Cor2-2011 - Impacts of Increased Corn Planting Density

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Impacts of Increased Corn Planting Density

Purpose:

The purpose of this trial was to examine corn plant density under two distinct scenarios: a) field scale trials that compare yield and profitability under a range of corn seeding rates, b) the impact that higher seeding rates might have on corn performance when other stress levels are increased

Methods:

a) Field scale population trials: cooperators were asked to plant field scale plots with 3 different target plant densities; 30,000, 35,000, and 40,000 plants per acre. A variety of hybrids were used. Actual populations were recorded (based on plant counts) and placed within a target population category. Most sites were replicated twice. All other factors except seeding rate were held constant. In total eight sites were completed by the Thames Valley Soil and Crop Improvement Association.

b) High Density and other Stresses: an experiment first conducted in 2010 was repeated in 2011 at the Elora Research Station to determine the interaction of stress, fertility, and corn density (Figure 1). The experimental design was a split-split plot design with the no-stress, weed competition, and soil compaction as main plot treatments, with or without starter fertilizer as split-plot treatments, and four plant densities as split-split plot treatments. All plots were side-dressed with 150 lb/ac of N (UAN) when corn was at the 8-leaf tip stage.

Weed competition consisted of seeding winter wheat immediately prior to corn planting. Weeds were controlled in the no-stress and compaction treatments with a 892gai/ac rate of Halex™ herbicide (glyphosate + mesotrione + s-metolachlor) applied when corn was at the 2 leaf-tip stage. In the weed stress treatments, wheat was controlled with Halex™ herbicide when corn was at the 10-leaf tip stage. Soil compaction was created by vehicle compaction on May 5, one day after receiving 30 mm of rainfall. Starter fertilizer treatments were: (i) no starter fertilizer; and (ii) starter fertilizer (200 lb/ac of 5-20-20 plus 10 gal/ac of 28-0-0 applied 2” below and 2” to the side of the seed furrow, and 4 gal/ac of 6-24-6 applied in the seed furrow). Pioneer 38N88 was planted at densities of 30, 36, and 42,000 plants per acre on May 25, 2011. Grain yield was measured at maturity.

Results:

a) Field scale population trials: Little yield difference was observed for increasing seeding rate at these eight sites in 2011 (Table 1). Increasing target populations from 30,000 to 35,000 plants per acre resulted in an average yield gain of 0.6 bu/ac, which was characterized by small responses of +/- 3bu/ac for all fields except 1 and 5 which were 8 and 7 bushels higher respectively. Yield responses for increasing target populations from 35,000 to 40,000 plants per acre ranged from -8 to 0 bushels per acre with an average yield response of -4.25bu/ac, demonstrating no benefit to increasing seeding rates at these sites.

   The average yield increase of 0.6bu/ac for increasing target populations from 30,000 to 35,000 plants per acre was insufficient to cover the cost of the extra seed (Table 2), although the response at sites 1 and 5 would have been economical. No yield or economic responses were observed for increasing target populations from 35,000 to 40,000 plants per acre.

Figure 1. Photo of population and stress experiment at Elora with plots of increasing weed stress and soil compaction.

Table 1. Yield response to three different corn population targets at eight sites in Ontario, 2011

Site	Hybrid	Target Population (thousand pl/ac)					
		30K		35K		40K	
		Actual Pop	Yield (bu/ac)	Actual Pop	Yield (bu/ac)	Actual Pop	Yield (bu/ac)
1	DKC 50-45	30.5	216	34.0	224	40.5	219
2	38B85	32.6	215	33.0	212	37.2	212
3	37F40	30.6	214	34.3	211	40.2	204
4	-	30.0	209	35.0	208	40.0	202
5	37Y12	29.7	204	35.4	211	38.4	206
6	DKC 40-07	29.7	184	34.2	181	38.2	173
7	38M58	27.8	173	33.3	176	37.0	176
8	DKC 48-37	30.8	135	35.4	132	42.3	129
Average		30.2	193.8	34.3	194.4	39.2	190.1

Table 2. Yield response (bu/ac) required to cover seed cost associated with every 5,000 seed/acre increase in seeding rate

		Seed Cost ($/bag)		
		$200	$250	$300
Corn Price ($/bu)	$5.00	2.5	3.1	3.8
	$6.00	2.1	2.6	3.1
	$7.00	1.8	2.2	2.7

Results from 2011 support those from 2010 which demonstrate that, on average, increasing target populations from 30,000 plants per acre to 35,000 or 40,000 plants per acre fails to provide an economic response for these hybrids at these sites (Table 3).

Table 3. Average corn yields for three population rates for two years 2010 and 2011.

