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Soybean Seed Yield Performances under Different Cultural Practices

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Abstract: This study was carried out to investigate the yield response of 2 soybean (*Glycine max* (L.) Merrill) cultivars to different planting dates and plant populations and to examine the relationships of seed yield with leaf area index (LAI) and total dry matter (TDM) during the vegetative and reproductive periods for planting dates, plant populations, and cultivars. Two soybean cultivars, A-3127 (early maturity group, MG-III) and 1530 (late maturity group, MG-IV), were planted in 2 planting dates; mid-April and mid-May during 2005 and 2006 at high (660,000 plant ha^{-1}) and low (330,000 plant ha^{-1}) plant populations. Plantings in mid-April increased seed yield by about 10.0%-13.5% compared with mid-May plantings. High plant populations produced 17.7% higher seed yield than the low population. Seed yield of the late maturity cultivar was more than that of the early maturing cultivar. Significant and positive relationships between seed yield and LAI were evident for planting dates at all growth stages in 2005 and 2006. Seed yields at high and low plant populations were negatively and significantly correlated with LAI at vegetative stage (V_5), but positively and closely related to LAI at reproductive stages (R_4 and R_6) in both experimental years. The relationships between seed yield and LAI with early and late maturity cultivars were significant and positive at all growth stages except the V_5 growth stage in both 2005 and 2006. Seed yield was positively and significantly correlated with TDM at all growth stages for planting dates, plant populations, and cultivars.

Key Words: Soybean, planting date, plant population, leaf area index, seed yield, total dry matter, yield components

Farklı Kültürel Uygulamalar Altındaki Soyanın Tohum Verimi Performansı

Özet: Bu çalışma, iki farklı soya (*Glycine max* (L.) Merrill) çeşidinin farklı ekim zamanları ve bitki sıklıklarına tepkisi ile vejetatif ve generatif gelişme dönemlerinde ekim zamanları, bitki sıklıkları ve soya çeşitleri bakımından tohum veriminin yaprak alan indeksi (LAI) ve toplam kuru madde miktarı (TDM) arasındaki ilişkileri belirlemek amacıyla yapılmıştır. Erkenci olgunlaşma grubuna (MG-III) dahil A-3127 ve geççi olgunlaşma grubuna (MG-IV) dahil 1530 çeşitleri 2005 ve 2006 yıllarında iki farklı ekim zamanı (15-Nisan ve 15-Mayıs) ve iki farklı bitki sıklığında (Yüksek: 660.000 bitki ha^{-1} ve Düşük: 330.000 bitki ha^{-1}) yetiştirilmiştir. 15-Nisan ekimleri, 15-Mayıs ekimlerine göre tohum verimini % 10,0 - % 13,5 oranında arttırmıştır. Yüksek bitki sıklıkları, düşük bitki sıklıklarına göre % 17,7 oranında daha fazla tohum verimi sağlamıştır. Aynı zamanda, geç olgunlaşma grubuna dahil olan 1530 çeşidinden, erken olgunlaşma grubuna dahil olan A-3127 çeşidine göre daha fazla tohum verimi alınmıştır. Hem 2005 hem de 2006 yıllarında her iki ekim zamanında ve bütün gelişme dönemlerinde tohum verimi ile yaprak alan indeksi arasında önemli ve pozitif yönlü bir ilişki bulunmuştur. Yüksek ve düşük bitki sıklıkları bakımından tohum verimi ile yaprak alan indeksi arasındaki ilişki her iki deneme yılında da V_5 vejetatif gelişme döneminde önemli ve negatif yönlü iken R_4 ve R_6 generatif gelişme dönemlerinde pozitif yönlü ve önemli olmuştur. Erkenci ve geççi çeşitler bakımından tohum verimi ile yaprak alan indeksi arasındaki V_5 vejetatif gelişme dönemi dışındaki bütün gelişme dönemlerinde, her iki deneme yılında da pozitif yönlü ve önemli çıkmıştır. Ayrıca, tohum verimi ile toplam kuru madde içeriği arasındaki ilişki, bütün deneme yıllarında ve bütün gelişme dönemlerinde ekim zamanları, bitki sıklıkları ve çeşitler bakımından önemli bulunmuştur.

