2022 Soybean Yield Response to Planting Populations, Row Spacing and Irrigation in Delaware

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Introduction and Objectives

Many agronomic practices and standards need periodic evaluation. Soybean population studies are being evaluated across the United States and observing that lower populations do not necessarily result in lower yield. While Delaware results may be like those of other regions, our climate and soil types will still have an interaction with plant population. This study observed yield results from 5 different planting populations between 60-180,000 seeds per acre. Additional treatments were added to include row spacing (15 and 30") as well as plots that were irrigated and rainfed.

Methods

Figure 1: 2022 Soybean population, rows spacing, and irrigation plots at the Warrington research farm in Harbeson, DE.

Soybeans (maturity group 4.3) were planted at the UD Warrington Irrigation Research farm in May 2022. All plots were placed under the variable rate linear research field at the farm. There were 5 planting populations between 60-180k seeds per acre separated by 30k between each treatment (60, 90, 120, 150, 180k). For each population, row spacings were set to both 15 and 30 inch spacings. Finally, selected zones under the linear irrigation system received no irrigation so that replications of each population by row spacing were represented. This lead to a total of 298 plots.

Plots were harvested in November 2022 with a plot combine. The results were analyzed statistically as a randomized complete block design with three factors (population*row-spacing*irrigation) with means separation by Fisher's LDS (alpha = 0.1).

Results and Discussion

There were no interactions between population, row spacing, or irrigation status, so results in Figures 2, 3, and 4 can display the difference between each individual factor. It should be understood that results by population (Figure 2) are averaged across all row spacings and

irrigation, with similar averages for either row spacing (Figure 3) or irrigation status (Figure 4).

Population

By population, yields ranged from 63 to 68 bu/acre, with no significant differences between full season planting populations (Figure 2). The yields on the Y axis are scaled (59-69 bushels), which gives the appearance that 90 and 180,000 planting populations were much lower, but were only 5-6 bushels lower than the maximum yields of 68 bushels (120,000 seeds acre^{-1}). This is supported by nationwide results and previous work with the Delaware Soybean Board that lower full season populations can achieve similar yields to the standard higher seeding rates.

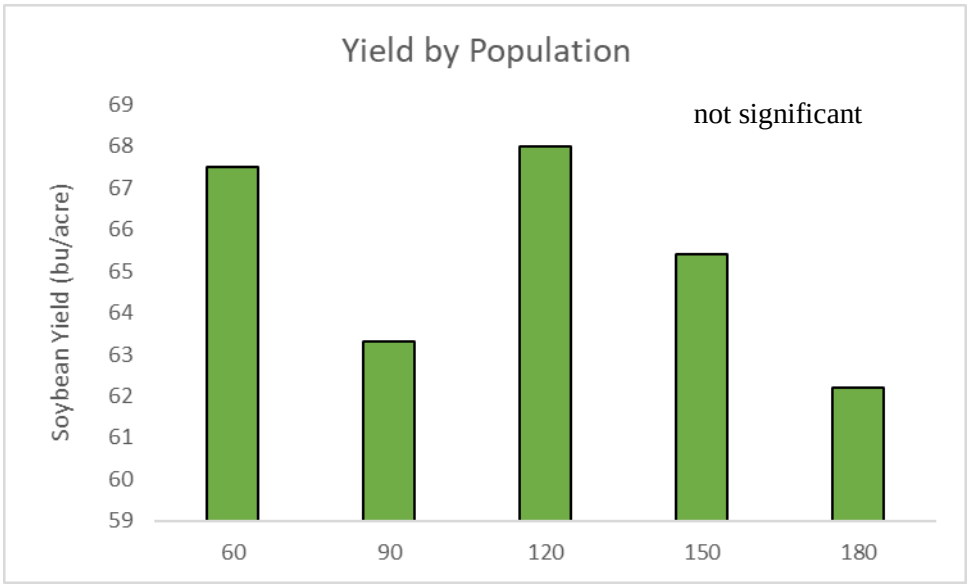

Figure 2: Soybean yields by planting population, averaged across row spacings and irrigation status.