Year	No. of Sites	Target Population (plants/ac)		
		30,000	35,000	40,000
2010	10	184.9	186.4	182.6
2011	8	193.8	194.4	190.1

b) High Density and other Stresses: increasing plant density tended to increase corn yields in the experiment at Elora in 2011; yields for 30,000, 36,000 and 42,000 plants per acre were 170, 174 and 180 bu/acre respectively when averages across all plots. Both delayed weed control and soil compaction caused a significant reduction in corn yields. However within the three different stresses (no stress, delayed weed control, and soil compaction) the tendency was for yields to increase with additional population (Figure 2).

Summary:

a) Field scale trails in 2011 did not result in a positive response to increasing populations from 30 to 35 or 40,000 plants per acre. Average yields were quite high across the field sites. Although there is a large amount of interest in increasing seeding rates this data would suggest growers should move in that direction with caution.

b) Contrary to our original hypothesis, there was no significant interaction between corn density and stress. Stress reduced corn yield but higher densities did not result in greater yield loss. This experiment only examined one hybrid (Pioneer 38N88) which may be more tolerant to high populations than others so this type of stress and density comparison will need to be evaluated with additional hybrids.

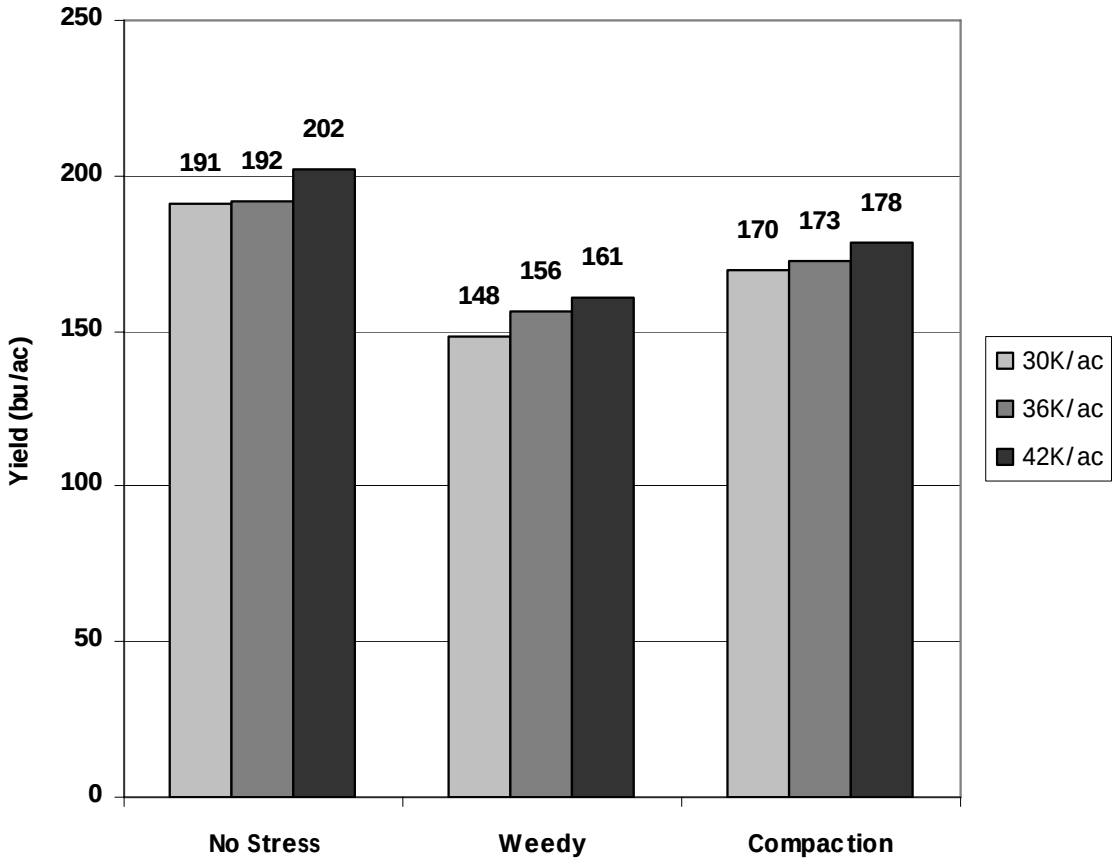

Figure 2. Corn yield response to increases in population density under no stress, weed stress and compaction stress at Elora, Ontario in 2011

Next Steps:

Evaluating higher corn seeding rates will continue in 2012 on the field scale experiments. The impact of hybrid selection on yields from higher corn plant populations and the hybrid response when stress is increased also needs to be further examined.

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