On-Farm Corn and Soybean Population Trials

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Jim Fawcett, extension field agronomist (retired)
Josh Sievers, Northwest Farm, superintendent
Lyle Rossiter, Allee Farm, superintendent
Zack Koopman, AEA Farm, ag specialist

Introduction

As corn and soybean seed prices continue to rise, and grain prices fall, it is important for farmers to find a population that maximizes both yield and profit. Planting too high of a corn population can result in increased barrenness and thus lower yields, but too low of a population also can result in lower yields. Most past research has shown the optimal planting rate for corn yield falls in a range from about 35,000 to 37,000 seeds/acre. Past studies have indicated soybean yields are similar across a wide range of populations, but too low of a population can result in reduced yields and too high of a planting population can reduce profits. A common recommendation is to plant soybeans at a seeding rate that will achieve a final stand of 100,000 plants/acre or more. The objective of these trials was to evaluate what effect planting population would have on corn and soybean yield.

Materials and Methods

In 2015, seven corn trials (Table 1) and five soybean trials (Table 2) examined the effect of various planting populations on grain yield. All trials were conducted on-farm by farmer cooperators using the farmer's equipment. Plots were arranged in a randomized complete block design with at least three replications/treatment. Plot size varied from field to field depending on field and equipment size. Plant stand counts were made in some trials in the spring and/or fall. All plots were machine harvested for grain yield.

In Trial 1, corn was planted at 28,000 and 34,300 seeds/acre in 36-in. rows. In Trial 2, two corn varieties were planted in 30-in. rows at 30,000, 35,000, and 38,000 seeds/acre. In Trial 3, corn was planted at 30,000, 35,000, and 40,000 seeds/acre in 30-in. rows. In Trials 4 and 6, corn was planted at approximately 32,000, 34,500, and 37,000 seeds/acre in 20-in. rows. In Trial 5, corn was planted in 30-in. rows at 29,000, 33,000, 35,000, and 38,000 seeds/acre. In Trial 7, two corn varieties were planted at 30,000, 36,000, and 42,000 seeds/acre in both 20-in. and 30-in. rows.

In Trial 8, soybeans were planted at 100,000, 125,000, and 150,000 seeds/acre in 30-in. rows. In Trial 9, soybeans were planted at 101,000 and 148,500 seeds/acre in 36-in. rows. In Trials 10 and 11, soybeans were planted at 125,000, 140,000, and 155,000 seeds/acre in 30-in. rows. In Trial 12, soybeans were planted at 154,000 seeds/acre in 30-in. rows and 176,000 seeds/acre in a diamond pattern by using a 30-in. row planter and planting a second time diagonally across the field.

Results and Discussion

In Trials 1 and 3, there was a significant increase in yield of 4 to 6 bushels/acre ($P \leq 0.07$) with the planting population of 34,000 to 35,000 seeds/acre compared with 30,000 seeds/acre or less (Table 3). In Trial 7, there also was a significant yield increase of four bushels/acre with the 36,000 seeds/acre vs. the 30,000 seeds/acre population when all treatments including both hybrids were analyzed together, but no difference among populations with Pioneer P0157 when analyzing only the treatments within each hybrid (Table 4). It likely would take a yield increase of about six bushels/acre to pay for an extra 5,000 seeds/acre at current corn and seed prices.

In Trial 7, there was no effect of row spacing on corn yield ($P = 0.30$), but Pioneer P0157 yielded 11 bushels/acre more than Pioneer PO297 ($P < 0.01$). None of the interactions in Trial 7 (hybrid × population, spacing × population or hybrid × spacing × population) were significant at $P = 0.05$. There was no effect of population on corn yield for any of the other trials.

In Trials 8 and 11, soybeans planted at the lowest populations of 100,000 to 125,000 seeds/acre yielded more than the soybeans planted at the highest populations of 150,000 to 155,000 seeds/acre ($P \leq 0.03$). There was no effect of planting population on the soybean yield in any of the other trials (Table 5).

Results from these trials suggest there may be an opportunity for some farmers to cut costs by cutting seeding rates, because the planting populations that resulted in the highest yields are lower in some trials than the commonly recommended planting rates. However, results likely will vary from year to year.

Table 1. Hybrid, row spacing, planting date, previous crop, and tillage practices in the 2015 plant population trials on corn.

