On-Farm Corn and Soybean Population by Planting Date Demonstration Trials

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Introduction

Corn and soybean planting is one of the most critical operations of the season. 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. 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 population can reduce profits. Planting timing also can have a yield effect on corn and soybean. The objective of these trials was to investigate the effect of various plant populations and various planting dates on corn and soybean yield.

Materials and Methods

In 2020, five trials investigated the effects of various plant populations on soybean yield, and three trials investigated the effects of various plant populations on corn yield (Table 1). Trials 200101 and 200403 incorporated multiple planting dates as well as different populations. In trial 200307, soybean planting populations of 100,000, 120,000, and 140,000 were investigated. Trial 200503 and 200504 investigated a low soybean population of 80,000 compared with 120,000 and 160,000 on two different varieties. Trial 200401 investigated standard corn seeding populations of 30,000, 32,000, and 34,000 seeds/acre. Trial 200308 studied two corn populations with the lower of 26,000 and the high of 32,000 seeds/acre. Trial 200702 investigated higher corn seeding populations of 34,000, 36,000, and 38,000 seeds/acre. Some of the trials were conducted on-farm by farmer cooperators using the farmer's equipment, and some trials were conducted on research farms. Strips were arranged in a randomized complete block design with at least three replications/treatment. Strip length and width varied from field-to-field depending on field and equipment size. All plots were machine harvested for grain yield.

Results and Discussion

In soybean trial 200101 (Table 2), there was a significant difference in yield to the $P < 0.01$ level based on the planting date. The later planting date yielded better than the early planting date. Trial 200503 also showed significant yield difference with the 160,000 seeds/acre out yielding the 80,000 seeds/acre by nine bushels/acre. There was no significant yield difference between treatments in trials 200403, 200307, and 200504. Past studies have indicated soybean yields are similar with a wide range of seeding rates. It is usually recommended to seed about 140,000 seeds/acre in order to have a final plant stand of 100,000 plants/acre or more. These trials indicate seeding rates less than 140,000 seeds/acre may be sufficient, although results will likely vary from year-to-year. None of the corn population trials showed a significant yield difference at the $P = 0.10$ level. Seeding rates of 34,000 seeds/acre or more are usually recommended. Based on these trials, it is apparent that seeding rates as low as 28,000 seeds/acre may be adequate for maximum corn yields. These results display the wide range of profit potential and costs associated with different seeding populations.

There may be opportunities for some farmers to reduce their seeding rates and improve profits, although results will likely vary from year-to-year.

NOTE: The results presented are from replicated demonstration trials. Statistics are used to detect differences at a location and should not be interpreted beyond the single location.

Table 1. Variety, row spacing, planting date, planting population, previous crop, and tillage practices in the 2020 population trials on corn and soybean.

Trial	County	Variety	Row spacing (in.)	Planting date	Planting population (seeds/ac)	Previous crop	Tillage
Soybean							
200101	Sioux	Pioneer 23A15X	30	4/21/20 5/9/20	90,000 110,000 130,000 150,000	Corn	No-till
200403	Hancock	Pioneer 23A15X	30	4/20/20 5/1/20 5/15/20 5/30/20	100,000 140,000 140,000 Trt 180,000	Corn	Conventional
200307	Monona	LG 2898LL	30	5/21/20	100,000 120,000 140,000	Corn	No-till
200503	Boone	Miller 2659LL	30	5/17/20	80,000 120,000 160,000	Corn	Fall rip/spring cultivate
200504	Boone	Pioneer 25A96L	30	5/13/20	80,000 120,000 160,000	Corn	Fall rip/spring cultivate
Corn							
200401	Hancock	Wyffels W5086	30	4/22/20	30,000 32,000 34,000	Soybean	Conventional
200308	Monona	LG 5525	30	5/11/20	26,000 32,000	Soybean	No-till
200702	Washington	Stine 9808E-20	30	4/27/20	34,000 36,000 38,000	Soybean	Spring soil finisher

Table 2. Yields and economics for on-farm corn and soybean plant population trials in 2020.