Anahtar Sözcükler: Soya, ekim tarihi, bitki sıklığı, yaprak alan indeksi, tohum verimi, toplam kuru madde, verim komponentleri

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Introduction

Environmental factors have an important role in soybean production. Agronomic characteristics of soybeans are modified in their expression by environmental conditions, which vary between seasons, locations, and years (Whigham and Minor, 1978). In addition, these characteristics are significantly affected by many cultural practices (planting date, plant population, cultivar, fertilization, irrigation, and tillage management). In a field situation, soil and climate provide the major portion of the environmental influence on soybean development and yield; however, soybean producers can manipulate this environment with proven managerial practices (Pedersen and Lauer, 2003). Soybean development and yield can be improved by cultural practices suitable for soil and climate conditions of regions. Cultivar adaptability to a region and its influence on soybean yield and yield components can be affected by growth habit and planting date (Pedersen and Lauer, 2004). In general, delayed planting reduces yields compared to earlier plantings (Beatty et al., 1982; Egli and Bruening, 2000). A combination of photoperiod and temperature is probably responsible for the early flowering and shorter vegetative growth phase of late planted soybean (Board and Hall, 1984). Consequences of early flowering and smaller vegetative mass at the beginning of seed filling (R_5 stage) were associated with lower yields in late plantings (Egli and Bruening, 2000). Pedersen and Lauer (2004) reported that early planting date produced higher seed number, pod number, and harvest index, but lower seed number per pod than late planting date. Moreover, relevant characteristics showed yield enhancement when soybean is grown at 50-cm compared with 100-cm spacing, whereas others found only slight or no yield improvement at narrow vs. wide-row spacing (Caviness, 1966; Heatherly, 1988). Furthermore, Boerma and Ashley (1982) reported that yield enhancement of narrow rows was greater compared to delayed planting.

Objectives of this research were to (i) determine the yield component response of soybean cultivar to plant population and planting date, (ii) examine the relationships between seed yield and leaf area index (LAI) and total dry matter (TDM).

Materials and Methods

Field studies were conducted during 2005 and 2006 at the Applied Research Centre for Agriculture, Uludağ University, Bursa, (Latitude 40°15′29″N, Longitude 28°53′39″E and altitude 72 m above sea level) Turkey. The local climate is temperate, summers are hot and dry, and winters are mild and rainy. According to long-term meteorological data (1929-2001), annual mean rainfall, temperature, and relative humidity are 699 mm, 14.6 °C, and 69%, respectively. A sub-humid climate prevails in the region according to the mean rainfall amount (from 600 to 700 mm of annual precipitation) (Jensen, 1980). Total monthly precipitation, relative humidity, and mean air temperature in 2005, 2006, and long-term in Bursa are presented in Table 1. The climate of the region is sub-humid, but rainfall amounts are extremely low in the summer period. Seasonal rainfall amount is 73 mm, which coincides with 10% of total annual rainfall, for the summer period (June, July, and August) (Table 1). The soil is very fine (average 48.5% clay content), having 0.11% total nitrogen content (Kjeldahl Method), 0.40 kg ha^{-1} phosphorus (Olsen Method, P_2O_5), 5.70 kg ha^{-1} exchangeable potassium (Ammonium Acetate Method, K_2O), and 1.90% organic matter (Walkley-Black Method). The soil pH was 7.2.

The experimental treatments consisted of a factorial combination of 2 planting dates: mid-April and mid-May, 2 plant populations: low population (330,000 plants ha^{-1}) (wide row spacing (100-cm)) and high population (660,000 plants ha^{-1}) (narrow row spacing (50-cm)), and 2 cultivars: A-3127, early maturity group (Maturity Group-III) (Noel and Sikora, 1990), and 1530, late maturity group (Maturity Group-IV) (Acikgoz et al., 2007). The experimental design was a randomized complete block with 4 replications in a split-split plot treatment arrangement with planting dates, plant populations, and cultivars as main plots, split plots, and split-split plots, respectively. Plot size was 8 rows of 50-cm for high plant population and 4 rows of 100-cm for low plant population by 5.0 m long. Plantings were performed by hand at a 4-cm depth on April 15 and May 18 in 2005 and on April 19 and May 20 in 2006. Emergence date and phenological growth stages (Fehr and Caviness, 1977) were recorded weekly. Plant population was determined 2 weeks after emergence by counting the total number of emerged plants in 2-

Table 1. Mean air temperature, relative humidity, and total monthly precipitation in 2005, 2006, and long-term (1929-2001) in Bursa.

