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RESPONSE OF SOYBEANS TO PLANTING DATE IN SOUTHWEST LOUISIANA

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Climatic conditions in southwest Louisiana are generally favorable for planting soybeans (*Glycine max* L. Merr.) from April through July. Since soybeans grown in the South are determinate in their growth habit and flower according to day length and temperature, planting date is important in determining yield potential.

Planting at optimum dates provides a long growing season which encourages the production of plants with high yield potential. In large farm operations, extending the planting season over a long period is desirable for efficient use of labor and machinery. Problems can occur, however, from planting too early or too late. Poor seed germination and reduced plant vigor due to soil and air temperatures, weeds, insects, diseases, and premature flowering can result in loss of yield potential at early planting dates. Late planting can also be detrimental because plants are exposed to a shorter growing season and often lack the size to support a large seed crop.

Soybean yield varies with planting date since varieties differ in flowering date, growth habit, and response to growing conditions. Studies were initiated in southwest Louisiana at the Rice Experiment Station to study yield and agronomic performance of four widely grown soybean varieties as affected by planting date. Information on the effect of planting date on soybean performance would be useful in variety selection especially where weather conditions preclude planting at the optimum time or where replanting late in the season is necessary.

Literature Review

Soybeans can produce good yields when planted over a wide range of dates. The soybean plant has an advantage over other agronomic crops because it is photoperiod sensitive and changes from vegetative to flower-

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ing in direct response to day length. Southern adapted varieties initiate flowering more rapidly when there are less than 14 hours between sunrise and sunset. (*10*)[3]. Determinate varieties grown in the South make little vegetative growth after flowering is initiated thus soybean plant size is dependent on growing conditions and day length. Planting date is, therefore, an important factor in determining plant size and yield potential.

Day length and low temperature are the major restrictions to planting early in the South. June 22 is the longest day of the year after which days become shorter. Since soybeans are short day plants, they will flower as the day length shortens after June 22. However, if soybeans are planted too early, the critical day length which triggers flowering is reached prior to June 22 resulting in premature flowering. Gray (*4*) working with soybeans in the 1950's in Louisiana observed that "crushing" types planted in March and April produced and shedded blooms and pods throughout the spring and summer. 'Lee' was observed to have maturing pods as well as blooms on June 23. Early plantings may also encourage potential weed problems because of slower soybean seed germination and seedling growth. As a result, mature plants are shorter and lower yielding as compared to those planted at an optimum time (*4, 6, 9, 11*).

Soybean varieties differ in response to day length and, consequently, to varying planting date. For most varieties, optimum planting time is from May through early June (*1, 3, 6, 9, 11*). Significant yield reductions are often associated with planting at nonoptimum times. 'Davis', however, has been shown to be more consistent than other varieties at producing high yields when planted at nonoptimum planting dates (*1, 11*).

Row spacing has been shown to influence yield responses to planting date. In northeast Louisiana Boquet *et al*. (*1*) reported higher grain yields at row spacings of 10 and 20 inches vs. 40 inches whether soybean varieties were planted on optimum or nonoptimum planting dates. Yield responses were greatest for soybeans planted at later dates (late June through early July). Other researchers have reported that narrow and wide row spacing were equally productive when soybeans were planted at optimum dates (*3, 7*).

Length of the growing season (days from planting until maturity) is reduced as planting date is delayed. For a given planting date the effect of reduction in length of the growing season is greater for early maturing varieties than later maturing varieties since following of early varieties is triggered much sooner after planting (*6*). Consequently, the yield of early varieties is generally reduced more with delay in planting compared to late varieties.

Plant height and lower pod height of early varieties are often reduced more with delay in planting than those of late varieties. This can account for

[3]Italic numbers in parentheses refer to Literature Cited, page 12.

the higher yields generally observed for late varieties planted at nonoptimum dates providing the growing season is of sufficient length (*10*). Lodging has been reported to be more severe when planting is delayed (*10, 11*).

Parker *et al.* (*9*) reported highest soybean seed weight when plantings were made in late May or early June. Seed quality has been shown to be higher for late plantings than early plantings in Missouri (*5*) and in Northeast Louisiana (*2*). Similar responses would be expected under high humidity and high temperature conditions of southwest Louisiana. Joshi (*8*) reported that soybeans planted by or after mid-June in Maryland generally were more susceptible to corn earworm (*Heliothis zea* Boddie) than earlier plantings.

