Identifying Economically Optimal Soybean Seeding Rates Under No-Till Conditions

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Objective

To determine a minimum seeding rate to maximize economic soybean yield under no-till situations.

Background

Crop Year: 2014
Location: Farm Science Review MCAC Field 5
County/Town: Madison/ London
Soil Type: Kokomo, Crosby, Lewisburg
Drainage: Natural
Previous Crop: Corn
Tillage: No-till
Soil Test: OM 3.2%, CEC 25, pH 6.8, BpH 6.9, Bray P1 P 25 ppm, K 125 ppm
Planting Date: May 8
Variety: Pioneer P93Y05
Fertilizer: None in 2014
Seeding Rate: 50,000 to 200,000 seed/A
Harvest Date: September 26

Methods

Soybean yield is used as the measure for seeding rate effects. This study was designed as a randomized complete block with four replications of each treatment. Seeding rates were randomly assigned within each replicate. The trial was conducted in large plots of 1000 feet long by 40 feet wide (0.92 A) for each treatment at the Ohio State University Farm Science Review Molly Caren Agricultural Center near London, Ohio.

Variable evaluated:

Seeding rate –

- Seven seeding rates were compared: 50, 75, 100, 125, 150, 175 and 200 thousand seeds per acre in 15 inch rows.
- Seed cost is $50.39 per unit of 150,000 seeds.

The seeding rates were set from the tractor cab as each treatment was planted with the John Deere 1790 planter. Stand counts (population estimates) were made June 13th in each plot by measuring a length of 17.4 feet and counting plants in two adjacent rows. Lodging on a 1 to 10 scale, with 1 erect and 10 being flat, was determined from the combine at harvest. A John Deere S660 combine with GreenStar yield monitor was used to harvest a 30 foot pass from the center of each 40 foot planted strip; grain was weighed, moisture determined and recorded. Yield was corrected for moisture content to 13%. Rainfall from planting date to harvest was 17.8 inches. This field is grid sampled, soil test values are an average of results from across the trial area.

Results

Soybean seeding rate effects are presented in Table 1 for yield, plant stand and percent plant stand. An ANOVA (Analysis of Variance) was used to determine differences among the treatments. An LSD (least significant difference) was determined at a 10% confidence level.

Table 1. Seeding rate effects on soybean yield and plant stand, London Ohio 2014.

Seeding rate thou seed/A	Yield bu/A	Plant stands thou/A	% stand
50	36.0	43	86%
75	48.0	63	84%
100	52.8	85	85%
125	51.8	111	88%
150	53.9	129	86%
175	53.3	149	85%
200	54.3	172	86%
LSD 0.10	*9.4*	*9.2*	

Summary

As shown in Table 1, there were significant yield differences by seeding rate ($p = 0.0379$). There were significant differences in stand counts by seeding rate and they closely followed the trial plan with approximately 86% emergence. While not shown, there were no differences in the lodging scores; all treatments and replicates were rated as a one (1) by the combine operator, indicating no lodging. The rainfall of 17.8 inches for the growing period is slightly below the normal of 18.6 inches for London for the months of May through September (US Climate Data).

Of greater interest was maintaining yield while reducing seed cost. The current Farm Science Review practice is to plant 155,000 seeds per acre. Taking a look at the economics of the seed costs, shown in Table 2, indicates that we can improve our net return per acre with a reduction in the seeding rate.

Table 2. Economic impact of seeding rate on net return per acre, London, Ohio 2014. Soybean price here is $10 per bushel.

Seeding rate (thou. seed/A)	Yield (bu/A)	Seed cost ($/Acre)	Gross ($/Acre)	Net return (less seed cost)
50	36.0	$16.80	$360.43	$343.63
75	48.0	$25.20	$479.68	$454.49
100	52.8	$33.59	$528.30	$494.71
125	51.8	$41.99	$517.77	$475.77
150	53.9	$50.39	$539.43	$489.04
175	53.3	$58.79	$532.65	$473.86
200	54.3	$67.19	$542.57	$475.38

There may be a case made that reducing the seeding rate to 100,000 seeds per acre would provide more economic and agronomic value with reduced handling costs, reduced interest cost, reduced wear and tear on mechanisms, etc. However, maintaining a seeding rate of approximately one unit per acre (of 140,000 to 150,000 seeds/unit) can be justified as a way to reduce risk of yield loss when unknown conditions for stand loss occur such as seen in 2013 (Watters, Douridas). A comparison of spring weather conditions at a nearby location between 2013 and 2014 sheds no light on why 30-day stand counts were 68% in 2013 and 86% in 2014 (The Weather Collector), hence the suggestion for not reducing the seeding rate too greatly.

References

US Climate Data, London Ohio. http://www.usclimatedata.com/climate/london/ohio/united-states/usoh0520.
The Weather Collector, data for London State Fish Hatchery 2013, 2014. http://www.theweathercollector.com/.
Watters, H.D., Douridas, N. N. Soybean Seeding Rates by Tillage - No-Till vs. Vertical Till. http://agcrops.osu.edu/on-farm-research/research%20reports/2013/watters/Soybean%20Seeding%20Rate%20and%20Tillage%20FINAL%20WBC.pdf.

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