Months	Temperature (°C)			Relative humidity (%)			Precipitation (mm)		
	2005	2006	Long-term	2005	2006	Long-term	2005	2006	Long-term
January	6.2	5.5	5.3	75.2	71.1	74.1	150.4	78.3	88.8
February	6.6	7.4	6.2	65.2	69.4	73.4	77.7	71.3	77.5
March	8.5	9.2	8.3	67.4	68.2	70.2	77.9	38.8	69.8
April	13.7	12.1	13.0	60.1	74.0	70.3	56.1	20.4	62.9
May	17.6	16.6	17.6	68.3	61.4	69.5	23.5	9.2	50.0
June	21.2	21.5	22.1	58.7	64.2	62.9	21.1	43.5	30.4
July	24.7	23.8	24.5	62.2	52.3	58.1	55.2	3.6	24.0
August	25.1	26.4	24.1	63.5	50.6	60.5	4.5	3.7	18.9
September	20.1	19.9	20.1	68.8	65.9	66.4	16.8	91.2	40.1
October	13.2	16.7	15.6	72.7	77.1	72.8	37.5	45.6	60.4
November	9.3	13.8	11.2	74.6	75.2	75.6	109.3	43.1	76.3
December	6.1	8.7	7.6	70.2	71.4	74.2	58.0	68.2	99.9
Average	14.3	15.1	14.6	67.2	66.7	69.0	688.0	516.9	699.0

m lengths of row from four 50-cm rows or two 100-cm rows. Fertilizer was applied before planting at the rate of 30-60-0 kg ha^{-1} (N-P-K) according to soil test recommendations. Weed control was maintained by pre-emergence application of metolachlor [2-chloro-N-(2-ethyl-6-methyphenyl)-N-(2-methoxy-1-methylethyl) acetamide] and imazaquin [2-(4.5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1-H-imidazol-2-yl)-3-quino linecarboxylic acid]. The previous crop was sunflower (*Helianthus annuus* L.) in 2005 and 2006 experiment years. Water was applied when soil moisture reached 65% of the soil field capacity in each experimental year. Irrigation was applied 4 times (at V_5, R_1, R_2, and R_4 stages) with a sprinkler irrigation system in both experimental years.

At maturity, 10 plants per plot were randomly sampled at harvest to determine plant height, pod number, and seed number per plant. The center 4 rows for 50-cm and 2 rows for 100-cm row spacings were harvested by hand to determine seed yield, harvest index, and 1000-seed weight. Seed yields adjusted to moisture content of 130 g kg^{-1}. Harvest index was calculated as the ratio between seed dry weight and total above ground dry weight at harvest. Hundred-seed lots were weighed four times to determine the 1000-seed weight.

Leaf area index (LAI) and total dry matter (TDM) were based on the same 0.5 m^2 random samples (1.0-m and 0.5-m row lengths for 50-cm and 100-cm row spacings, respectively). LAI was determined by placing 25% of the leaf blades through a LI-COR 3000 portable leaf area meter at V_5, R_2, R_4, and R_6 growth stages, respectively (Board et al., 1990). TDM was determined after drying to constant weight at 70 °C in a forced air dryer.

All data were analyzed by analysis of variance (ANOVA) with the SAS Statistical Software Package (1996). Error variances for the data collected during 2005 and 2006 were not homogenous, so a separate analysis is presented for each year. The significance of main effects and interactions were determined at the 0.05 and 0.01 probability levels by F-test. Mean comparisons for main effects and interactions were made using the Fisher's protected LSD test ($P \leq 0.05$). Correlation coefficients of seed yield with LAI and TDM were calculated separately at each growth stage or period among 2 development stages. Correlations between these parameters were based on both all cultivar/plant population treatment means within planting dates and all cultivar/planting date treatment means within plant populations across both years. Correlation coefficients were computed using PROC CORR of SAS.

