Agronomic strategies to intercrop corn in Manitoba

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Introduction

As acres in Manitoba increase, there is more interest in using corn for late fall/early winter grazing for beef cattle. The low protein content of corn limits its ability to meet the nutritional requirement of growing beef cattle. Thus, intercropping corn with high protein annual forages could increase feed quality for extended grazing while also providing agro-ecosystem services through soil cover and weed suppression. There are several agronomic management questions that need to be tested to understand how to best establish productive corn intercrops for grazing including: seeding method, seeding timing, and corn row spacing. Successful methods for intercropping corn for grazing might also have applications for grain corn.

Objective

To explore intercrop establishment strategies, such as seeding method and seeding timing for corn grown on standard 30-inch row spacing and a wider 60-inch row spacing.

Material and Methods

Experiments were conducted at the University of Manitoba Carman and Glenlea Research Stations in 2022. Treatments included: 1) Main plot factor of 2 corn row-spacings (30-inch and 60-inch) 2) Sub-plot factor of 5 intercrop establishment strategies (broadcast at planting, drilled at planting, broadcast at V4 stage, drilled at V4 stage, and a no intercrop control) (Figure 1).

A dual-purpose grain and silage hybrid (DKC 31-85, 2125 CHU) with herbicide tolerance to glyphosate was planted on May 24 at Carman and June 20 at Glenlea. Seeding rates were 36,000 seeds/ac for the 30-inch row spacing and 18,000 seeds/ac for 60-inch row spacing. Plant to plant spacing within 30-inch and 60-inch row spacing treatments was kept same to avoid lodging. Before seeding intercrop treatments on July 13 at Glenlea and on July 15 at Carman at corn V4, two applications of glyphosate were used to control weeds.

Measurements included: corn and intercrop biomass (mid-Sep and mid-Nov), weed biomass (mid-Sep), and corn grain yield.

Statistical Analysis

Response variable data were subjected to analysis of variance (ANOVA) using proc Glimmix of SAS. Row-spacing, intercrop strategies and location were treated as fixed factor. Row-spacing x replication was used in random statement to identify the sub plot error error term. Replication nested within location was treated as a random factor. The nobound option was used to remove boundary constraints on covariance parameters of random effects and it allowed their estimates to be negative. All variables were normally distributed with the exception of intercrop biomass in Nov. A lognormal distribution was used for the latter. Means separation between treatments was conducted using Tukey's test within row spacing.

Table 1. *p-values* for the effect of intercrop establishment treatment and row spacing on corn grain yield, corn and intercrop biomass harvested in September and November in 2022 at Carman and Glenlea, MB

Source of variation	Grain yield	Sep biomass		Nov Biomass	
		Corn	Intercrop	Corn	Intercrop
	Pr> F				
Location (L)	**0.0017**	**0.0006**	0.4746	**0.0003**	0.8054
Row spacing (R)	**0.0156**	**0.0115**	**0.0129**	**0.0023**	**0.0029**
L x R	0.3604	**<.0001**	0.1246	**<.0001**	0.0765
Treatment (T)	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**
L x T	0.7900	**0.0002**	**0.0221**	**0.0117**	**0.0134**
R x T	0.5046	**0.0082**	0.0504	**0.002**	**<.0001**
L x R x T	0.1311	**0.0274**	0.4076	**0.0071**	0.0692

