Effect of Early Planting on Soybean Yield: 2021-2024 at Kansas River Valley

Eric Adee, Scott Dooley, Udit Debangshi, and Gaurav Jha

Summary

To increase soybean yield potential, early planting dates have been promoted as a management practice that can increase the yield of soybeans. Early planting of soybeans can be a relative term, meaning late April/early May for some soybean producers in Kansas, but this study's definition of early planted soybeans is late March/early April. Theoretically, the earlier planting date could allow for more vegetative growth and interception of more light before blooming, increasing the yield potential. With the improvement of soybean seed treatments to protect seeds when emergence is slowed due to cool and wet conditions, early planting may be a viable option. Over the four years this study has been conducted at the Kansas River Valley Experiment Field, the early planting dates in late March/early April have shown soybean yields as either stable or increased when planting in late March/early April compared to planting in mid-to-late April and early-to-mid May. This study also shows the increased yield potential compared to more traditional planting dates later in May.

Procedures

Early soybean planting studies were conducted in 2021-2024 at Kansas State University experiment field, Kansas River Valley (Topeka). Reports of results from individual years, 2021-2023 from Topeka and North Central Experiment Field have been published in previous Field Research Reports (Vol. 8, Iss. 4 2022; Vol. 9, Iss. 4 2023: Vol. 10, Iss. 3 2024). The experiment at Topeka in 2024 was irrigated, receiving 5.75 inches of water from July 29 to September 16. Two varieties were planted at two seeding rates (100,000 and 150,000 seeds/a) at each of three planting dates in both studies. The varieties at Topeka were Pioneer 37A18E (Maturity Group MG 3.7) and Pioneer 42A84E (MG 4.2), and they were treated with ILeVO (BASF, Florham Park, NH) and Lumigen (Corteva Agriscience, Indianapolis, IN). The 2024 planting dates at Topeka were March 29, April 15, and May 1. Soybeans were planted in four 30-inch row plots at 10 ft wide × 40 long. The experimental design utilized was a randomized complete block design with four replications. Yields were determined from the middle two rows of each plot to avoid influence from neighboring plots. Yields were corrected to 13% grain moisture. Weed control was managed to have no effect on yields.

Results

The average days to emerge for the planting dates for the four years of the study decreased from 20 days for the first planting date at the end of March to just under 12 days for the third date at the beginning of May (Table 1). The difference between the emergence dates of the first and third planting dates was not as great as the difference in

the planting dates, 25.6 days versus 34 days, respectively. The planting and emergence dates, days to emerge and growing degree days (GDD) for the four years and average of four years of the study are listed in Table 1.

The canopy dates between the first (July 10) and last (July 15) planting dates had shortened to a difference of 5.4 days (Table 1) compared to the 34-day difference between the same planting dates. By the end of the season, the maturity dates were only 3.2 days different between the first and third planting dates (Sept 25 and 28, respectively). This demonstrates the ability of the soybean plant to "hurry up" through the season in response to changes in day length as soybean is not as influenced by calendar date as other crops.

A low level of foliar symptoms of Sudden Death Syndrome (SDS) was observed, with the highest level being on the variety that did not have ILEVO seed treatment to protect against SDS in 2023 (Table 1). As reported previously and again this year, there were no significant differences in the severity of SDS between the planting dates for any years of the study.

There was more than a 4 bushel per acre (bu/a) (>5%) increase with yields from the late March and mid-April planting dates compared to the early May planting date during the four years of the study (Table 1). For individual years, the highest yield could be either the end of March or mid-April planting dates.

The earlier maturity group (MG) (3.7) soybeans tended to canopy and mature a few days earlier than the later MG soybeans (average MG 4.1) (Table 1). Over the four years of the study, the MG 3.7 varieties matured just under 4 days before the varieties averaging MG 4.1. There was no interaction between planting date and varieties for canopy and maturity dates.

Over the four years of the study, the MG 3.7 varieties yielded almost 2 bu/a better than the MG 4.1 varieties (Table 1). This may be in part due to the lack of ILEVO seed treatment and increased SDS on the MG 4.2 in 2023, and to the specific varieties selected. There was no interaction between planting date and varieties for yield.

Seeding rate was not a significant factor for any of the data collected in this study over the four years.

There has not been a killing frost experienced during this study for the four years. A chart for first and last frost dates for Topeka, KS put out by the National Gardeners Association (not shown) gives an idea of the risk associated with soybean emergence earlier in the season. According to this chart, there is a 10% chance of 28° on April 16, and 10% chance of 32° on May 3. The average emergence date for the late March planting date was April 20, with the earliest being April 15. The temperatures that soybeans can survive are influenced by several factors including the soil type, moisture and residue cover, but the general thought is soybeans can tolerate 28° for several hours.

Combining the data with a previous study (Vol 5, Iss. 6 2019) conducted in 2015-2018 at the same location that looked at soybean planting dates from early May to mid-June may give a more complete picture of the effect of soybean planting date on yield. The MG 3.7 variety tolerant to SDS and with ILeVO seed treatment averaged

almost the same yield when planted on May 4 as the varieties planted in this study planted on May 4. The yield of subsequent planting dates every two to three weeks later continued to decline, with a sharp decline in yield when planted after the first week of June (Fig. 1). The SDS susceptible variety in this study did not show an increased yield response when planted earlier than the first week of June due to the yield limiting effect of increased SDS with the earlier planting dates.

