

Earlier Planting Date and Decreased Population Impacts on Full Season Early Maturity Soybeans

Progress Report to Maryland Soybean Board

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Project Objectives

This project is the first of a multiple year study to evaluate changes to full season soybean planting date and population and its impact on yield and farmer profitability. We began this multi-year evaluation focusing on maturity group (MG) 3 varieties only.

Progress of Work

To complete the evaluation, we utilized three popular seed brands (Pioneer, Agrigold, and Xitavo) and selected an early MG 3 (<3.4) and late MG 3 (>3.6) and three seeding rates (80k, 100k, and 120k seeds acre⁻¹; Table 1). The experiment design was a randomized complete block design with three replications at two locations (Wye Research and Education Center in Queenstown, MD and Central Maryland Research and Education Center – Beltsville in Beltsville, MD). Each replicate was split, with one half randomly selected to be planted early and the other half planted at recommended timing, and all variety by seeding rate combinations (n=18) were in each half replicate (Figure 1) for ease of planting at two dates. We established small plots (10' x 20') using John Deere Maxemerge-2 four-row no-till planter with 30" row spacings at both locations. Early planting was April 18, 2023 at Wye and April 19, 2023 at Beltsville while the second planting was May 8, 2023 at Wye and May 11, 2023 at Beltsville. The Agrigold G3490XF were not Enlist and were killed at Wye when the study was sprayed. We evaluated stand count and branching in season and collected yield via harvest of the center two rows of each plot with Almaco R1 research combine (Almaco Co., Nevada, IA) on November 7, 2023 at Beltsville and October 24, 2023 at Wye. Grain yield, harvest moisture, and test weight was measured for each plot. The data will be collected with a Seed Spector LRX system (Almaco Co., Nevada, IA) and recorded on Microsoft xTablet T1600. Data were analyzed using a mixed model analysis of variance by location, initially evaluating a potential interaction between brand, maturity group (early or late), planting date, and seeding rate as fixed effects and replication as random effect in SAS using Tukey's HSD (P < 0.05) for means separation. When interactions were not significant, significance of treatment effects were considered.

Results

Table 2 lists the P values for the interactions and treatment effects at the two locations, with significant relationships highlighted. When evaluating interaction effects, all pairwise interactions must be considered first and when interactions are not significant, then means separation can be performed on individual treatment effects. For the present data, we must first assess the significance of the interaction of planting date by brand by seeding rate by maturity group. When that relationship is not significant, then the three-way interactions are assessed, then so on. For the Beltsville location, there was a significant interaction effect of planting date by seeding rate by maturity group on soybean yield with no effect of brand on the results (Table 2). Figure 2 depicts the mean yield within these interaction categories and the standard error of the mean, with letters indicating most treatment combinations were similar, with yield of late MG 3, planted early at 140k seeds ac⁻¹ significantly outyielded early MG 3 planted early at 80k seed

ac⁻¹. The results at Beltsville indicate this is a complicated relationship where many of these combinations of planting date and seeding rate and maturity group will result in similar yields.

At Wye, there was a significant interaction effect between seeding rate and maturity group and planting date and brand on yield (Table 2). Figure 3 indicates significantly decreased yields with early MG 3 varieties planted at low seeding rate (80k seeds ac⁻¹). Figure 4 indicates the Pioneer varieties planted early yielded significantly less than the other brand by planting date combinations, but this can likely be attributed to the MG 3.1 variety from Pioneer compared to the MG 3.4 varieties from the other brands. Moreover, the early MG 3 Agrigold variety was killed via herbicide application, so the mean yields for Agrigold in this figure are for the late MG 3 variety only.

While this is only the first year of this evaluation and the team plans to repeat the project in 2024, preliminary results demonstrate a general trend that early MG 3 soybean varieties planted at low seeding rates may not be the strategy for optimizing soybean yield. If a farmer is planning to plant early, they may want to avoid an early MG 3 variety or if a farmer plans to utilize an early MG 3 variety, they may want to wait to plant that variety later or closer to the recommended planting date.

Benefits to Soybean Farmers

The overall goal of this multi-year study is to provide MD farmers with updated planting recommendations when shifts in planting date must be made. The preliminary results of Year 1 of the evaluation indicate that early planting of early MG 3 varieties (< 3.4) planted early at low seeding rates (80k seeds ac⁻¹) may decrease soybean yield. As farmers are considering shifting planting dates earlier, they may want to avoid shifting to maturity groups that are too short for our region or planting these at too low of a population. We plan to strengthen these results with another year of data collection.