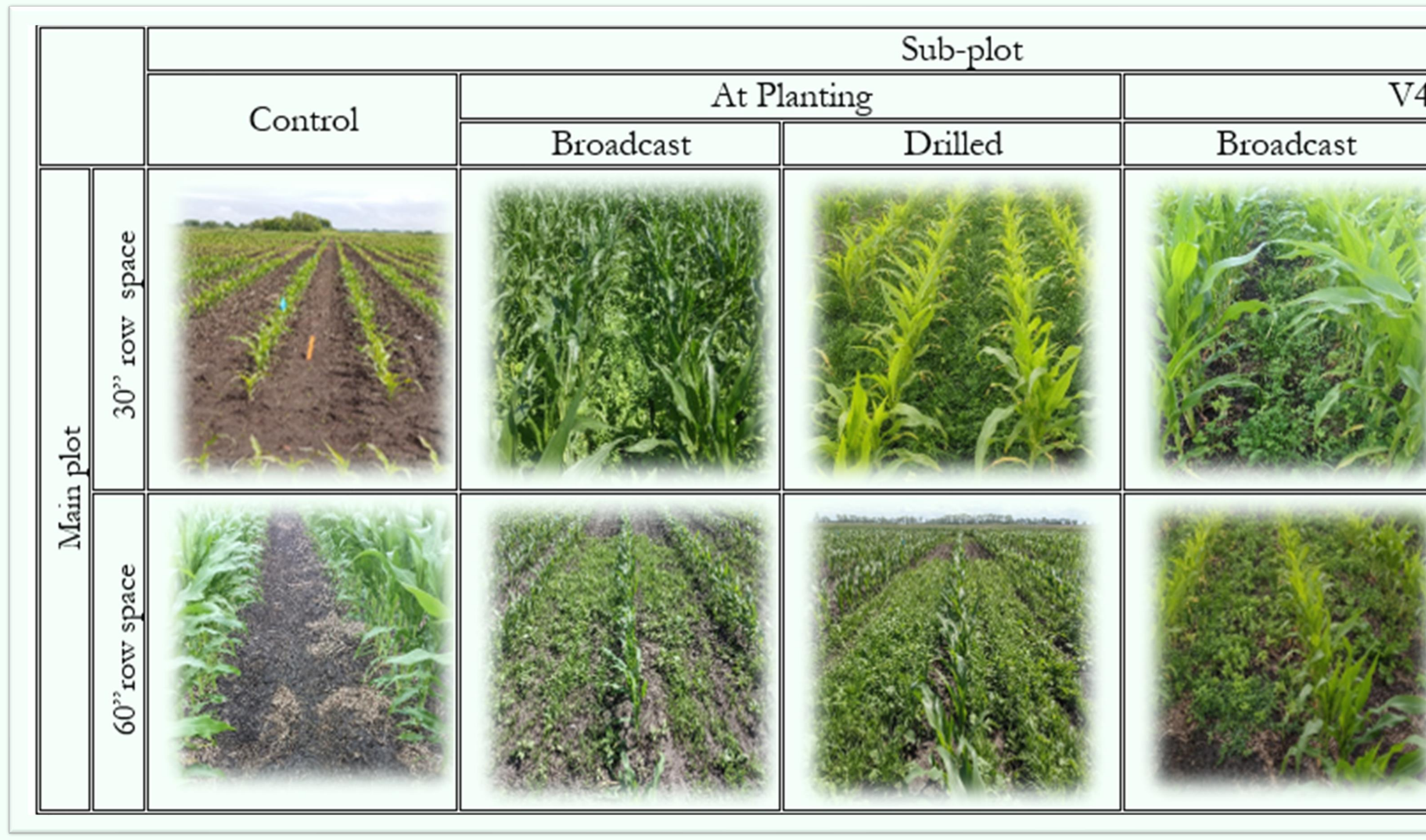

Figure 1: The main plot factor included 2 corn row spacing treatments (30-inch and 60-inch) and the sub-plot factor included 5 intercrop establishment strategy treatments (no intercrop control, broadcast at corn planting, drill at corn planting, broadcast at V4 stage of corn, and drill at V4 stage of corn).

