

Effect of seed rate x herbicides on annual ryegrass management in wheat (Gladstone, SA)

Key messages

- A field trial was undertaken at Gladstone in 2022 to investigate combinations of wheat seed rate and herbicide treatments on annual ryegrass (ARG) control.
- Even though the increase in wheat plant density from 100 to 250 plants/m² reduced ARG spike density by 19%, this was not statistically significant ($P=0.225$). However, ARG spike density was significantly affected by different herbicide treatments ($P<0.001$).
- Surprisingly Sakura® (pyroxasulfone) was relatively ineffective with more than 700 spikes/m². In contrast, Overwatch® (bixlozone) treatment had significantly less ARG spike density. The most effective herbicide treatment was the combination of Overwatch® immediately before crop sowing (IBS) with early post-emergent (EP) Mateno Complete® (aclonifen, pyroxasulfone, and diflufenican).
- Overwatch® by itself produced wheat yield of 6.2 t/ha, which was almost 1 t/ha higher than Sakura®. The highest crop yield (7.03 t/ha) was achieved in the treatment where Overwatch® was followed by early post-emergent application of Mateno Complete®.

Introduction

Crop seed rate has been shown to provide weed suppression in many weed species including ARG. Crop seed rate is an easy tactic for the growers to adopt provided they are convinced of its benefits for weed management and profitability. Higher crop density can provide improved weed suppression especially when used in conjunction with effective pre-emergent herbicides.

This field trial at Gladstone was undertaken to investigate factorial combinations of wheat seed rate and herbicides on the management of ARG.

Methods

Trial design: Factorial randomised block design

Replicates: 3

Measurements: crop density, ARG spike density, ARG seed production, wheat grain yield and quality.

Table 1. Key management operations undertaken.

Operation	Details
Location	Gladstone, SA
Plot size	1.83 m x 10 m
Fertiliser	At sowing – DAP + zinc + impact (18:20:0:2) @ 100 kg/ha. Urea (46:0:0) @ 100kg/ha late tillering (August 1) Urea (46:0:0) @ 100kg/ha at GS32 (September 13)
Variety	Scepter wheat
Seeding rate	100 seeds/m ² 150 seeds/m ² 200 seeds/m ² 250 seeds/m ²
Crop sowing date	June 16
Herbicides	Pre-emergent treatment spray: June 16 (applied just before seeding - IBS), Early post-emergent EP treatments applied 15 July (wheat GS 11-12, ARG GS11) Refer to Table 1 for information on herbicide treatments.

All data collected during the growing season was analysed using the Analysis of Variance function in GenStat version 19.0.

Table 2. Rainfall received at Gladstone in 2022 and the long-term average for the site.

Month	Rainfall (mm)	
	2022	Long-term rainfall
Jan	35.2	20.4
Feb	14.6	18.9
Mar	3.8	18.9
Apr	3.8	30.3
May	65.4	41.9
Jun	30.0	47.7
Jul	12.4	47.1
Aug	83.0	48.8
Sep	81.4	47.2
Oct	138.6	41.0
Nov	44.0	30.1
Dec	23.4	24.0
Annual total	535.6	416.3
GSR total	414.6	304

In 2022, the annual rainfall and growing season rainfall at Gladstone was well above the long-term average for the site (Table 2). Consistent with other areas in SA, the autumn was extremely dry but good rainfall received at the end of May. Rainfall in early winter (Jun-Jul) was below average but Aug-Nov rainfall was much higher than the long-term average, which was conducive for high yields.

Results and Discussion

Wheat plant density

As expected, wheat seed rate had a significant effect on crop density ($P < 0.001$, Table 3). It is worth noting that the seed rate treatments were able to achieve wheat plant densities close to the target density.

Table 3. Effect of wheat seed rate on plant density ($P < 0.001$) established in the field trial at Gladstone.

Wheat seed rate (seeds/m ²)	Crop density (plants/m ²)
100	115.1
150	152.3
200	192.0
250	232.2
P	<0.001
LSD (P=0.05)	9.5

Annual ryegrass spike density

ARG spike density was significantly affected by the herbicide treatments (Table 4). None of the herbicide treatments prevented ARG from producing spikes or setting seed. Surprisingly Sakura® (pyroxasulfone) was relatively ineffective with more than 700 spikes/m². In contrast, Overwatch® (bixlozone) treatment had significantly less ARG spike density. The most effective herbicide treatment was the combination of Overwatch® IBS with EP Mateno Complete (aclonifen, pyroxasulfone, and diflufenican) (Table 4). Below average rainfall at Gladstone in June-July may have reduced Sakura efficacy in this field trial. As a result of an extremely delayed harvest at Gladstone in 2022, ARG samples are still being processed to determine seed production.

