# Best Planting Management for Double-Crop Soybeans in Delaware

**Jarrod O. Miller**
**University of Delaware Extension**
**2024 Final Report**

## Introduction and Objectives

Double-cropping systems, where soybeans are planted following small grains such as wheat, have gained increasing attention as a strategy to maximize land use efficiency. However, optimal planting populations and row spacings for double-crop soybeans have not been fully established. Studies across the United States have indicated that lower planting populations do not always result in lower yields, yet variations in climate and soil types may lead to different outcomes depending on the region. In Delaware, the effects of planting populations and row spacings on double-crop soybean yield remain unclear and require further investigation. Additionally, the influence of wheat residue on soybean performance, particularly in relation to decomposition dynamics, is an underexplored factor that may affect yield and crop management strategies.

This study aims to evaluate the effects of soybean planting population and row spacing on yield in double-crop systems, as well as the impact of these factors on wheat residue breakdown. The results will provide valuable insights for agronomic practices, contributing to more informed decisions regarding planting density, row spacing, and residue management in double-crop soybean systems.

### Objectives

1. Plant double-crop soybeans at five planting rates between 60,000 and 180,000 seeds per acre.
2. Plant double-crop soybeans at two row spacings: 15 and 30 inches.
3. Evaluate the yield response of double-crop soybeans to planting population and row spacing.
4. Assess wheat residue breakdown under different planting populations and row spacings.

## Methods

This study was conducted at the Carvel Research and Education Center in Georgetown, DE, in a June-harvested wheat field. Soybeans were planted in a randomized complete block design with five planting populations (80,000, 100,000, 120,000, 140,000, and 160,000 seeds per acre) and two row spacings (15 and 30 inches). The plots were irrigated as needed throughout the growing season to ensure optimal growth (Figure 1).

In plots with three population treatments (80,000, 120,000, and 160,000 seeds per acre), logging sensors were installed in both 15-inch and 30-inch row spacings. These sensors measured electrical conductivity (EC), moisture, and temperature throughout the growing season. Soybean yields were recorded using a plot combine in late fall.
Data analysis was performed in SAS using a randomized complete block design. The analysis included a

factorial structure to assess soybean yield responses to planting population and row spacing. Yield data were also correlated with environmental factors (e.g., EC, moisture, and temperature) measured by the logging sensors to better understand the factors influencing soybean production in double-crop systems.

**Figure 1:** Sand, silt, and clay content mapped across the Warrington Irrigation Research Farm. Light colors are more sand, while dark black is higher silt, and dark red is greater clay.

## Results and Discussion

There was no interaction between population and row spacing, so they can be discussed separately. Row spacing and planting population had significant effects on soybean yield in the double-crop system. Soybeans planted in 15-inch rows yielded 27.3 bushels per acre, while those planted in 30-inch rows produced 22.4 bushels per acre, demonstrating a clear advantage for narrower row spacing. The improved yield in the 15-inch rows likely resulted from quicker canopy closure, which can enhance light interception and reduce weed pressure.

Based on the Least Squares Means (LS-means) analysis at an alpha level of 0.1, significant differences in yield were observed across different population levels. The highest yield estimates were observed at the 120, 180, and 150 plant populations, with LS-means yields of 27.39, 27.31, and 27.07, respectively, showing no significant differences among them. The 90 plant population had a lower yield estimate of 25.32, but still performed better than the lower populations. The 60 and 40 plant populations produced the lowest yields, with LS-means yields of 22.71 and 19.41, respectively, indicating a significant decline in yield as population density decreased. In conclusion, higher plant populations (120, 180, and 150) yielded the best results, while lower populations (60 and 40) resulted in a marked reduction in yield.

**Table 1:** Yield as Least Squares Means (Alpha=0.1) for Population and Row Spacing. Yields with different letters are significantly different.

| **Row Spacing** | **Yield** | **Grouping** |
|---|---|---|
| 15 | 27.2834 | A |
| 30 | 22.4497 | B |
| **Population** | | |
| 120 | 27.3909 | A |
| 180 | 27.3063 | A |
| 150 | 27.0692 | A |
| 90 | 25.3159 | B A |
| 60 | 22.7093 | B C |
| 40 | 19.4077 | C |

The results suggest that both planting population and row spacing play important roles in the yield of double-cropped soybeans. Higher populations (120, 180, and 150) consistently resulted in the best yields, while lower populations (60 and 40) produced significantly lower yields. This indicates that for double-cropped soybeans, higher planting populations may help compensate for the shorter growing season and environmental stresses, maximizing yield potential.

In addition to population, row spacing also influenced yield. Soybeans planted at a 15-inch row spacing outperformed those planted at 30-inch row spacing, with a yield estimate of 27.28 compared to 22.45. This suggests that narrower row spacing allows for better resource utilization, likely improving canopy cover and reducing competition for light, which is critical in the limited growing period typical of double-cropped systems.

Interestingly, past studies on full-season soybeans have not observed significant differences in yield based on population, indicating that other factors like soil fertility and growing season length may be more influential for full-season beans. However, for double-cropped soybeans, where the growing season is reduced and competition for resources is more intense, both higher planting populations and narrower row spacing seem to enhance yield.

In summary, for double-cropped soybeans, both higher populations and narrower row spacings could be key strategies to optimize yield. While population density may not significantly affect full-season soybean yields, it appears to have a more pronounced effect when soybeans are planted later in the season. The combination of these two factors – higher populations and 15-inch row spacing – could help maximize yield potential under double-cropping conditions.

## Conclusions

For double-cropped soybean in Delaware, higher planting populations (at least 120,000 seeds per acre) and narrower row spacing (15 inches) both significantly improve yield. These findings suggest that increasing plant density and reducing row spacing can help optimize yield potential in the shorter growing season typical of double-cropping systems. While previous research on full-season soybeans has shown no significant population effects, the constraints of shorter season for double cropping highlight the importance of these factors in maximizing yield.