Effect of Early Planting on Soybean Yield

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Introduction

For Kansas agriculture, soybeans are a crucial crop in terms of economic importance. Continuously changing climate patterns across the United States, especially in the Midwest, directly affect soybean yield. Howden et al. (2007) have discussed the importance of modifying the management practices such as planting dates could improve the yield in changing climate. Though some studies have shown that the scale of the response to early planting can vary between years (Pedersen & Lauer, 2003), location (Lueschen et al., 1992), and cultivars (Grau et al., 1994), more recent studies show a general trend of higher yields associated with earlier planting dates (Nleya et al., 2020). Therefore, exploring earlier planting dates for better yield and profitability of soybeans in different parts of Kansas is imperative. This study was conducted to determine the effect of early planting dates, seed density, and maturity groups on soybean yield.

Materials and Methods

Early soybean planting studies were conducted at three Kansas State University Experiment Fields, Kansas River Valley (Topeka), North Central (Scandia), and the Southeast Research and Extension Center (Parsons) in 2022. The experimental fields at Topeka and Scandia were irrigated whereas Parsons field was rainfed. Two seeding rates (100,000 and 150,000 seeds/acre) at each planting date were used for three fields. Table 1 shows the planting dates, maturity groups with respect to to the study area, and condition.

Table 1. Three study areas for early soybean planting described planting date, maturity group, and field condition.

Field	Field condition	Planting date	Maturity group
Topeka	Irrigated	Early (03-30-2022)	GH3982X GH3728X
		Mid (04-15-2022)	
		Late (05-04-2022)	
Scandia	Irrigated	Early (04-06-2022)	GH3442XF GH4222XF
		Mid (04-27-2022)	
		Late (05-17-2022)	
Parsons	Rainfed	Early (04-08-2022)	4121RXF/SR 4720RXF/SR 5420RXF/SR
		Mid (04-29-2022)	
		Late (05-23-2022)	

The randomized complete block design was used at all locations with soybeans planted in four 30-inch rows, 10 feet wide and 40 to 50 ft feet long. Weed control measures were taken to prevent

yield reductions on all fields. The biomass data was analyzed at different growth stages of the crop i.e., V6-R1, R2-R5, and R6. Finally, yields were determined from the middle two rows of each plot to reduce the influence of neighboring plots. and was corrected to the standard grain moisture content of 13%.

Results and Discussion

Figure 1 shows that soybean biomass varied at different growth stages. Soybean biomass ranged between 4523 to 11289 lb/ac, 2945 to 8956 lb/ac, and 362 to 7630 lb/ac for Scandia, Topeka, and Parsons fields, respectively. It was found that soybean biomass was higher for early planting dates as compared to the middle and late planting dates in all the locations. The highest biomass was obtained for the Scandia location at the R6 growth stage for a 150K plant population for the earliest planting date.