Trial	Treatment	Planting date	Yield (bu/ac)[a]	P-value[b]	Seed cost per acre[c]	Seed yield profit per acre[d]
Soybean						
200101	Planted at 90,000 seeds/ac	4/21/20	70 c	<0.01	$28.93	$671.07
	Planted at 110,000 seeds/ac	4/21/20	72 c		$35.36	$684.64
	Planted at 130,000 seeds/ac	4/21/20	72 c		$41.79	$678.21
	Planted at 150,000 seeds/ac	4/21/20	71 c		$48.21	$661.79
	Planted at 90,000 seeds/ac	5/9/20	77 b		$28.93	$741.07
	Planted at 110,000 seeds/ac	5/9/20	80 ab		$35.36	$764.64
	Planted at 130,000 seeds/ac	5/9/20	80 a		$41.79	$758.21
	Planted at 150,000 seeds/ac	5/9/20	80 ab		$48.21	$751.79
200403	Planted at 100,000 seeds/ac	4/20/20	59 ab	0.80	$32.14	$557.86
	Planted at 140,000 seeds/ac	4/20/20	58 bc		$45.00	$535.00
	Planted at 140,000 seeds/ac Trt w/Lumisena	4/20/20	56 bcd		$45.00	$515.00
	Planted at 180,000 seeds/ac	4/20/20	58 ab		$57.86	$522.14
	Planted at 100,000 seeds/ac	5/1/20	53 d		$32.14	$497.86
	Planted at 140,000 seeds/ac	5/1/20	53 d		$45.00	$485.00
	Planted at 140,000 seeds/ac Trt w/Lumisena	5/1/20	55 bcd		$45.00	$505.00
	Planted at 180,000 seeds/ac	5/1/20	54 cd		$57.86	$482.14
	Planted at 100,000 seeds/ac	5/15/20	58 ab		$32.14	$547.86
	Planted at 140,000 seeds/ac	5/15/20	58 bc		$45.00	$535.00
	Planted at 140,000 seeds/ac Trt w/Lumisena	5/15/20	58 abc		$45.00	$535.00
	Planted at 180,000 seeds/ac	5/15/20	58 abc		$57.86	$522.14
	Planted at 100,000 seeds/ac	5/30/20	58 abc		$32.14	$547.86
	Planted at 140,000 seeds/ac	5/30/20	59 ab		$45.00	$545.00
	Planted at 140,000 seeds/ac Trt w/Lumisena	5/30/20	62 a		$45.00	$575.00
	Planted at 180,000 seeds/ac	5/30/20	59 ab		$57.86	$532.14
200307	Planted at 100,000 seeds/ac		59 a	0.88	$32.14	$557.86
	Planted at 120,000 seeds/ac		61 a		$38.57	$571.43
	Planted at 140,000 seeds/ac		60 a		$45.00	$555.00
200503	Planted at 80,000 seeds/ac		45 c	<0.01	$25.71	$424.29
	Planted at 120,000 seeds/ac		52 b		$38.57	$481.43
	Planted at 160,000 seeds/ac		56 a		$51.43	$508.57
200504	Planted at 80,000 seeds/ac		60 a	0.33	$25.71	$574.29
	Planted at 120,000 seeds/ac		62 a		$38.57	$581.43
	Planted at 160,000 seeds/ac		62 a		$51.43	$568.57

Table 2 (continued). Yields and economics for on-farm corn and soybean plant population trials in 2020.

Corn					
200401	Planted at 30,000 seeds/ac	164 b	0.17	$93.75	$398.25
	Planted at 32,000 seeds/ac	161 b		$100.00	$383.00
	Planted at 34,000 seeds/ac	163 b		$106.25	$382.75
	Planted at 36,000 seeds/ac	169 ab		$112.50	$394.50
	Planted at 38,000 seeds/ac	175 a		$118.75	$406.25
200308	Planted at 26,000 seeds/ac	227 a	0.99	$81.25	$599.75
	Planted at 32,000 seeds/ac	228 a		$100.00	$584.00
200702	Planted at 34,000 seeds/ac	214 a	0.75	$106.25	$535.75
	Planted at 36,000 seeds/ac	219 a		$112.50	$544.50
	Planted at 38,000 seeds/ac	217 a		$118.75	$532.25

[a]Values denoted with the same letter within a trial are not statistically different at the significance level of 0.10.
[b]P-value = the calculated probability that the difference in yields can be attributed to the treatments and no 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. This is consistent for demonstration trials.
[c]Cost/acre is based on current cost estimates of corn at 80k/bag at $250/bag and soybeans at 140k/bag at $45/bag. Local costs structures and discounts will vary. The baseline formula is population x cost per unit seed/acre.
[d]Seed yield profit/acre based on formula (market price x yield achieved – seed costs). Market Price used was $9.00 for soybeans and $3.00 for corn.