Brand	Variety	MG and Category
Agrigold	G3490XF	3.4 (early)
	G3649E3	3.6 (late)
Pioneer	P31A73E	3.1 (early)
	P38A544E	3.8 (late)
Xitavo	XO 3483E	3.4 (early)
	XO 3803E	3.8 (late)

Table 1. Brands, variety names, and maturity groups utilized in the present study.

P value	Beltsville	Wye
Planting Date	0.0094	0.2371
Brand	0.1779	0.0295
MG	0.4674	0.1868
Seeding Rate	0.0413	0.1397
Plant Date*Brand	0.6984	0.0156
Plant Date*MG	0.0536	0.7234
Plant Date*Seeding Rate	0.8458	0.9253
Brand*Seeding Rate	0.8386	0.6750
Brand*MG	0.6427	0.1956
Seeding Rate*MG	0.1244	0.0424
Plant Date*Brand*Seeding Rate	0.2872	0.4549
Plant Date*MG*Seeding Rate	0.0225	0.5271
Brand*MG*Seeding Rate	0.7224	0.4011
Plant Date*Brand*MG	0.5419	0.6579
Plant Date*Brand*MG*Seed Rate	0.6673	0.2039

Table 2. P values from ANOVA results indicating significant interaction or treatment effects. P<0.05 is considered significant.

rep 1	6	13	11	1	7	15	12	16	17	plant date 2
	9	5	2	8	4	10	18	14	3	
	16	2	18	10	11	7	13	6	8	plant date 1
	15	9	3	14	5	4	17	1	12	
rep 2	3	18	5	1	6	12	8	16	7	plant date 1
	2	4	9	13	10	11	14	15	17	
	11	13	9	1	6	17	10	8	15	plant date 2
	3	12	5	14	16	18	7	4	2	
rep 3	6	14	2	12	8	18	5	17	11	plant date 1
	1	13	15	16	7	9	3	10	4	
	4	18	17	16	10	7	13	9	5	plant date 2
	3	8	6	14	11	12	15	2	1	

Figure 1. Example plot plan indicating layout of replicates and planting dates within replicates. Layout was utilized for ease of executing sequential plantings while avoiding unnecessary equipment traffic over earliest planting.

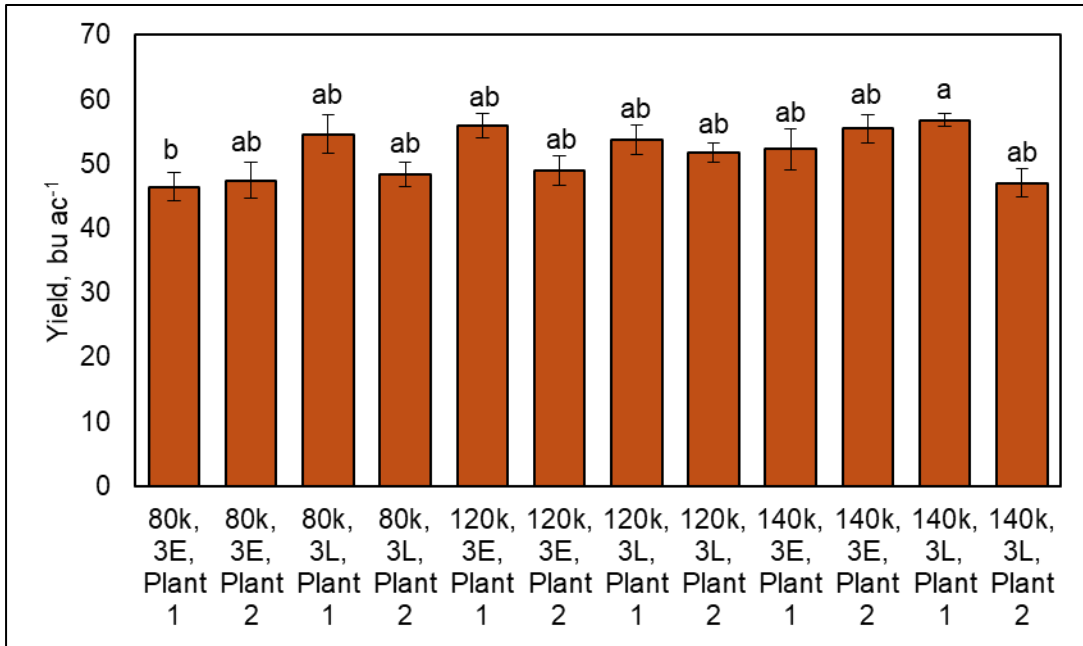


Figure 2. Mean soybean yield by seeding rate, maturity group, and planting date at Beltsville. Different letters indicate significant differences at $P < 0.05$.