Exp. no.	Trial	County	Hybrid	Row spacing (in.)	Planting date	Previous crop	Tillage
150202	1	Buena Vista	Dekalb DK5358	36	5/22/15	Soybean	Field cultivate
150214	2	Pocahontas	Golden Harvest 06N80 & OW74	30	4/30/15	Soybean	Field cultivate
150218	3	Buena Vista	Syngenta E98	30	5/3/15	Soybean	Disk, cultivate
150105	4	Lyon	Croplan L5369 RIB	20	4/27/15	Soybean	Conventional
150119	5	Sioux	Pioneer PO591 AMX	30	4/30/15	Soybean	Conventional
150160	6	Lyon	Golden Harvest 05T82	20	4/27/15	Soybean	Conventional
150112	7	Lyon	Pioneer PO157 & Pioneer PO297	20 & 30	4/29/15	Soybean	Conventional

Table 2. Variety, row spacing, planting date, previous crop, and tillage practices in the 2015 plant population trials on soybean.

Exp. no.	Trial	County	Variety	Row spacing (in.)	Planting date	Previous crop	Tillage
150120	8	Sioux	Pioneer 28T33	30	4/28/15	Corn	No-till
150203	9	Buena Vista	Asgrow 2433	36	6/3/15	Corn	Chisel, field cultivate
150215	10	Pocahontas	Syngenta S26-P3	30	5/22/15	Corn	Chisel, field cultivate
150219	11	Buena Vista	Golden Harvest 25E5	30	6/1/15	Corn	Chisel, disk, cultivate
150505	12	Hardin	Pioneer 25T51R	30 vs diamond pattern	5/15/15	Corn	Fall disk ripped, Spring field cultivate

Table 3. Spring stand, fall stand, and yield from corn planting population trials in 2015.

Exp. no.	Trial	Treatments (seeds/A)	Spring stand (plants/A)	Fall stand (plants/A)	Yield[b] (bu/A)	P-value (yield)[c]
150202	1	28,000	27,900 a	26,800 a	195 a	0.07
		34,300	33,600 b	32,800 b	199 a	
150214	2a[a]	30,000	30,000 a	29,000 a	228 a	0.22
		35,000	32,500 a	33,400 ab	229 a	
		38,000	37,100 b	36,500 b	227 a	
	2b[a]	30,000	29,700 a	29,000 a	215 a	0.30
		35,000	32,300 a	33,400 ab	218 a	
		38,000	37,100 b	36,500 b	221 a	
150218	3	30,000	29,600 a	28,700 a	191 a	0.01
		35,000	33,500 b	32,300 b	197 b	
		40,000	37,600 c	35,500 c	199 b	
150105	4	32,500			215 a	0.56
		34,500			213 a	
		37,500			215 a	
150119	5	29,000			206 a	0.21
		32,000			203 a	
		35,000			199 a	
		38,000			200 a	
150160	6	32,000			224 a	0.77
		34,500			224 a	
		37,000			227 a	

[a]Variety was Golden Harvest 06N80 for 2a and Golden Harvest OW74 for 2b.
[b]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.05.
[c]P-value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.

Table 4. Yield from a corn population by row spacing trial in 2015. - new

Exp. no.	Trial	Hybrid	Row spacing (in.)	Population (seeds/A)	Yield (bu/A)[a]	P-value (within each hybrid)[b]
150112	7	Pioneer PO157	20	30,000	229 a	0.25
		Pioneer PO157	30	30,000	230 a	
		Pioneer PO157	20	36,000	234 a	
		Pioneer PO157	30	36,000	233 a	
		Pioneer PO157	20	42,000	230 a	
		Pioneer PO157	30	42,000	225 a	
				MEAN	**230 a**	
		Pioneer PO297	20	30,000	219 a	0.08
		Pioneer PO297	30	30,000	219 a	
		Pioneer PO297	20	36,000	224 a	
		Pioneer PO297	30	36,000	221 a	
		Pioneer PO297	20	42,000	216 a	
		Pioneer PO297	30	42,000	215 a	
				MEAN	**219 b**	

[a]Values denoted with the same letter within a hybrid are not statistically different at the significance level of 0.05.
[b]P-value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.

Table 5. Spring stand, fall stand, and yield from soybean planting population trials in 2015.

Exp. no.	Trial	Treatments (seeds/A)	Spring stand[a] (plants/A)	Fall stand[a] (plants/A)	Yield[a] (bu/A)	P-value (yield)[b]
150120	8	100,000			77 a	0.01
		125,000			76 ab	
		150,000			75 b	
150203	9	101,000	96,600 a	78,700 a	61 a	0.50
		148,500	142,500 b	110,300 b	62 a	
150215	10	125,000	123,800 a	115,500 a	68 a	0.35
		140,000	138,000 b	127,500 b	67 a	
		155,000	152,900 c	138,700 c	66 a	
150219	11	125,000	123,000 a	119,800 a	64 a	0.03
		140,000	138,900 b	131,800 b	63 ab	
		155,000	150,100 c	138,600 c	62 b	
150505	12	154,000	154,300 a		53 a	0.76
		176,000	174,300 b		52 a	

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.05.
[b]P-value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.