Results

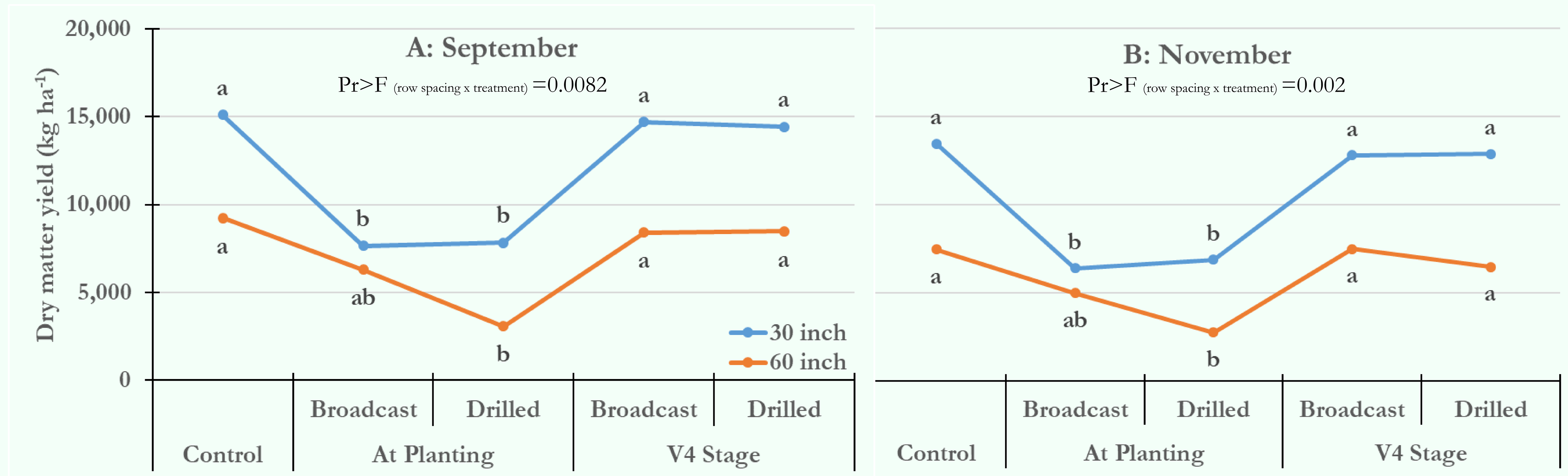

Figure 2. Effect of intercrop establishment strategies on corn biomass when sampled in (A) mid-Sep (B) mid-Nov in 30-inch and 60-inch row spacing treatments averaged over two sites in 2022. Least Square Means of establishment strategy treatments followed by same letters within row spacing treatments do not differ significantly at p<0.05.