Based on these data, growing soybeans in East Central Kansas under irrigation show the best yield potential when planted mid-April or earlier. Selection of a variety with good tolerance to SDS and a good seed treatment package would be necessary to ensure good stands with the slower emergence through the cooler soils. Dryland soybean production offers other challenges, such as lack of rainfall later in the season, which may limit yield response to the earlier planting dates.

With the improvement of varieties and seed treatments, there is an opportunity to increase soybean production with earlier planting dates when the soil conditions are favorable than when soybeans have been traditionally planted. If moisture is not a limiting factor during the season, lengthening the growing season allows for increased yield potential of soybeans. Also, early planting date may spread out the risk of suffering through planting delays if a rainy period starts in May.

Table 1. Effect of early planting date and variety maturity group on soybean emergence, canopy closure, maturity date and yield at Kansas River Valley Experiment Field-Topeka, 2021-2024

	Planting day	Emergence	Days to emerge	GDD	Canopy date	Maturity date	SDS (R6)	Yield
pl date	**2021**							
1	30-Mar	19-Apr	20	156	.	263.0	.	72.7
2	15-Apr	2-May	17	174	.	267.3	.	70.6
3	4-May	19-May	15	180	.	268.4	.	65.7
	2022							
1	4-Apr	25-Apr	21	198	196.5	274.5	4.2	79.9
2	21-Apr	4-May	13	161	197.0	274.5	5.6	78.6
3	9-May	16-May	7	246	198.9	276.6	4.3	76.4
	2023							
1	29-Mar	20-Apr	22	280	188.8	266.6	24.7	71.2
2	13-Apr	28-Apr	15	167	187.0	266.8	23.1	76.3
3	1-May	11-May	10	188	191.4	269.2	11.9	72.9
	2024							
1	29-Mar	15-Apr	17	215	187.1	267.8	5.6	82.3
2	15-Apr	29-Apr	14	180	189.4	270.3	7.2	82.0
3	1-May	16-May	15	207	198.4	270.8	4.2	74.7
4 year Average								
1	31-Mar	Ap 20	20	212	190.8	268.1	11.5	76.5
2	Ap 16	1-May	14.75	171	191.1	269.7	12.0	76.9
3	May 4	16-May	11.75	205	196.2	271.3	6.8	72.4
	Pr>F			<0.0001	<0.0001	<0.0001	0.0198	<0.0001
Variety	**Maturity Group**							
	2021							
1	3.7				.	265.6	.	71.2
2	4				.	266.8	.	68.1
	2022							
1	3.7				197.5	275.1	4.5	78.8
2	3.9				197.4	275.7	4.8	77.8
	2023							
1	3.7				187.3	264.2	0.5	74.0
2	4.2	no ILEVO			190.8	270.9	39.3	73.0
	2024							
1	3.7				190.0	266.5	3.8	80.7
2	4.2				193.2	272.8	7.5	78.6
4 year Average								
	3.7				191.6	267.8	2.9	76.17
	4.1				193.8	271.5	17.2	74.39
	Pr>F				0.001	<0.0001	<0.0001	0.03

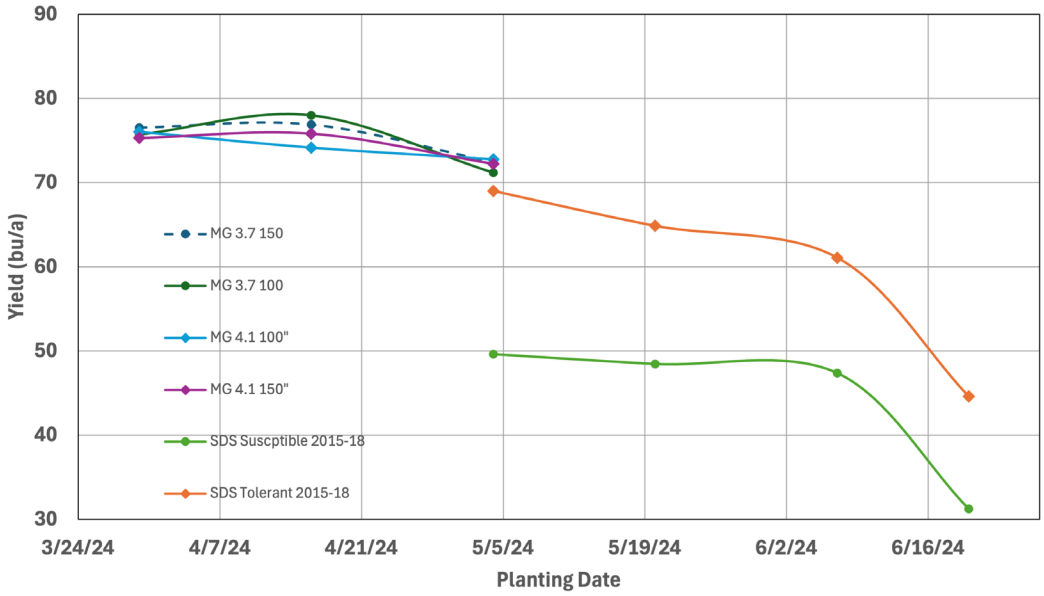

Figure 1. Effect of planting date on soybean yield under irrigation, KRV 2015-18, 2021-24