Materials and Methods

Field experiments were conducted during 1978-80 on an Acadia silt loam (Aeric Ochraqualf) soil at the Rice Experiment Station, Crowley, La. to study responses of soybeans to planting date. Soil tests from the experimental area indicated: pH = 5.8, P = 19 ppm, and K = 55 ppm. Four cultivars, 'Dare' (Maturity Group V), 'Tracy' and 'Davis' (Maturity Group VI), and Bragg (Maturity Group VII) were evaluated. Attempts were made to plant varieties in mid-April, mid-May, mid-June, and mid-July. Weather conditions did not allow for plantings to be made at a closer range of dates. Planting dates in 1978, 1979, and 1980 were: April 21, 17, 22; May 25, 10, 29; June 19, 13, 20; and July none, 31, 31, respectively.

A split plot experimental design with four replications was used. Soybean varieties were whole plots with planting dates as subplots. Subplots consisted of six 32-inch rows, 35 feet in length. All plots were planted with a conventional 2-row planter at approximately 12 seed per foot of row (about 55 to 65 pounds of seed per acre) at a 1- to 2-inch depth. Since soybeans had been grown in the area previously, seed was not inoculated. Fungicide seed treatment was not used. Fertilizer was applied broadcast and incorporated prior to planting at a rate of 0-60-60 (N-P_2O_5-K_2O). Weeds were controlled with preemergence and postemergence herbicides and cultivation. The four center rows from each plot were combine harvested after maturity. Grain yields were adjusted to 13 percent moisture and reported in bushels per acre based on 60 pounds per bushel. Test weights were determined using a standard pint Winchester bushel. Plant height, lower pod height, and lodging were determined at maturity.

Combined analysis of variance for the 3 years (1978-80) was used for the April, May, and June planting dates. A 2-year (1979-80) combined analysis was used for April, May, June, and July planting dates. Duncan's Multiple Range test was used to detect differences among main effect means and Fisher-protected LSD was used for interaction mean comparisons.

Results and Discussion

Grain Yields

Rainfall quantities (April through September) for 1978, 1979, and 1980 at the Rice Experiment Station, Crowley, deviated from the 50-year mean by −4.3, +8.3, and +3.9 inches, respectively (Table 1). The season total for 1980, however, is misleading because of an abnormally large amount of rain received in May (16.9 inches). The largest moisture deficit of the 3 years occurred in July and August in 1980. Performance of soybeans planted in mid-April, mid-May, and mid-June were compared over three growing seasons (1978-1980). Averaged over the 3 years, yields for all varieties were highest when planted in mid-May and lowest when planted in mid-April (Table 2). Average yields at the mid-May planting date ranged from a high of 35.3 bu/A in 1979 to a low of 19.6 bu/A in 1980. Yield differences among years were related to rainfall amount and distribution. Delaying planting from mid-May until mid-June reduced yields 10.6 bu/A which corresponds to a decrease of approximately 0.4 bu/A per day. The sharp yield decrease associated with delaying planting emphasizes the importance of planting in May or early June. The extremely low yields observed for Dare and Tracy planted in mid-April were related to premature flowering. Both Davis and Bragg produced highest yields when planted in mid-April and in mid-June. Dare yielded lowest of the varieties tested on all planting dates.

The 1979-1980 yields for the four planting dates are presented in Table 3. Yields were highest for all varieties when planted in mid-May and lowest when planted in mid-July. Soybeans planted at the optimum time in mid-May yielded 16.7 bu/A higher than those planted in mid-April and 23.1 bu/A higher than those planted in mid-July. Yields of Dare and Tracy were more adversely affected by nonoptimum planting date compared to the other varieties. Davis and Bragg were least affected by planting date and yields were higher than those of the other varieties at both early and late planting dates. Even so, yields of both Davis and Bragg at mid-April and mid-July planting dates were too low to be profitable.

Averaged over varieties, delaying planting from mid-May until mid-July reduced yields 23 bu/A (a 9 bu/A decrease from mid-May to mid-June and a 14 bu/A decrease from mid-June to mid-July). This corresponds to a decrease in yield of approximately 0.4 bu/A for each day planting is delayed after mid-May (0.3 bu/A loss from mid-May to mid-June and 0.5 bu/A loss from mid-June to mid-July). Rainfall accumulation from June through September 1979 was nearly twice that received in 1980 (21 vs. 11 inches) (Table 1). Consequently, yield reductions associated with the late planting date was more severe in 1980. Averaged over varieties, yields of soybeans planted in mid-May in 1980 were 15.7 bu/A lower than those planted in 1979.