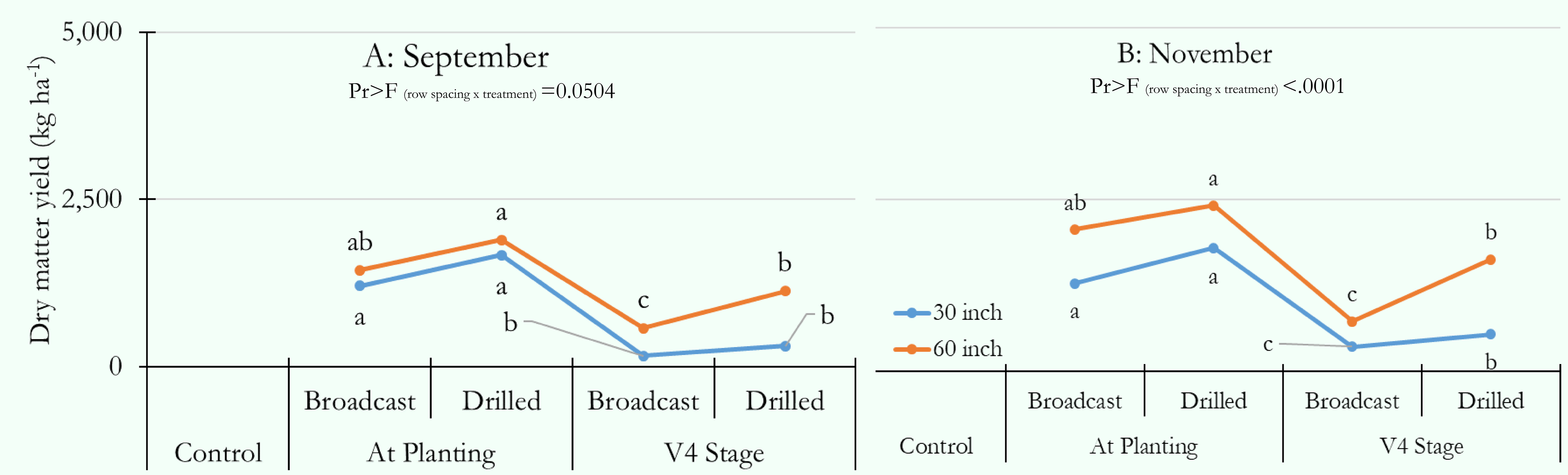

Figure 3: Effect of intercrop establishment treatments on intercrop biomass when sampled in (A) mid-Sep (B) mid-Nov in 30-inch and 60-inch row spacing treatments averaged over two sites in 2022. Least Square Means of establishment strategy treatments followed by same letters within row spacing treatments do not differ significantly at p<0.05.

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Key findings

Corn performance

- As expected, average corn biomass was higher in the 30-inch row treatments compared to the 60-inch at both sampling dates (Figure 2A and B). Corn grain yield was highest in the 30-inch row treatments when averaged over both sites (Figure 5).
- Intercropping after herbicide application at the V4 stage did not reduce corn biomass at both row spacing treatments relative to the non-intercropped control treatments (Figure 2A and B). Corn grain yields averaged over row spacing treatments and locations were equivalent to the control treatment if intercrops were planted at the V4 stage after weed control (Figure 5).

Intercrop performance

- Intercrop biomass was greatest in 60-inch row treatments when drilled at planting followed by drilled at the V4 (Figure 3A and B).
- As expected, intercrop biomass increased from September to November by 19 % in 30-inch row spacing and by 36 % in 60-inch row spacing when averaged over all treatments (Figure 2A and B).

Weeds

- Weed biomass was similar among all planting methods at 30-inch row spacing and lower for all treatments at 60-inch row spacing (Figure 4).
- Among 60-inch row spacing treatments, weed biomass was greatest in the broadcast treatment at the V4 stage (Figure 4).