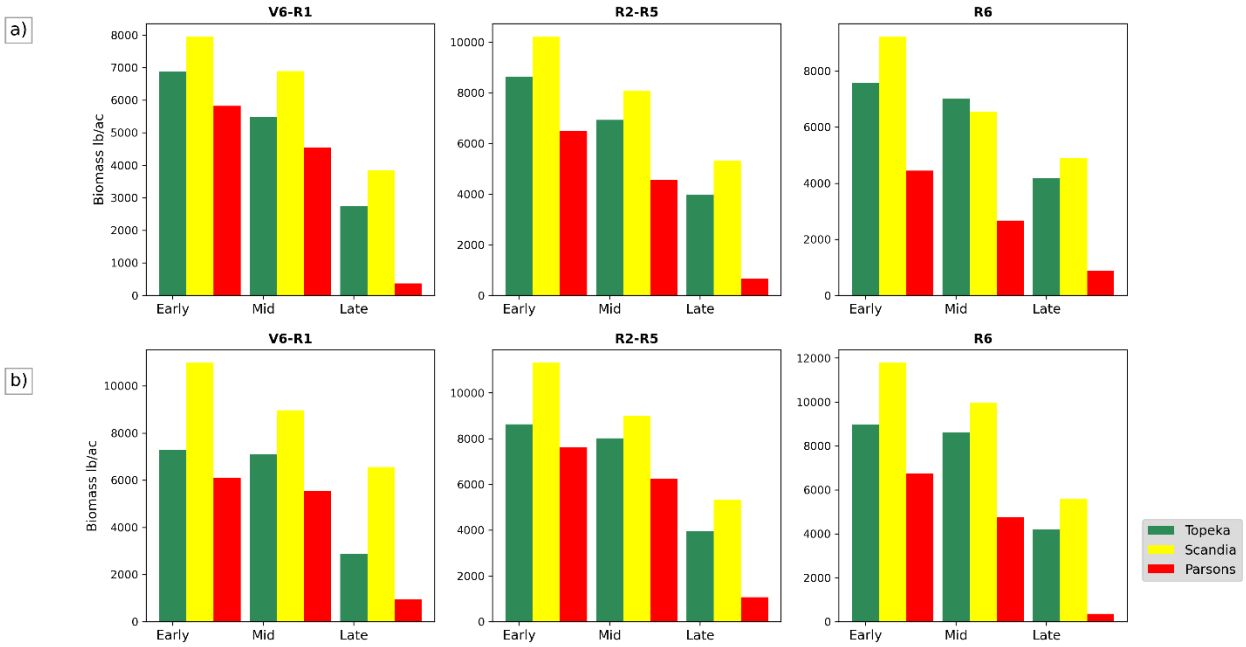

Figure 1. Biomass of Soybean for two plant populations a) 100K, and b) 150K seeds per acre for early, mid, and late planting dates for Topeka, Scandia, and Parsons fields**.**

Figures 2, and 3 show the effect of planting date on end-of-season soybean yield at Topeka, and Scandia locations, respectively, and show that the yield ranged from 78 to 82 bu/ac for Topeka, and 68 to 87bu/ac for Scandia. We found that a higher yield was observed for the first (early) planting date for both of these locations. In addition, for both Topeka and Scandia locations, a higher yield was observed for the early planting date for the GH3728X with a 150K seed population, and GH4222XF with a 100k seed population, respectively. For the Parsons location, the crop failed because of extremely dry conditions and the experiment being rainfed.

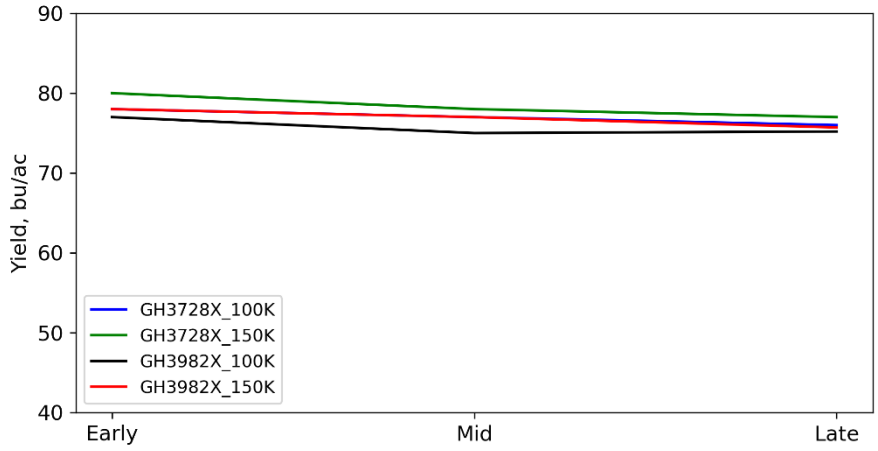

Figure 2. Effect of different planting dates on soybean yield at Kansas River Valley Experiment Field-Topeka, 2022

