EFFECT OF PLANTING DATE AND MATURITY GROUP ON EMERGENCE, DEVELOPMENT, AND YIELD OF SOYBEAN

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Justification:

The occurrence of soybean rust in the southern states of the USA caused Missouri farmers and researchers to consider soybean management strategies to reduce the impact of the disease on soybean yield. Because soybean rust does not over-winter in Missouri, the disease organism must move into the state from more southern regions. This means that if establishment in Missouri occurs, it will probably occur sometime during the growing season. The later in the soybean life cycle that rust occurs, the less the impact from the disease on yield. So, if the soybean crop could be managed to be further along when rust occurs we might be able to lessen the impact on soybean profitability.

Two possible methods to reduce impact from rust on yield are planting on an earlier date and planting early-maturing varieties. We need to understand the effectiveness of these strategies on changing dates for key stages of development, the impact on yield, and the impact on other considerations such as emergence in order to give best recommendations

Methods:

This experiment was conducted at three locations: Albany in northwest Missouri, Columbia in central Missouri, and Portageville in southeast Missouri (Figure1). To determine the effects of planting early-maturing varieties, performance of three adapted varieties were compared to the performance of three varieties in one or two maturity groups earlier than the adapted varieties. Maturity group III, IV, and V were considered adapted to northwest, central, and southern Missouri, respectively (see tables 1, 2, and 3 for variety names). For each location, two or three planting dates were used. At least one of the planting dates was several weeks earlier than considered normal for the location.

At Albany, plots were 30 feet long and four 30-inch rows wide. The previous crop was corn and plots were planted following a field cultivator. Pre-emergence herbicides were Dual, First Rate, and Authority. Roundup Ultra was used for post emergence weed control. Before harvest, plots were end-trimmed to 25 feet. The center two rows were harvested and yields were corrected to 13% moisture. Plot management at Columbia was similar to Albany except that post emergence herbicides were: Assure, Flexstar, and First Rate, and plots were planted without tillage. At Portageville, the plot area was tilled and bedded for furrow irrigation. Row width at Portageville was 38 inches.

Results:

Both planting date and the use of early-maturing varieties affected the dates on which soybean plants reached key stages of development: flowering (R1), seed-filling (R5), and physiological maturity (R7) (figures 2, 3, 4). However, because soybean plants are

sensitive to photoperiod the effects from each strategy were small. In addition, drought conditions at Columbia probably affected timing of some development stages.

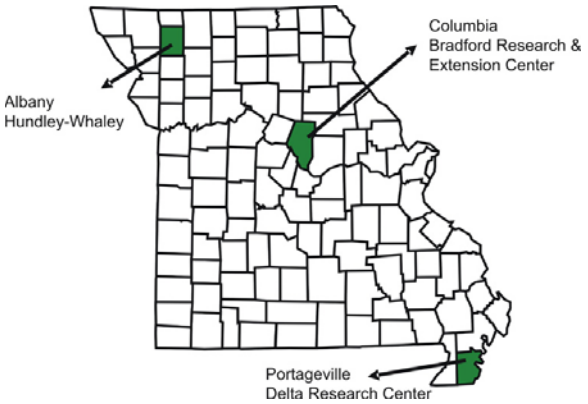

Figure 1. Location of three sites for experiment.

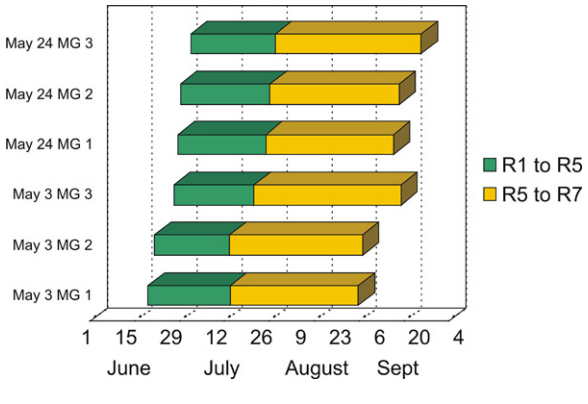

Figure 2. Effect of maturity group and planting date on soybean development at Albany. Beginning of green bar is flowering date, beginning of yellow bar is seed-filling date, and end of yellow bar is physiological maturity date.

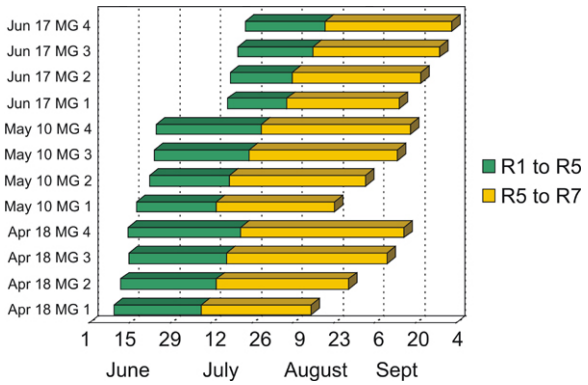

Figure 3. Effect of maturity group and planting date on soybean development at Columbia. Beginning of green bar is flowering date, beginning of yellow bar is seed-filling date, and end of yellow bar is physiological maturity date.

