06/2014
Time of Sowing
Yield Ave
Ryegrass Ave


Wyalkatchem @ 250 pl/m2
Crop Yield (t/ha)
4
3.5
3
2.5
2
1.5
1
0.5
0
Ryegrass Plants/m2
45
40
35
30
25
20
15
10
5
0
5/05/2014
16/05/2014
11/06/2014
Time of Sowing
Yield Ave
Ryegrass Ave

What does this mean?

The results from this trial are unclear for two reasons. Firstly, variability in ryegrass numbers between plots mean that statistically significant differences associated with treatments are hard to determine (as the sampling error is high). Analysis of the effects of interactions of TOS, variety and sowing rate on ryegrass returned extreme coefficients of variability. Simpler analysis of the effects of isolated treatments reduced this variability and showed useful 'trends'. Sowing earlier improved yields at Yeelanna and generally limited ryegrass, while sowing at a higher rate generally suppressed ryegrass at both sites.

A second issue is determining causality in any 'perceived trend' in crop yield with earlier/later times of sowing. It may be that in some cases earlier sowing results in a crop more capable of competing for resources, thus crowding out the ryegrass and utilising available resources to provide optimal yield. Alternately, it may simply be that, where a crop fails to thrive entirely due to seasonal conditions, ryegrass will obligingly take its place.

Where to from here?

The intention is to repeat these trials over two further years. Firstly, it is expected that improved methods may allow greater distinction between treatment effects and random error, with regards to ryegrass numbers. Reducing trial variability will allow the trial to be analysed more successfully. Furthermore, there is an expectation that, while crop competition may not have had a single-season, immediate effect of the emergence and survival of ryegrass, there may be a compound effect over a number of seasons. It could reasonably be expected that, while ryegrass may not have been totally suppressed by increased crop density or early crop vigour, there may have been an effect on ryegrass seed set. This may become evident in following seasons.

Acknowledgements

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