Barley agronomy, seeding rate and annual ryegrass

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Key findings

- Annual ryegrass did not affect crop establishment, but did reduce grain yield.
- Increasing the seed rate from 80 seeds/m^2 to 150 seeds/m^2 had no significant impact on grain yield, however, increasing the seeding rate to 220seeds/m^2 significantly reduced grain yield, by 13%.
- At 220 seeds/m^2 25% of the annual ryegrass survived, compared to 45% at 80 seeds/m^2.

Why do the trial?

The investigate barley varietal performances under various seeding rates and the influence of annual ryegrass.

How was it done?

The trial contained 4 barley varieties; Maritime, Fleet, Hindmarsh and Flagship. All varieties differ in growth rates and habit. The varieties were compared over three seeding rates 80, 150 or 220 seeds/m^2. These treatments were compared against two weed densities, annual ryegrass planted at 25 kg/ha and an un-treated control. The trial was sown with chisel points and press wheels.

Plot size	1.5m x 10m	**Fertiliser**	DAP @ 70 kg/ha + 2% Zn
Sowing date	13th May 2009		

Barley and annual ryegrass (ARG) plant counts were carried out four weeks after sowing to determine crop and ARG establishment. ARG populations were re-scored on October 14th to assess ARG survival. The trial was harvested on the 9th of November. Grain quality was assessed for retention with a 2.5 mm screen, protein (% dry basis), screenings with a 2.2 mm screen and test weight (kg/hL).

Results

Increasing the seed rate of barley from 80 seeds/m^2 to 150 seeds/m^2 had no significant impact on grain yield (averaging 3.35 t/ha), however, grain yield was significantly reduced (2.87 t/ha) when the seeding rate was increased to 220seeds/m^2 (Table 1).

The establishment of ARG across the three seeding rates showed no significant difference, indicating that the seeding rate of barley had no impact on ARG establishment.
The second assessment of the ARG on the 14th October showed that there was no difference between the 80 and 150 seeds/m^2, however, ARG survival was significantly lower in the 220 seeds/m^2 treatments.

Table 1. Grain yield, ARG establishment and survival averaged across variety and ARG for barley seeding rate at Hart in 2009.

Seeding rate (seeds/m²)	Grain yield (t/ha)	ARG establishment (plants/m²)	ARG survival (plants/m²)
80	3.40	76	34
150	3.31	57	20
220	2.87	53	13
LSD (0.05)	0.16	ns	15

Hindmarsh recorded the highest grain yield of 3.77 t/ha (Table 2). ARG establishment was significantly different across barley varieties. ARG establishment in Hindmarsh (81 plants/m^2) was significantly higher than that in Flagship and Fleet (53 and 51 plants/m^2) while Maritime was similar to all other varieties. There was no difference in ARG survival across varieties.

Table 2. Grain yield, ARG establishment and survival averaged across sowing rate and the presence of ARG for barley variety at Hart in 2009.

Variety	Grain yield (t/ha)	ARG establishment (plants/m²)	ARG survival (plants/m²)
Flagship	3.02	53	18
Fleet	3.20	51	18
Hindmarsh	3.77	81	34
Maritime	2.80	63	19
LSD (0.05)	0.19	23	ns

The presence of ARG had no significant impact on grain yield, averaging 3.20 t/ha (Table 3). The ARG data shown in Table 3 shows that there was a very low background ARG population of just 4 plants/m^2. By the 14th October the ARG population in the plus ARG treatments had been reduced by 63%.

Table 3. Grain yield, ARG establishment and survival averaged across variety and sowing rate for the presence of ARG at Hart in 2009.

ARG	Grain yield (t/ha)	ARG establishment (plants/m²)	ARG survival (plants/m²)
Minus ARG	3.22	4	0
Plus ARG	3.17	121	45
LSD (0.05)	ns	16	12

Table 4 shows the mean grain quality characteristics for seeding rate. Seed rate had no impact on grain protein (averaging 14.2%). The 220 seeds/m^2 treatments had significantly higher screenings and lower retention levels compared to the lower seed rates. Although increasing the seed rate above 80 seeds/m^2, significantly reduced grain quality, all seed rates met the requirements for the receival grade of Feed 1.

Table 4. Protein, screenings, retention, test weight and receival grade averaged across variety and the presence of ARG for barley seeding rate at Hart in 2009.

Seeding rate (seeds/m²)	Protein (%)	Screenings (%)	Retention (%)	Test weight (kg/hL)	Receival grade
80	14.2	1.9	87.3	69.0	Feed 1
150	13.9	3.6	79.5	68.6	Feed 1
220	14.5	6.0	69.8	67.5	Feed 1
LSD (0.05)	ns	0.9	2.7	1.1	

There was no significant difference between varieties for grain protein (Table 5). Flagship showed significantly higher screenings (6.0%) compared to all varieties (averaging 3.1%). The retention levels and test weights of Fleet (83.2%) and Maritime (83.9%) were significantly higher compared to Flagship (72.8%) and Hindmarsh (75.6%), however all varieties were high.

Table 5. Protein, screenings, retention, test weight and receival grade for barley variety at Hart in 2009.

Variety	Protein (%)	Screenings (%)	Retention (%)	Test weight (kg/hL)	Receival grade
Flagship	14.2	6.0	72.8	68.7	Feed 1
Fleet	14.0	2.9	83.2	67.3	Feed 1
Hindmarsh	14.0	3.9	75.6	69.6	Feed 1
Maritime	14.6	2.5	83.9	68.0	Feed 1
LSD (0.05)	ns	1.1	3.1	1.3	

The addition of ARG had no impact on grain protein, screenings, retention, test weight and overall receival grade (Table 6).

Table 6. Protein, screenings, retention, test weight and receival grade for the presence of annual ryegrass (ARG) at Hart in 2009.

ARG	Protein (%)	Screenings (%)	Retention (%)	Test weight (kg/hL)	Receival grade
Minus ARG	14.4	3.9	79.3	68.4	Feed 1
Plus ARG	14.1	3.7	78.4	68.4	Feed 1
LSD (0.05)	ns	ns	ns	ns	

Discussion

Early rainfall allowed good crop and annual ryegrass establishment at Hart. Rains throughout winter led to good biomass production with crops setting a high grain yield potential. These beneficial conditions resulted in good grain yields and grain quality.

Increasing the seed rate from 80 seeds/m^2 to 150 seeds/m^2 had no significant grain yield impact, however, increasing the seeding rate to 220 seeds/m^2 significantly reduced grain yield by 13%. This is likely the due to excessive biomass in the high density treatments using more soil water than the other treatments.

Comparing the establishment of ARG across the three seeding rates showed no significant difference. However, when comparing the ARG survival there was no difference between the 80 and 150 seeds/m^2 but the 220 seeds/m^2 had significantly lower ARG survival, 63% lower than 80 seeds/m^2. Despite the grain yield penalty of the higher seeding rate these results suggest that increasing seeding rate will result in better ARG competition and a lower seed set.

The establishment of ARG in Hindmarsh was significantly higher compared to other varieties in the trial, indicating this variety has lesser ability to compete with ARG early in the season. However, there was no significant difference between varieties for ARG survival, indicating that all varieties have the same ability to compete with ARG later in the season.

Seed rate had no impact on receival quality of the barley. However, the seed rate of 80 seeds/m^2 did have significantly lower screenings, higher retention levels and test weights compared to the higher seed rates. This can be explained by the smaller canopy produced by having a lower crop density using less moisture early in the season, leaving more for later growth and grain fill.

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