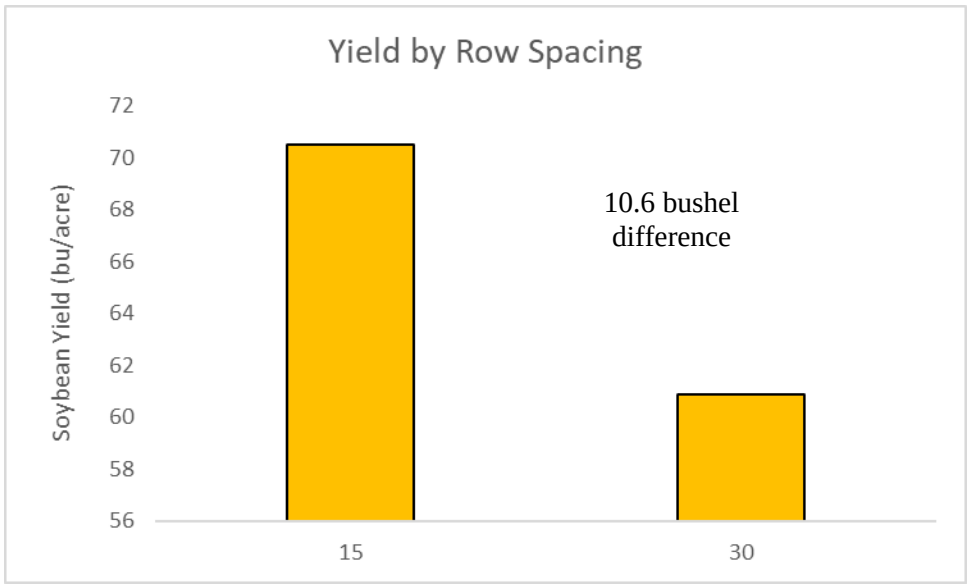

Figure 3: Soybean yields by row spacing, averaged across population and irrigation status.

Row Spacing

Across all of the populations and irrigation conditions, 15 inch rows yielded 10.6 bushels better than 30 inch rows. This is also supported by national research that shows either 7.5 or 15 inch rows often yield similar, but higher yields than 30 inch rows. That this occurred across all population and irrigation combinations supports this practice under many management scenarios.

Irrigation

Moisture is agricultures most limiting factor and the very dry summer of 2022 provided a major boost to zones that received irrigation under our linear field. Across all population and row spacing combinations, irrigation provided a 25.9 bushel difference over rainfed conditions. This would certainly vary by season and rainfall availability, but 2022 was particularly dry from July to August during reproductive stages in Harbeson, and irrigation provided a major advantage. Drone imagery also revealed the effect of soil type and water holding, where some rainfed zones have strong growth (greener colors or higher NDVI), revealing possible soil moisture holding that occurs there. Although the differences still held out across treatments, this project does help show the importance of both irrigation and soil moisture holding in maintaining higher yields. However in the case of soybeans, management in terms of populations did not matter with irrigation, while row spacing works best at 15 inch rows and irrigated conditions.