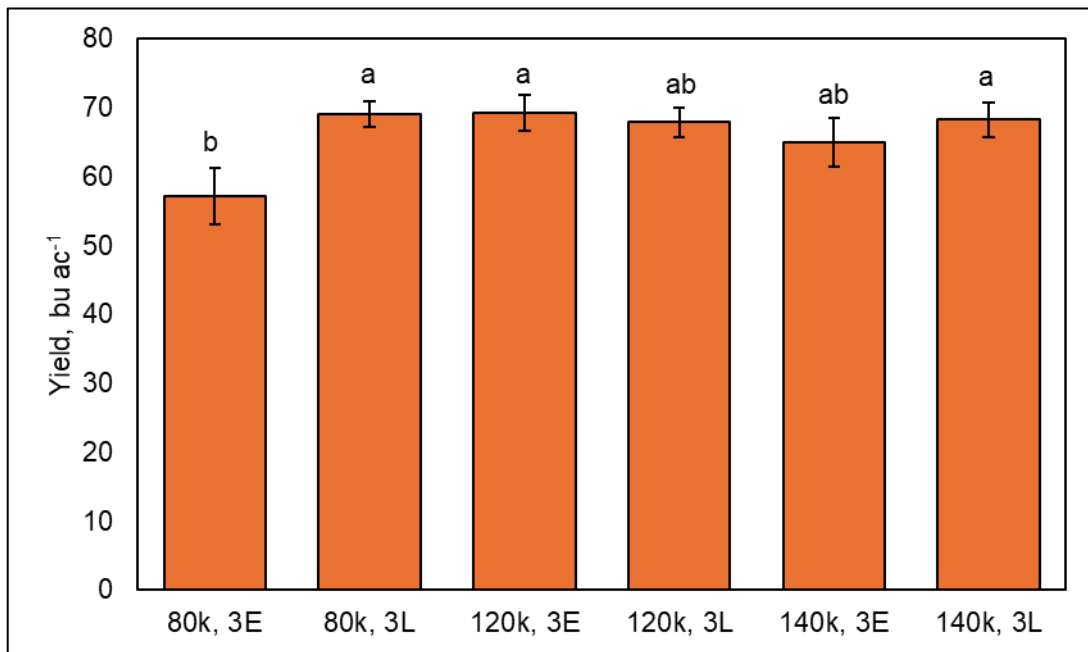


Figure 3. Mean soybean yield by seeding rate and maturity group at Wye. Different letters indicate significant differences at $P < 0.05$.

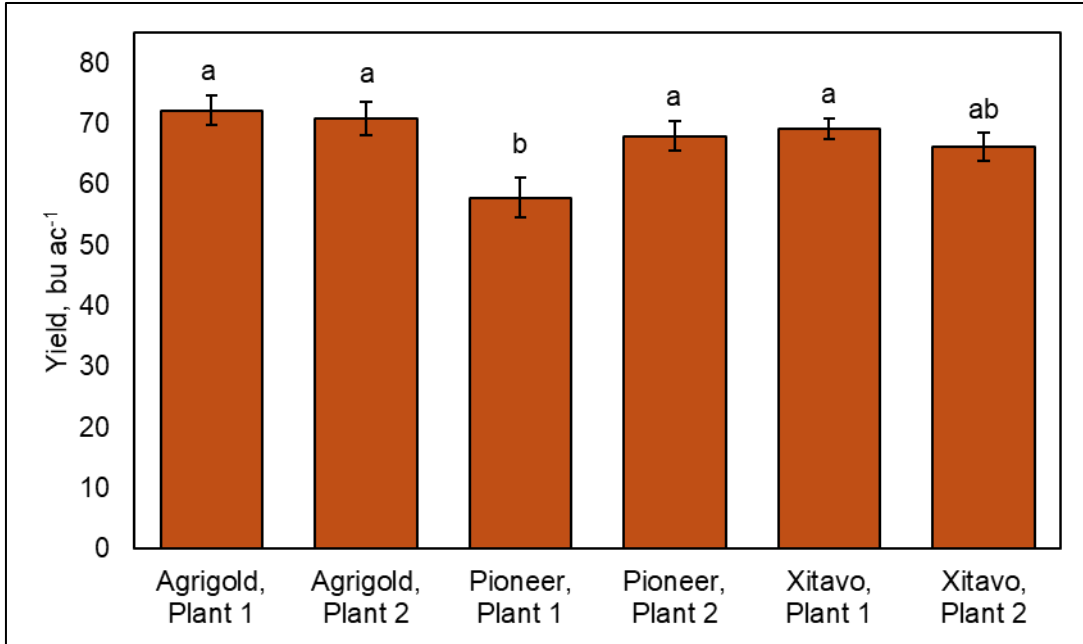


Figure 4. Mean soybean yield by brand and planting date at Wye. Different letters indicate significant differences at $P < 0.05$.