Preliminary Investigation of Strip Intercropping Corn among Other Crops in Manitoba – Quantifying the Edge Effect

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Background

Strip farming, or contour farming, is a concept that has been practiced in hilly areas to minimize soil erosion using crops with varying amounts of residue production.

Intercropping is the practice of producing multiple crops in a given space, based on the assumption that competition for resources between species is less than exists within the same species.

Unlike a true intercropping scenario, where two different crops are planted in the same field at the same time, strip intercropping with two or more crops (such as corn and soybeans) is done with alternating crop strips with the intent to capitalize on the premise that outside corn rows capture more sunlight if more plants are exposed to an open edge like that found at the corn-soybean border (Van Dee, 2004).

This practice has been conducted in Minnesota, Illinois and Iowa and other states with varying degrees of success, particularly under moisture-limiting conditions. Research compiled by Ghaffarzadeh (1999) suggests the positive effect occurs mainly at the rows at the crop strip border, though it may extend into the second outside rows; yield in the centre of strips wider than four rows is equivalent to sole-cropped corn. They also suggest that strip intercropping benefits are maximized when the strips run north-south rather than east-west. Negative impacts to yields of soybeans and other crops adjacent to corn strips (due to shading, water competition and nutrient depletion) must be offset by increases in corn yields for the concept to be appealing.

Based on previous work in other areas, the concept of strip intercropping may be of interest to prairie producers who may be considered early adopters of corn production in their area with smaller row crop equipment (4-12 rows wide) and access to Real-Time Kinematic differential correction (RTK) guidance.

The objectives of this study are to quantify the edge effect on corn as measured by row position, adjacent crop type and corn row orientation.

Methodology

Using the plot design layout in Figure 1, a John Deere planter (30-inch rows) was set to plant 26,000 seeds/ac for corn and 215,000 seeds/ac for soybeans on June 1, 2015. Canola was planted on 6-inch rows using a double disk press drill and a seeding rate of 7 lb/ac. The study area was fertilized May 25 @ 90-60-10-10 (actual) according to soil test recommendations. All crops in the study were Roundup Ready® varieties: corn = P7935R, soybean = LS Northwestern; canola = SY4135.

Plots were managed for weed growth uniformly using Roundup Transorb® (glyphosate) applied @ 0.67 L/ac on June 24. Fallow areas were tilled bare as needed. Plots were harvested on Sept 9 (canola), Oct 22 (soybean) and Nov. 9 (corn).

Discussion

Prior to corn harvest, observation data indicated that up to 50% bird damage and wind damage had occurred on the outside rows. If these losses could be prevented, then a significant positive edge effect for corn yield in Manitoba is possible. The challenge is to determine how to capitalize on this opportunity with precision agriculture technology and agronomic principles.

Earlier research by West and Griffith (1992) in Illinois compared “regular” vs “high input” management in an attempt to take advantage of the positive edge effect by increasing corn populations in the two outside rows and adding an extra 60 lb/ac between the two most outside rows, resulting in an additional 20 bu/ac yield under high input management.

Winsor (2011) explored options Iowa producers were examining to capitalize on the edge effect, such as varying corn hybrids and other crop varieties, using controlled traffic to reduce soil compaction and utilizing RTK guidance and planter technology to automate the planting of strip intercropped fields.

Although this study did not have enough replication to distinguish between corn yield differences due to row orientation, most of the literature recommends corn planted in a north-south orientation, with the east outside row (aka Row 8) benefiting the most from additional sunlight capture.

Likewise, with no significant differences between corn yields and the adjacent crop, this study does not indicate any agronomic advantage in the crop to plant adjacent to corn strips. The literature often defaults to soybeans because of their prevalence in US crop rotations, being suited for row crop production systems with corn, and having a growth pattern that does not compete with corn.

Summary

Future work on this topic in Manitoba requires more replication for more rigorous statistical analyses — to measure real differences in corn yield among individual rows, corn row orientation, and the effect of crop type adjacent to corn. An economic analysis of strip intercropping effects is also required.

Corn hybrids more resistant to bird and wind damage should be tested to find optimum plant populations to capitalize on the edge effect.

Although yields for canola and soybean were not reported, these should be analyzed to ensure negative effects from corn on these crops are minimized.

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References