Table 4. The effect of herbicide treatments ($P < 0.001$) on annual ryegrass spike density in the field trial at Gladstone.

Herbicide treatment	Annual ryegrass spikes/m ²
Overwatch® 1.25 L/ha IBS	408
Overwatch® 1.25L/ha IBS fb Mateno Complete® 1L/ha EP ¹	180
Sakura® 118g/ha IBS	715
Sakura® 118g/ha IBS fb Boxer Gold® 2.5L/ha EP	442
Trifluralin 2L/ha + Avadex Xtra® 2L/ha IBS	659
Trifluralin 2L/ha + Avadex Xtra® 2L/ha IBS fb Boxer Gold® 2.5L/ha EP	586
P	<0.001
LSD (P=0.05)	140.1

¹ EP = early post-emergent was used at the 1-leaf stage of annual ryegrass

Wheat grain yield

High seasonal rainfall in 2022 was reflected in excellent grain yields of up to 7 t/ha (Table 5), which was significantly affected by the seed rate ($P<0.001$) and herbicide treatments ($P<0.001$). Wheat grain yield increased steadily from 5.35 t/ha at 100 plants/m² to 6.24 t/ha at target wheat plant density of 250 plants/m². Given the high wheat grain price in 2022 (>400/t), higher seed rate treatments are likely to enhance gross margins.

The lowest wheat grain yield was obtained in Trifluralin + Avadex Xtra® (triallate) treatment, which produced a similar yield to Sakura® (Table 6). As mentioned previously, unexpectedly low crop yield in this treatment could be associated with below-average rainfall in June and July. Sequential application of Boxer Gold® (prosulfocarb and s-metalachlor) after Sakura® or Trifluralin plus Avadex Xtra® increased wheat yields by about 0.5 t/ha as compared to when these products were used on their own. Overwatch® by itself produced wheat yield of 6.2 t/ha, which was almost 1 t/ha higher than Sakura®. The highest crop yield (7.03 t/ha) was achieved in the treatment where Overwatch® was followed by EP application of Mateno Complete®.

Table 5. The effect of target wheat plant density on wheat grain yield ($P<0.001$) in the field trial at Gladstone.

Wheat target density (plants/m ²)	Grain yield (t/ha)
100	5.35
150	5.78
200	6.09
250	6.24
P	<0.001
LSD (P=0.05)	0.287

Table 6. The effect of herbicide treatments on wheat grain yield ($P<0.001$) in the field trial at Gladstone.

Herbicide treatment	Wheat grain yield (t/ha)
Overwatch® 1.25 L/ha IBS	6.21
Overwatch® 1.25L/ha IBS fb Mateno Complete® 1L/ha EP ¹	7.03
Sakura® 118g/ha IBS	5.26
Sakura® 118g/ha IBS fb Boxer Gold® 2.5L/ha EP	5.72
Trifluralin 2L/ha + Avadex Xtra® 2L/ha IBS	5.23
Trifluralin 2L/ha + Avadex Xtra® 2L/ha IBS fb Boxer Gold® 2.5L/ha EP	5.73
P	<0.001
LSD (P=0.05)	0.351

As expected, there was a clear negative relationship between ARG spike density and wheat grain yield (Figure 1). These results clearly highlight the competitive effect of ARG on wheat even in an above-average rainfall growing season.

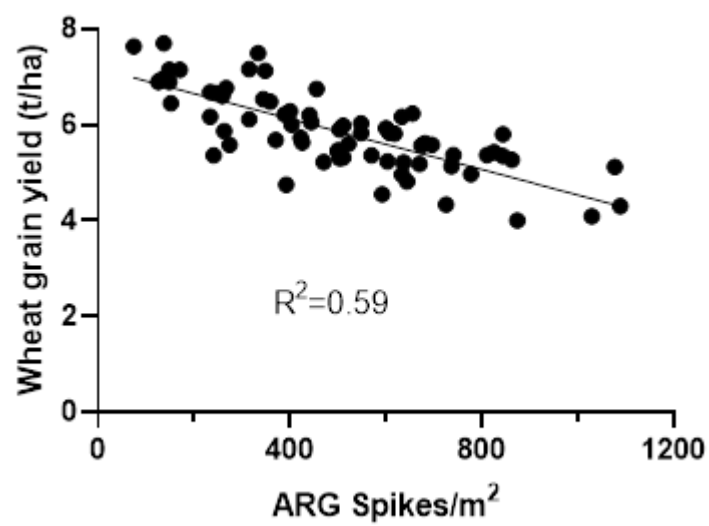


Figure 1. The relationship between annual ryegrass pressure (ARG spikes/m²) and wheat grain yield (t/ha), $R^2=0.59$.