

## Effect of Seeding Rate on Soybean Yield – How Low Can We Go?

Published: May 2024

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### **Objective**

Understand the yield impact of varying soybean seeding rates and determine the economic and agronomic optimal rate for Williams County, Ohio

### **Background**

Soybean seed cost in Ohio (per 1,000 seeds, treated) has increased 20% in the past ten years (Ward, 2022). Lowering seeding rates may be an opportunity for Williams County soybean growers to increase profitability by reducing total seed costs. However, the optimum seeding rate of soybean [*Glycine max* (L.) Merr.] is highly dependent on the environment. Replicated on-farm strip trials provide growers with personalized data to better inform their seeding rate decisions. Thus, on-farm trials were conducted in 2019, 2020, and 2021 to determine if lower seeding rates would significantly impact yield.

### **Methods**

After corn, soybeans were planted in 2019, 2020, and 2021 near Montpelier, Ohio in Williams County. Planting in 2019 was significantly delayed due to wet weather conditions, and soybeans were planted on July 2. Soybeans were planted on June 8 in 2020 and April 27 in 2021. All three sites had one conventional fall tillage pass followed by one vertical tillage pass in the spring prior to planting.

The study was a randomized complete block design (RCBD) with four replications in 2019 and 2021 and three replications in 2020. The plot size was 40-feet wide and field length. Five seeding rates ranging from 80,000 – 240,000 seeds per acre in increments of 40,000 were evaluated.

Stand counts were taken 4 – 6 weeks after planting to determine the final emergence. Precipitation data was obtained from cocorahs.org and recorded daily. Yield and grain moisture data were obtained using a calibrated yield monitor. Yields were standardized to 13% moisture. Treatment comparisons within crop year were made using Fisher's Protected Least Significant Differences test. The effect of seeding rate on yield across years was determined using a linear mixed effects model with year, and block nested in year, treated as random effects using R. Return above seed cost was calculated using a uniform seed cost of \$0.432/1,000 seeds and soybean price of \$12.00/bushel.



**Results**

Soybean yields from the seed rate treatments were not significantly different in 2019, 2020, or 2021 ( $P > 0.05$ ; Table 1).

| <b>Table 1. Average emergence, moisture, yield, and return above seed per seeding rate in 2019, 2020, and 2021.</b> |                                   |                     |                                       |  |
|---|-----------------------------------|---------------------|---------------------------------------|--|
| <b>Crop Year: 2019</b>  |                                   |                     |                                       |  |
| <b>Seeding Rate (seeds/ac)</b>  | <b>Avg. Emergence (plants/ac)</b> | <b>Moisture (%)</b> | <b>Yield (bu/ac)</b>                  | <b>Return Above Seed (\$/ac)<sup>†</sup></b> |
| 80,000  | 67,000                            | 16.6                | 48 b                                  | 398  |
| 120,000   | 102,000                           | 16.4                | 50 ab                                 | 399  |
| 160,000   | 139,000                           | 16.5                | 53 a                                  | 409  |
| 200,000   | 175,000                           | 16.4                | 52 a                                  | 382  |
| 240,000   | 212,000                           | 16.4                | 50 ab                                 | 347  |
|   |                                   |                     | <b>P &gt; 0.05</b><br>LSD (0.05) 3.00 |  |

| <b>Crop Year: 2020</b>         |                                   |                     |                                       |  |
|--------------------------------|-----------------------------------|---------------------|---------------------------------------|--|
| <b>Seeding Rate (seeds/ac)</b> | <b>Avg. Emergence (plants/ac)</b> | <b>Moisture (%)</b> | <b>Yield (bu/ac)</b>                  | <b>Return Above Seed (\$/ac)<sup>†</sup></b> |
| 80,000                         | 81,000                            | 16.2                | 45 b                                  | 392  |
| 120,000                        | 90,670                            | 16.2                | 47 ab                                 | 395  |
| 160,000                        | 143,670                           | 16.2                | 45 b                                  | 360  |
| 200,000                        | 179,330                           | 16.2                | 49 a                                  | 382  |
| 240,000                        | 193,670                           | 16.2                | 48 a                                  | 357  |
|                                |                                   |                     | <b>P &gt; 0.05</b><br>LSD (0.05) 3.45 |  |