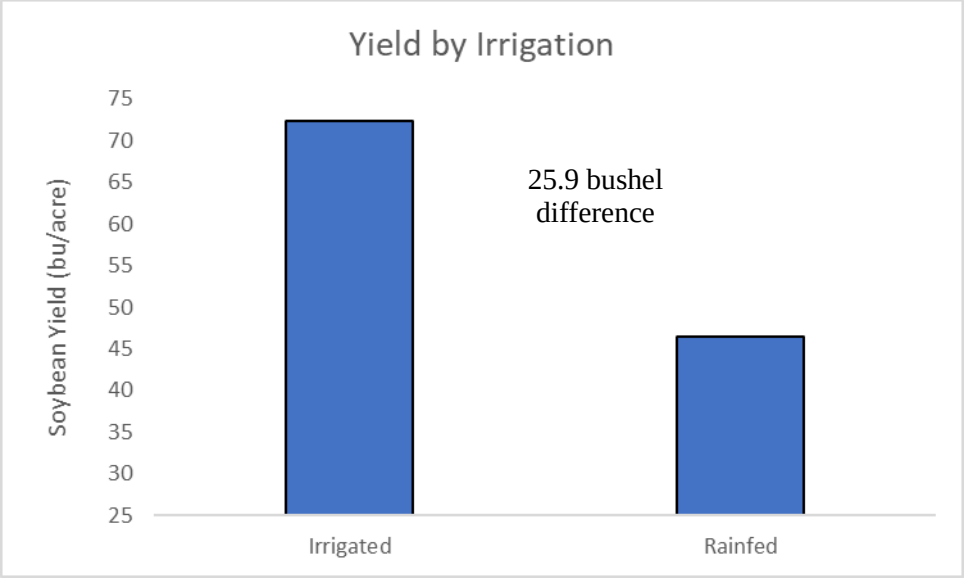

Figure 4: Yields based on Irrigation status, averaged across population and row spacing.

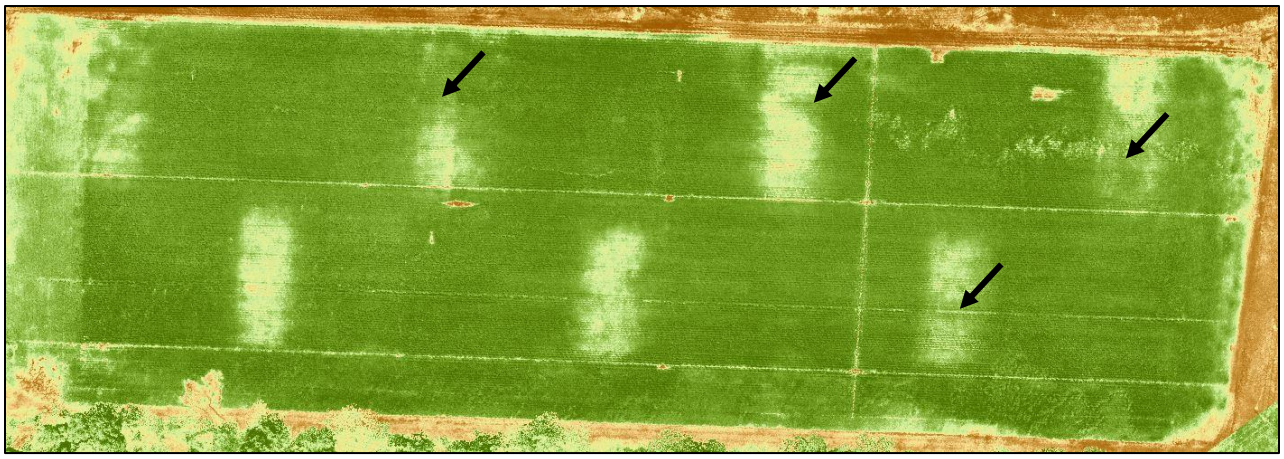

Figure 5: Drone imagery showing rainfed (light white colors) and irrigated zones under the linear irrigated field at Warrington. Patterns in soil variability (black arrows) are evident where some rainfed zones have variation in growth.

Conclusions

For the 2022 dataset, there was no difference in populations (maturity group 4.3) for full season soybeans ranging from 60-180,000 seeds acre^{-1}. This certainly gives flexibility for Delaware farmers in lowering seeding rates in an era of higher costs. However, this represents one year at one site, and local on-farm seeding rates should be performed by each producer.

Row spacing remains best for full season soybeans at 15 inches, with a 10 bushel advantage. This was only based on one variety, however this matches most nationwide research.

Irrigation remains one of the best methods for Delaware farmers to remain competitive for higher soybean yields, providing a 25-bushel advantage averaged across all row spacings and populations. The interesting observation from this study is that there was no interaction with population, so lower populations on rainfed and irrigated fields have similar differences to higher populations under the same scenarios. This type of work should be performed annually to keep up with varying weather conditions.