Table 1.—Rainfall received during growing seasons at the Rice Experiment Station, Crowley, La, 1978-1980

Year	Manth						
	April	May	June	July	Aug.	Sept.	Tatal
	Inches						
1978	2.28	2.51	6.75	6.96	3.91	3.41	25.82
1979	9.36	8.38	0.33	8.88	6.13	5.43	38.51
1980	5.85	16.91	1.55	4.76	2.25	2.66	33.98
Narmal[1]	4.13	5.13	4.80	6.24	5.73	4.10	30.13

[1]Determined fram Davis, J. H., *et al*. Fifty Years of Weather at LSU Rice Experiment Statian, Crawley, La., 1910-1959. Inclusive. LSU Agricultural Experiment Statian Circular Na. 69.

Table 2.—Effect of planting date on yield of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1978-1980

Variety	Planting date[1]			Average
	Mid-April	Mid-May	Mid-June	
	bu/A			
Dare	10.5	21.9	14.3	15.6c[2]
Davis	19.6	29.3	17.0	22.0a
Tracy	10.8	28.8	15.4	18.4b
Bragg	17.3	28.2	19.3	21.6a
Average	14.5c	27.1a	16.5b	

[1]LSD (.05) = 3.0 bu/A for variety x planting date interactian.
[2]Means fallawed by the same letter are nat significantly different (P<.05) using DMRT.

Table 3.—Effect of planting date on yield of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1979-1980

Variety	Planting date[1]				Average
	Mid-April	Mid-May	Mid-June	Mid-July	
	bu/A				
Dare	6.2	23.0	15.3	3.0	11.9c[2]
Davis	16.1	30.6	19.8	6.2	18.2a
Tracy	6.2	29.1	16.4	2.9	13.6b
Bragg	14.5	26.9	21.9	5.1	17.1a
Average	10.7c	27.4a	18.4b	4.3d	

[1]LSD (.05) = 2.7 bu/A for variety x planting date interaction.
[2]Means fallawed by the same letter are not significantly different (P<.05) using DMRT

Table 4.—Effect of planting date on test weight of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1978-1980

Variety	Planting date[1] Mid-April	Mid-May	Mid-June	Average
	lb/bu			
Dare	51.2	54.4	55.4	53.6c[2]
Davis	52.7	55.9	53.7	54.1c
Tracy	54.8	55.7	54.6	55.0b
Bragg	56.9	57.8	56.9	57.2a
Average	53.9c	56.0a	55.2b	

[1]LSD (.05) = 1.5 lb/bu for variety x planting date interaction.
[2]Means followed by the same letter are not significantly different (P<.05) using DMRT.

Table 5.—Effect of planting date on test weight of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1979-1980

Variety	Planting date[1] Mid-April	Mid-May	Mid-June	Mid-July	Average
	lb/bu				
Dare	49.3	54.3	55.0	48.7	51.8c[2]
Davis	52.8	57.2	55.0	49.0	53.5b
Tracy	55.2	56.4	55.4	49.6	54.2b
Bragg	56.5	58.1	58.5	49.3	55.6a
Average	53.5b	56.5a	56.0a	49.1c	

[1]LSD (.05) = 1.9 lb/bu for variety x planting date interaction.
[2]Means followed by the same letter are not significantly different (P<.05) using DMRT.

Test Weight

The yield differences among planting dates were reflected in lower seed quality as measured by test weight. Test weight is an important determinant in both grade and price of soybeans marketed. A minimum test weight of 56 lb/bu is required to make a US No. 1 grade. Soybean test weights were similar for the varieties when planted in mid-May and mid-June but were significantly lower when planted in mid-April and mid-July (Tables 4 and 5). At the mid-April planting date and averaged across planting dates, seed quality as measured by test weight was lowest for Dare and highest for Bragg.

The effect of early planting on seed quality and on yield potential of earlier maturing varieties raises questions concerning the common practice in the South of planting early maturing varieties before later maturing ones. In northeast Louisiana, yield of 'Forrest' was higher when planted in mid-May than on May 1 (*1*). Later maturing varieties produced maximum yields when planted on May 1 and had a longer optimum planting season than that of Forrest. Results of these studies indicate the importance of variety selection where soybeans are planted earlier than mid-May.