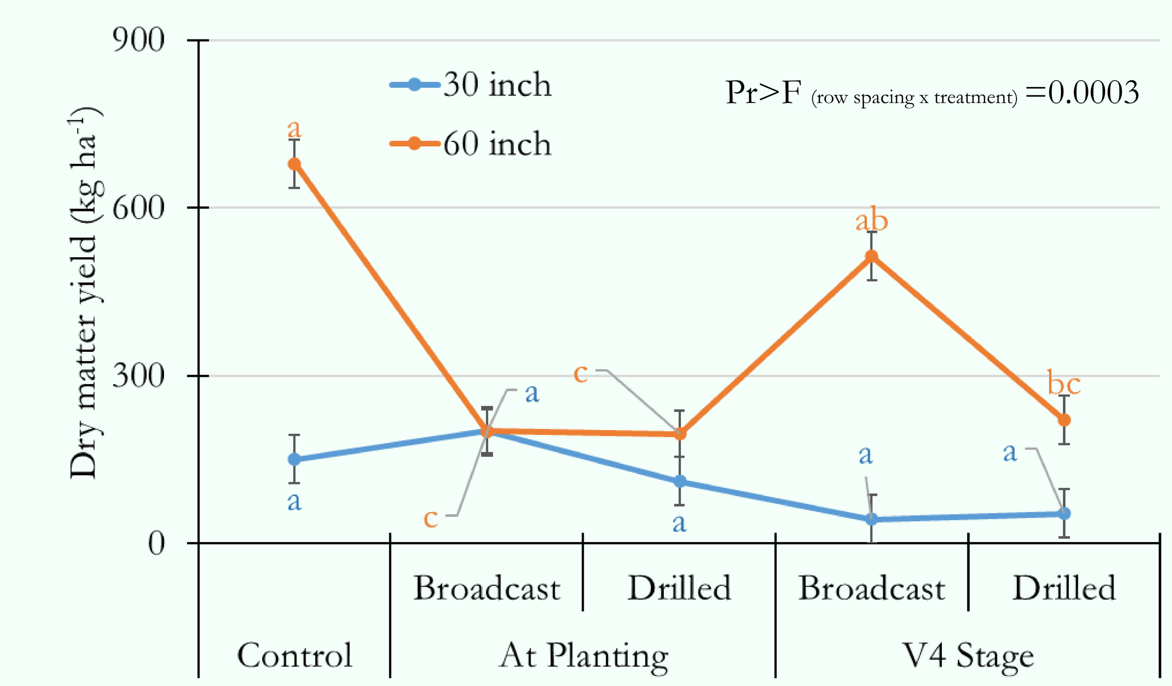

Figure 4: Effect of intercrop establishment treatments on weed biomass sampled in September at Carman in 2022. Least Square Means followed by same letters do not differ significantly at p<0.05. Error bars are standard errors.

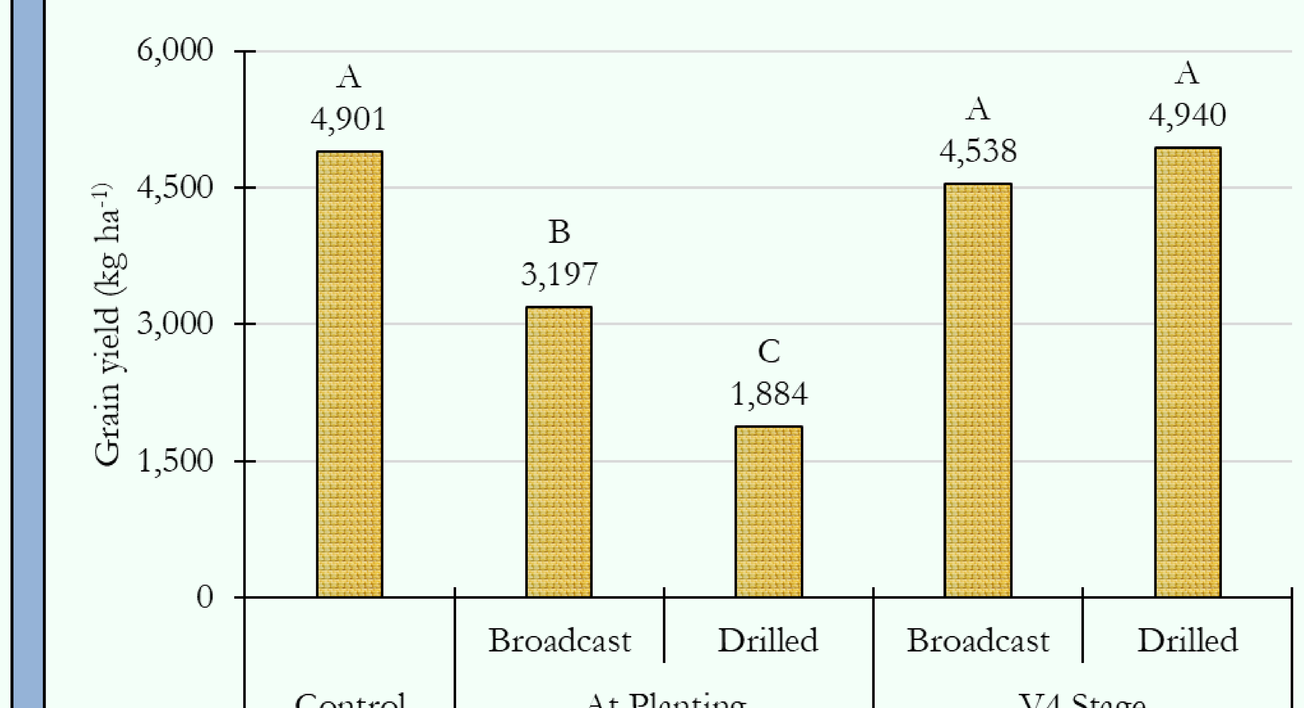

Figure 5: Effect of intercrop strategies on corn grain yield averaged over row spacing and sites in 2022 Least Square Means followed by same letters do not differ significantly at p<0.05.