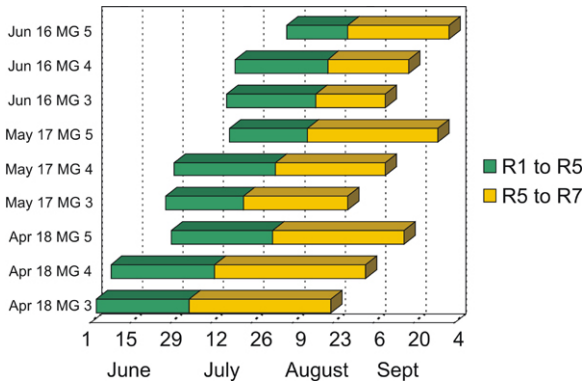

Figure 4. Effect of maturity group and planting date on soybean development at Portageville. Beginning of green bar is flowering date, beginning of yellow bar is seed-filling date, and end of yellow bar is physiological maturity date.

For example, planting at Albany 21 days earlier than May 24 resulted in flowering beginning less than 8 days earlier (figure 2). Similar results were found in the two other locations. At Columbia, the number of days between the early planting date and the "normal' planting date was 22 days. On average, plots planted on April 18 flowered 9 days earlier than plots planted on May 10 (figures 3). Changing planting date 60 days at Portageville resulted in a change in flowering date of only 34 days (figure 4).

Planting early-maturing varieties affected timing of stages of development less than changing planting dates. Stage R3 is a critical stage for fungicide application. In north and central Missouri, varieties from two maturity groups earlier than adapted to the area

reached R3 about 10 days earlier than adapted varieties (figures 2, 3). Results were somewhat different in southeast Missouri perhaps because varieties also differed for growth habit. Maturity Group III varieties are indeterminate and flowered almost 30 days earlier than the determinate varieties of Maturity Group V (figure 4).

At Albany (Table 1), planting dates did not differ for yield. However, there was a significant interaction between varieties and planting dates. Yields of the MG I and II varieties increased from the May 3 planting date to the May 24 planting date; whereas yields of the MG III varieties decreased. Maturity Group III varieties yield more than MG I or II varieties on the May 3 planting date. For the May 24 planting date, one MG I variety yielded less than all of the other varieties. All of the other varieties yielded similarly.

Table 1. Yields for nine soybean varieties planted on two dates near Albany in 2005.

		Planting Date		
Variety	MG	May 3	May 24	average
Fontanelle Hybrids '7292 RR'	1	41.5cd†	53.0a	47.2c
Asgrow Seed 'AG1701'	1	36.9d	43.4b	40.1d
Merschman Seeds 'Venis'	1	43.5c	52.9a	48.2c
Merschman Seeds 'Shawnee'	2	52.6b	50.4a	51.5bc
Asgrow Seed 'AG2703'	2	53.8b	52.7a	53.2ab
Fontanelle Hybrids '8182 RR'	2	46.6bc	50.8a	48.7c
DeKalb Seed 'DK38-52'	3	60.2a	52.1a	56.9a
Asgrow 'AG3602'	3	59.2a	52.7a	55.9a
Pioneer Hi-Bred '93M50'	3	59.0ab	50.6a	54.8ab
average of all varieties		50.4a§	50.9a	

† numbers within a column (excluding averages of all varieties) followed by the same letter are not different (LSD 0.05).
§ numbers within this row followed by the same letter are not different (LSD 0.05).

At Colombia, the average yield for the April 18 planting date was less than the average yield of the other two planting dates (Table 2). Weather conditions were cool and wet after the April 18 planning date. This weather may have affected emergence and yield potential. In general, the MG III and IV varieties yielded more than the unadapted varieties on all three planting dates.

At Portageville, planting dates did not differ for yield. Maturity Group IV and V varieties, in general, yielded more than MG III varieties (Table 3). These results were somewhat surprising. In some of our other experiments, MG IV varieties often yielded more than MG V varieties. And, under certain circumstances MG III varieties yielded almost as much as adapted varieties.

Table 2. Yields for twelve varieties planted on three dates near Columbia in 2005.

Variety	MG	Planting Date			average
		April 18	May 10	June 17	
Fontanelle Hybrids '7292 RR'	1	34.8d†	42.6de	49.7bc	42.4g
Asgrow Seed 'AG1701'	1	27.5e	39.3de	37.6d	34.8h
Merschman Seeds 'Venis'	1	30.0 de	37.4e	44.6c	37.3h
Merschman Seeds 'Shawnee'	2	44.1 c	51.7c	49.1bc	48.3f
Asgrow Seed 'AG2703'	2	43.9 c	45.1d	57.9a	48.9f
Fontanelle Hybrids '8182 RR'	2	45.1 bc	53.0bc	56.6a	51.6ef
DeKalb Seed 'DKB38-52'	3	62.3a	67.4a	54.2ab	61.3ab
NK Syngenta 'NKS35-F9'	3	52.0b	61.8ab	58.9a	57.5cd
Pioneer Hi-Bred '93M50'	3	51.8b	54.5bc	56.9a	54.4de
Pioneer Hi-Bred '94M70'	4	65.9a	61.7ab	57.2a	61.6ab
Morsoy MFA '4124N'	4	60.6a	58.1b	55.8a	58.2bc
Asgrow Seed 'AG4403'	4	63.8a	64.0a	59.3a	62.4a
average of all varieties		48.5b§	53.0a	53.1a	

† numbers within a column (excluding averages of all varieties) followed by the same letter are not different (LSD 0.05).
§ numbers within this row followed by the same letter are not different (LSD 0.05).