Agronomic Characteristics

The length of the growing season decreased for each variety as planting date was delayed (Tables 6 and 7). For each month planting was delayed, the length of the growing season was reduced an average of 23 days. The soybean varieties grown were determinant types and are photoperiod and temperature sensitive. Consequently, when these varieties were planted early, the number of days to maturity was greater than for the same varieties planted at a later date. The longer growing season at early planting dates resulted in longer exposure to possible adverse growing conditions which

Table 6.—Effect of planting date on agronomic characteristics of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1978-1980

Planting date and variety	Length of growing season (days)[1]	Plant ht. (in)	Lower pod ht. (in)	Lodging[2]
Mid-April				
Dare	142	17.2	2.6	1.0
Davis	155	21.6	4.0	1.0
Tracy	173	16.8	2.6	1.0
Bragg	181	20.5	3.6	1.0
Average	163a[3]	19.0c	3.2c	1.0b
Mid-May				
Dare	125	22.0	3.7	1.0
Davis	141	27.7	4.4	1.0
Tracy	146	28.2	4.4	1.0
Bragg	152	31.3	4.7	1.1
Average	141b	27.3a	4.3a	1.0b
Mid-June				
Dare	115	21.5	3.3	1.4
Davis	122	25.0	4.3	1.4
Tracy	120	23.8	3.8	1.3
Bragg	126	26.8	4.1	1.3
Average	121c	24.3b	3.9b	1.4a

[1]Days from planting to maturity.
[2]1 = no lodging, 5 = all plants down.
[3]Means in each column followed by the same letter are not significantly different ($P<.05$) using DMRT.

affected both yield and seed quality.

Plant height of the varieties at maturity ranked as follows: mid-May > mid-June > mid-April > mid-July (Tables 6 and 7). Shorter plant heights for the mid-April planting date (approximately 19 inches) were related to unfavorable growing conditions early in the season. "Dwarfing out" related to premature flowering was noted for Dare and Tracy. Mid-April planted soybeans were never able to recover from the early season stress. Reduced plant height at the mid-July planting date was related to the short growing season. Grain yields were highly correlated (r = 0.93**) with plant height for all varieties and planting dates. The taller more branching plants produced highest yields and shorter plants the lowest yields.

Lower pod heights were similar for soybeans planted in mid-May and mid-June but were lower for those planted in mid-April and mid-July

Table 7.—Effect of planting date on agronomic characteristics of four soybean varieties grown at the Rice Experiment Station, Crowley, La, 1979-1980

Planting date and variety	Length af grawing seasan (days)[1]	Plant ht. (in)	Lawer pad ht. (in)	Ladging[2]
Mid-April				
Dare	146	16.0	2.5	1.0
Davis	160	21.5	3.5	1.0
Tracy	173	15.3	2.5	1.0
Bragg	181	19.6	3.3	1.0
Average	165a[3]	18.1c	2.9b	1.0
Mid-May				
Dare	128	22.4	3.4	1.0
Davis	140	29.5	4.5	1.0
Tracy	145	28.9	4.0	1.0
Bragg	155	32.4	4.5	1.0
Average	142b	28.3a	4.1a	1.0
Mid-June				
Dare	110	21.0	3.4	1.0
Davis	119	25.3	4.4	1.0
Tracy	120	25.3	4.1	1.0
Bragg	126	28.3	4.5	1.0
Average	119c	24.9b	4.1a	1.0
Mid-July				
Dare	91	14.0	1.8	1.0
Davis	97	13.9	2.0	1.0
Tracy	92	12.8	1.6	1.0
Bragg	104	15.3	1.9	1.0
Average	96d	14.0d	1.8c	1.0

[1] Days fram planting ta maturity.

[2] 1 = na ladging, 5 = all plants dawn.

[3] Means in each column fallawed by the same letter are nat significantly different (P<.05) using DMRT.

(Tables 6 and 7). The corresponding lower yields reported for soybeans planted in mid-July were not only related to shorter and less branched plants but were also related to higher yield losses since the combine was unable to harvest the lower pods. Lodging was not greatly affected by planting date.

Conclusions

Results of this study show the importance of planting date on soybean performance. As in previous studies, the optimum planting date for soybeans in southwest Louisiana was found to be during the month of May. Problems associated with April planting of soybeans in these studies were poor seed germination and reduced vigor due to cool, wet soil conditions, early season weeds, insects, and diseases, and lower seed yield and quality. Premature flowering of early planted soybeans resulted in "dwarfing out." Soybean yields declined approximately 0.3 bu/A for each day planting was delayed from mid-May to mid-June and 0.5 bu/A for each day delay from mid-June to mid-July. Davis and Bragg performed best of the varieties tested when planted in mid-April but even for these varieties yields were low. The lower yields at the April planting compared with the May and June plantings suggest that it would be more advantageous to delay planting until the later dates when conditions for plant growth are more favorable. Later maturing varieties would be more desirable if planting is delayed or replanting is necessary after mid-June.

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