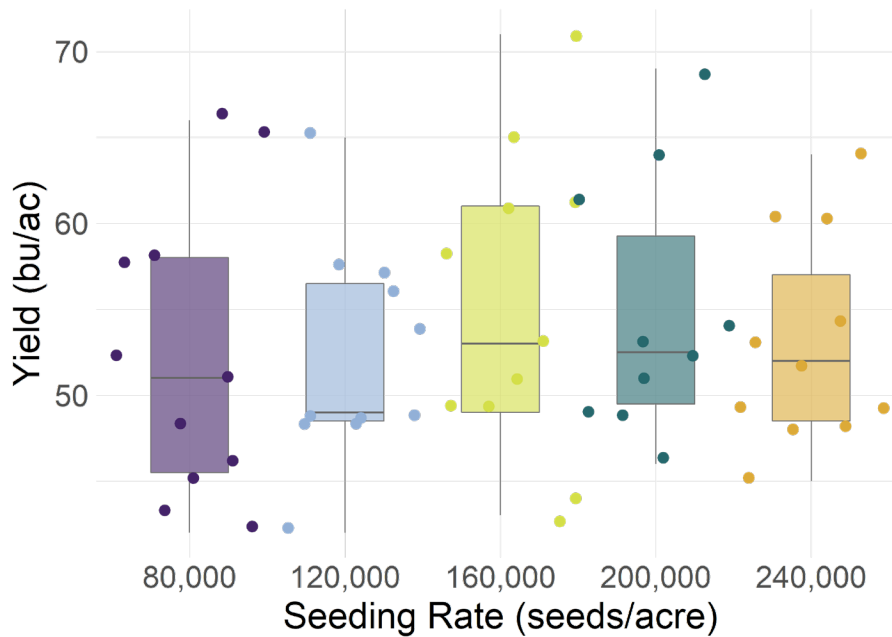
| <b>Crop Year: 2021</b>         |                                   |                     |                                       |  |
|--------------------------------|-----------------------------------|---------------------|---------------------------------------|--|
| <b>Seeding Rate (seeds/ac)</b> | <b>Avg. Emergence (plants/ac)</b> | <b>Moisture (%)</b> | <b>Yield (bu/ac)</b>                  | <b>Return Above Seed (\$/ac)<sup>†</sup></b> |
| 80,000                         | 64,000                            | 13.5                | 62 ab                                 | 709  |
| 120,000                        | 101,500                           | 13.5                | 59 b                                  | 656  |
| 160,000                        | 115,250                           | 13.5                | 65 a                                  | 711  |
| 200,000                        | 151,250                           | 13.5                | 62 ab                                 | 658  |
| 240,000                        | 188,500                           | 13.5                | 59 b                                  | 604  |
|                                |                                   |                     | <b>P &gt; 0.05</b><br>LSD (0.05) 5.34 |  |

<sup>†</sup>Return above seed cost equal total seed cost subtracted from the gross income.

Average yield across treatments was highest in 2021, most likely due to an earlier planting date.

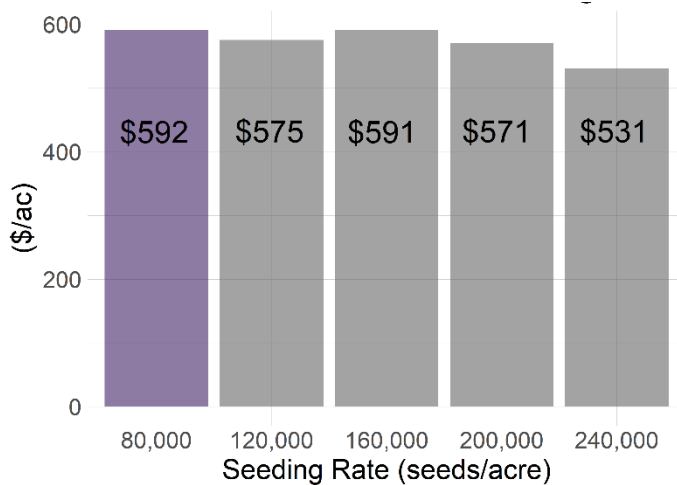
The seeding rate also did not significantly affect soybean yield across years combined (Figure 1)

**Figure 1. Final soybean yield (bu/ac) across years. P-value = 0.08.**



Overall, seeding rates less than 200,000 seeds per acre had the greatest return above seed cost. (Figure 2).

**Figure 2. Return above seed cost (\$/ac) across years.**



**Summary**

This study demonstrated that Williams County soybean growers can lower seeding rates to increase their return, though a final population of 100,000 plants per acre is still recommended to achieve maximum yield (Barker et al., 2017). Overall, these data will improve seeding rate recommendations for northwest Ohio soybean growers and inform future replant decisions and variable rate seeding prescriptions.

**Acknowledgements**

The author expresses appreciation to Dave Cunningham and Bridgewater Farms

**References**

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