Table 3. Yields for nine varieties planted on three dates near Portageville in 2005.

Variety	MG	Planting Date			average
		April 18	May 17	June 16	
Morsoy MFA '3304N'	3	51.0c†	52.0c	60.0cd	54.3c
Asgrow Seed 'AG3602'	3	53.2c	46.4c	45.6e	48.4d
Delta & Pine Land '3861RR'	3	49.4c	49.9c	56.9cd	52.0cd
Asgrow Seed 'AG4403'	4	68.1ab	65.7ab	70.6ab	68.1ab
DeKalb Seed 'DKB46-51'	4	66.7b	65.2b	71.5a	67.8ab
Delta King Seed DK4866RR'	4	66.2b	69.0ab	62.9bcd	66.1ab
Delta King Seed DK5366RR'	5	69.1ab	68.5ab	55.6d	64.4b
Asgrow Seed 'AG5501'	5	75.4a	74.0a	64.2abc	71.2a
Morsoy MFA 'RT 5903N'	5	75.9a	68.7ab	65.8ab	70.2a
average		63.9a§	62.2a	61.4a	

† numbers within a column (excluding averages of all varieties) followed by the same letter are not different (LSD 0.05).
§ numbers within this row followed by the same letter are not different (LSD 0.05).

The number of days for seed-filling and plant height were related to the yield potentials of the maturity groups (Table 4). Low yielding, early-maturing varieties exhibited shorter seed-filling periods and were shorter in height than adapted varieties. Fewer days for seed-filling reduced the potential to accumulate yield. Shorter plants produced fewer nodes and had less leaf area and this contributed to less photosynthesis.

Table 4. Lengths of vegetative (emergence to R1), seed-filling (R5 to R7), and life cycle (emergence to R7) plant development periods and plant heights for 12 varieties planted at Columbia and averaged over three planting dates.

Variety	MG	veg	seed	life cycle	height
		-------- number of days -------			inches
Fontanelle Hybrids '7292 RR'	1	27.3ef†	41.5e	92.8f	22.6h
Asgrow Seed 'AG1701'	1	27.8ef	36.6g	89.9f	25.0g
Merschman Seeds 'Venus'	1	26.8f	39.0f	92.8f	25.6g
Merschman Seeds 'Shawnee'	2	30.7d	46.5bc	102.9e	25.0g
Asgrow Seed 'AG2703'	2	28.6e	45.8cd	102.4e	27.4f
Fontanelle Hybrids '8182 RR'	2	30.3d	44.2d	102.3e	31.6d
DeKalb Seed 'DKB38-52'	3	32.3bc	52.1a	116.6b	30.0e
NK Syngenta 'NKS35-F9'	3	33.1bc	51.5a	114.8c	27.9f
Pioneer Hi-Bred '93M50'	3	31.8d	46.2c	107.4d	33.0c
Pioneer Hi-Bred '94M70'	4	33.8ab	48.2b	117.8b	36.5b
Morsoy MFA '4124N'	4	30.6d	52.1a	114.9c	37.6ab
Asgrow Seed 'AG4403'	4	35.3a	50.5a	119.9a	38.5a

† numbers within a column (excluding averages of all varieties) followed by the same letter are not different (LSD 0.05).

Conclusions:

1. Although results varied by location, changing planting date two days was required for every one day earlier response for critical soybean stages of development.
2. In north and central Missouri, varieties from two maturity groups earlier than adapted to the area reached R3 about 10 days earlier than adapted varieties.
3. In southeast Missouri, Maturity Group III varieties (indeterminate growth habit) flowered almost 30 days earlier than the determinate varieties of Maturity Group V.
4. In north Missouri, MG III varieties yielded more than MG I and MG II varieties when planted on May 3. For the May 24 planting date, all varieties preformed the same except for a single MG I variety.
5. In central Missouri, MG I varieties yielded the least on all planting dates. MG II varieties generally yielded less than MG III and MG IV varieties. The exception was on the third planting when the yields were similar.
6. In southeast Missouri, MG III yield less than either MG IV or MG V varieties. For most planting dates, MG V varieties were the highest yielding. This contradicts other data in which MG IV varieties out yield MG V varieties.
7. One of the reasons that early maturing varieties yielded less than adapted varieties is that early maturing varieties are shorter than adapted varieties. Early maturing varieties also have shorter seed filling.