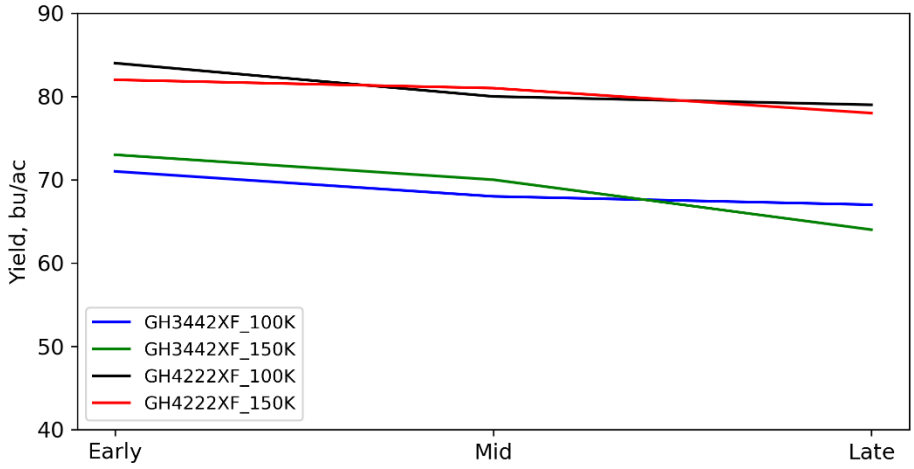

Figure 3. Effect of different planting dates on soybean yield at North Central Experiment Field-Scandia, 2022.

We found that the average historic yields for Topeka and Scandia were 66.35, and 59.43 bu/ac, respectively. According to figure 4, early planting can result in higher soybean yields. Additionally, the date of planting for the historic yields for Topeka, and Scandia were May-11 and

June-15, respectively.

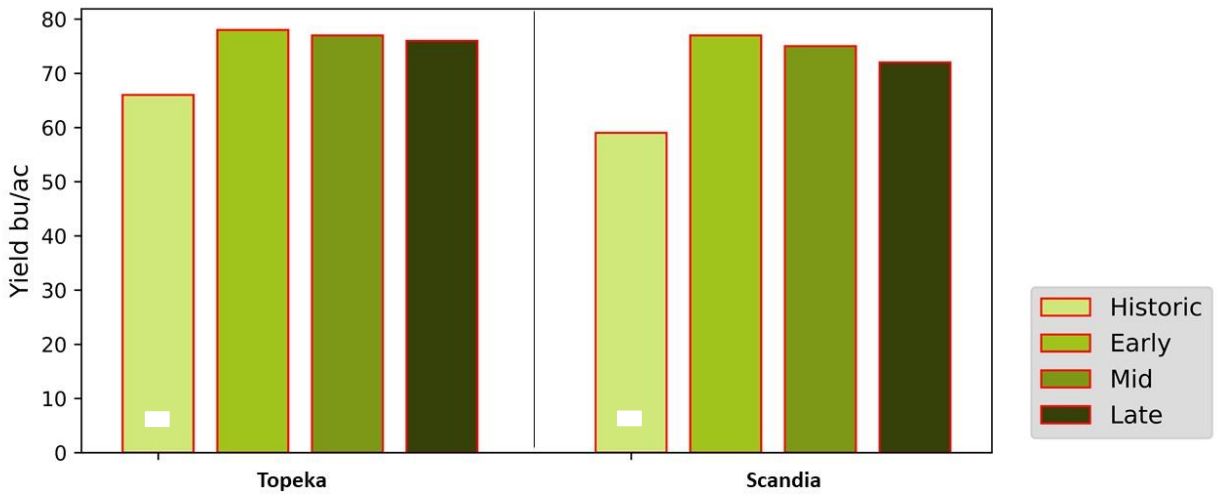

Figure 4. Bar plot represents the average soybean yield with historic (3-yr average) and early planting scenarios of 2022

Conclusion

This study found that Topeka and Scandia fields showed high plant biomass and end-season yield. In the Parsons field, plant biomass and yield were reduced because of drought conditions and the absence of irrigation. Therefore, we can conclude that planting soybeans earlier than traditional planting dates can result in increased yield if soil moisture is not a limiting factor. This study can help farmers make decisions by providing information on the optimal time to plant crops. This trial will be repeated in future years and sites.

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