Results

There were significant differences for pod number, seed number per plant, harvest index, and seed yield among planting dates, cultivars, and plant populations in both years. However, there were no significant differences between planting dates and plant populations for plant height and 1000-seed weight in 2005. Also, 1000-seed weight was not significantly affected by planting dates in 2006. On the other hand, 2-way interactions of planting date × plant population and plant population × cultivar were statistically significant at 5% level of probability for seed yield in 2005 (Tables 2, 3, and 4). Harvest index was significantly influenced by plant population × cultivar interaction in 2005.

Planting in mid-April produced 10.2% higher seed yield than planting in mid-May. Plant height, pod number per plant, seed number per plant, and harvest index in mid-May planting were 7.3%, 15.1%, 10.7%, and 4.1%, respectively, lower compared to mid-April planting. In 2005, the highest seed yields were obtained from high plant population in mid-April planting and also high plant population and late maturity cultivar combinations (Tables 3 and 4). In 2006, the low plant population experiences a significant increase in all yield components measured except seed yield, which significantly reduced compared to the high plant population. It is likely that the reduction in the yield of the low plant population was associated with fewer plants per unit area, which could not compensate the seed yield. Compared with the low plant population (100-cm row width), high plant population (50-cm row width) gave 17.7% higher seed yield in 2006. This percentage value was similar to that in 2005 experiment.

There were significant differences among the years in terms of seed yield and yield components. Our findings indicated that the mean values of seed yield and all the other characters observed in 2005 were higher compared to 2006 (Table 2). As known, amount and distribution of

Table 2. Yield and yield components for 2 soybean cultivars planted in 2 different plant populations and planting dates during 2005 and 2006.

Treatments	Plant height (cm)		Pod number per plant		Seed number per plant		Harvest index (%)		1000 seed weight (g)		Seed yield (kg ha^{-1})	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Planting date												
15 April	100.7	94.5 a	42.7 a	37.7 a	102.0 a	89.0 a	40.3 a	39.0 a	153.6	148.4	3360.6 a	2804.3 a
15 May	97.7	87.6 b	38.4 b	32.0 b	92.5 b	79.5 b	38.3 b	37.4 b	149.1	146.6	2960.3 b	2543.8 b
LSD (0.05)	ns	5.3	1.7	3.5	1.4	3.3	1.2	0.7	ns	ns	21.5	77.0
Plant population												
Low	101.0	92.9 a	48.9 a	42.2 a	120.5 a	104.0 a	40.0 a	39.0 a	153.6	149.6 a	2903.4 b	2456.3 b
High	97.5	89.2 b	32.2 b	27.5 b	74.0 b	64.5 b	38.6 b	37.3 b	149.2	145.4 b	3417.5 a	2891.8 a
LSD (0.05)	ns	3.6	2.2	0.5	3.2	6.0	0.6	1.0	ns	3.8	65.2	49.0
Cultivar												
Early	95.5 b	88.5 b	37.7 b	32.2 b	90.7 b	79.0 b	38.6 b	36.8 b	147.9 b	143.5 b	3046.5 b	2541.0 b
Late	103.0 a	93.5 a	43.4 a	37.5 a	103.7 a	89.5 a	40.1 a	39.5 a	154.8 a	151.5 a	3274.4 a	2807.0 a
LSD (0.05)	3.8	3.7	2.2	2.6	3.1	1.9	1.1	0.7	3.5	2.9	29.3	53.6
Significance of F-test of ANOVA												
Planting date (D)	ns	*	**	*	**	**	*	**	ns	ns	**	**
Plant population (P)	ns	*	**	**	**	**	**	**	ns	*	**	**
Cultivar (C)	**	*	**	**	**	**	**	**	**	**	**	**
D × P	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	*	ns
D × C	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
P × C	ns	ns	ns	ns	ns	ns	*	ns	ns	ns	**	ns
D × P × C	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

^{ns}No statistical difference at P < 0.05 and P < 0.01.
*Statistical difference at P < 0.05.
**Statistical difference at P < 0.01.

