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 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 56,000 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, 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 GLM 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 term. Replication nested within location was treated as a random factor. The model 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 effect of intercrop establishment treatment on corn biomass when sampled in November.

Results
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). Among 60-inch row spacing treatments, weed biomass was greatest in 60-inch row treatments when drilled at V4 stage after intercrop control 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 V4 stage (Figure 4).

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).

Figure 2: Effect of intercrop establishment strategies on corn biomass when sampled in (A) mid-Sep and (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 do not differ significantly at p<0.05.