Table 3. Planting date (D) × plant population (P) interaction for seed yield in 2005.

Planting date	Plant population	Seed yield (kg ha^{-1})
15 April	Low	3058.8 c
	High	3663.0 a
15 May	Low	2748.5 d
	High	3172.0 b
LSD (0.05)		75.1

Table 4. Plant population (P) × Cultivar (C) interaction for seed yield in 2005.

Planting date	Plant population	Seed yield (kg ha^{-1})
Low	Early	2817.0 d
	Late	2989.8 c
High	Early	3276.0 b
	Late	3559.0 a
LSD (0.05)		41.4

the precipitation and relative humidity are the major factors affecting plant production in humid and sub-humid regions. In 2006, due to low temperature in April and May, and low precipitation and low relative humidity in July and August, all traits observed in 2006 were lower compared to 2005 (Table 1).

Significant and positive relationships (r = + 0.833** to r = + 0.968**) between seed yield and LAI were evident for planting dates at all growth stages in 2005 and 2006 (Table 5). On the other hand, seed yields at high and low plant populations were negatively and significantly correlated with LAI at the V_5 stage, but positively and closely related to LAI (R_4) and LAI (R_6) (Table 6).

In both years, significant correlative relationships between seed yield and TDM at each growth stage were evident for planting dates. Seed yields in both mid-April and mid-May plantings were positively and closely correlated with TDM (V_5), TDM (R_2), TDM (R_4), and TDM (R_6) in 2005 and 2006 (Table 5). However, significant relationships were found between seed yield and TDM at different growth stages for plant populations in the each year (Table 6). In our study, seed yield at the high plant population was positively and strongly correlated with TDM (V_5) (r = + 0.908**) and (r = + 0.864**), TDM (R_2) (r = + 0.815**) and (r = + 0.866**), TDM (R_4) (r = + 0.776**) and (r = + 0.825**), and TDM (R_6) (r = + 0.581*) and (r = + 0.581*) in 2005 and 2006, respectively. Also, similar results were obtained from low plant populations (wide row spacing). On the other hand, seed yield in both cultivars (early and late maturity) was positively and closely correlated to TDM (V_5), TDM (R_2), TDM (R_4), and TDM (R_6) (Table 7).

Table 5. The correlation coefficients of seed yield with leaf area index (LAI) and total dry matter (TDM) for mid-April and mid-May planting dates at different growth stages in 2005 and 2006.

Trait	Developmental stage or period	r of seed yield			
		2005		2006	
		mid-April	mid-May	mid-April	mid-May
LAI	V_5	0.920**	0.854**	0.880**	0.833**
	R_2	0.968**	0.908**	0.897**	0.878**
	R_4	0.961**	0.914**	0.918**	0.905**
	R_6	0.957**	0.894**	0.876**	0.855**
TDM	V_5	0.966**	0.858**	0.948**	0.849**
	R_2	0.663**	0.815**	0.744**	0.833**
	R_4	0.596**	0.725**	0.681**	0.685**
	R_6	0.657**	0.782**	0.709**	0.787**

^{ns}No statistical difference at P < 0.05 and P < 0.01.
*Statistical difference at P < 0.05.
**Statistical difference at P < 0.01.

Table 6. The correlation coefficients of seed yield with leaf area index (LAI) and total dry matter (TDM) at high and low plant populations at different growth stages in 2005 and 2006.

Trait	Developmental stage or period	r of seed yield			
		2005		2006	
		High	Low	High	Low
LAI	V_5	-0.787**	-0.752**	-0.597*	-0.394^{ns}
	R_2	-0.260^{ns}	-0.247^{ns}	-0.080^{ns}	0.050^{ns}
	R_4	0.789**	0.803**	0.802**	0.921**
	R_6	0.908**	0.908**	0.767**	0.697**
TDM	V_5	0.908**	0.723**	0.864**	0.747**
	R_2	0.815**	0.830**	0.866**	0.796**
	R_4	0.776**	0.848**	0.825**	0.735**
	R_6	0.581*	0.696**	0.581*	0.835**

^{ns}No statistical difference at $P < 0.05$ and $P < 0.01$.
*Statistical difference at $P < 0.05$.
**Statistical difference at $P < 0.01$.

Discussion

The results clearly indicated that delaying the planting from mid-April to mid-May significantly reduced seed yield and other yield components measured except 1000-seed weight in both years (Table 2). In 2005, the highest seed yield was obtained when planting was performed in mid-April. Mid-April planting increased seed yield by about 13.5% compared to mid-May planting. Compared to mid-April planting, pod number per plant, seed number per plant, and harvest index produced 10.1%, 9.3%, and 5.0% lower mean values, respectively, in mid-May planting. Plant population had significant effects on seed yield and the other yield components measured except plant height and 1000-seed weight in 2005. Low plant population had a higher pod number, seed number per plant, harvest index, 1000-seed weight, and plant height, but lower seed yield compared to the high plant population. Increases in plant population from low (330,000 plants ha^{-1}) to high (660,000 plants ha^{-1}) reduced the pod number, seed number per plant, and harvest index by about 34.2%, 38.6%, and 3.5%, respectively, whereas, high plant population significantly increased the seed yield in both years because of the yield compensation of higher plant density per unit area. In 2005, the high plant population produced 17.7% higher seed yield than the low plant population (Table 2). Differences between cultivars in terms of all characters measured were statistically significant in 2005. Late maturity cultivar 1530 (Maturity Group-IV) had higher seed yield and yield components than the early maturity cultivar A-3127 (Maturity Group-III).

Results of the current study demonstrated that the response of cultivars for seed yield and its components in 2006 was very similar to the data in 2005. Our results are in agreement with those of Beatty et al. (1982), Pedersen and Lauer (2003), Board et al. (1990), and Egli and Bruening (2000) who reported that delayed planting reduced yields compared to earlier plantings. However, Johnson (1987) concluded that soybean is advantageous with its proven ability to yield well over a wide range of planting dates. Bullock et al. (1998) reported that a linear decrease with increasing row width was observed for grain yield, number of pods per plant, plant height, and harvest index. Furthermore, similar results to our findings on plant population and row spacing for seed yield and yield components have been reported (Devlin et al., 1995; Graterol et al., 1996; Edwards and Purcell, 2005).

Significant and positive relationships between seed yield and LAI were evident for planting dates at all growth stages in 2005 and 2006. This result indicated that increasing leaf area in vegetative development stage reduced seed yield at both high and low plant populations. Our findings were partly in agreement with the results reported by Wells et al. (1982), Johnson (1987), Board and Tan (1995), and Kumudi (2002).

Table 7. Correlation coefficients of seed yield with leaf area index (LAI) and total dry matter (TDM) with early and late maturity cultivars at different growth stages in 2005 and 2006.

Trait	Developmental stage or period	r of seed yield			
		2005		2006	
		Early	Late	Early	Late
LAI	V_5	0.287^{ns}	0.405^{ns}	0.444^{ns}	0.497^{ns}
	R_2	0.584*	0.695**	0.683**	0.731**
	R_4	0.814**	0.918**	0.870**	0.933**
	R_6	0.973**	0.990**	0.960**	0.950**
TDM	V_5	0.927**	0.923**	0.938**	0.920**
	R_2	0.819**	0.785**	0.751**	0.791**
	R_4	0.730**	0.730**	0.624*	0.755**
	R_6	0.613*	0.778**	0.613*	0.789**

^{ns}No statistical difference at $P < 0.05$ and $P < 0.01$.
*Statistical difference at $P < 0.05$.
**Statistical difference at $P < 0.01$.

Significant correlative relationships between seed yield and TDM at each growth stage were evident for both planting dates. Seed yields in both mid-April and mid-May plantings were positively and closely correlated with TDM in both years. Similarly, Hayati et al. (1995) reported that yield was best correlated with an increase in TDM. In our study, seed yield at the high plant population was positively and strongly correlated with TDM at all growth stages in 2005 and 2006. Moreover, similar results were obtained from the low plant population (wide row spacing). Board et al. (1990) reported that seed yield was strongly correlated with TDMD (R_5-R_8) ($r^2 = 0.86$, $P = 0.001$), but not with TDMD (E-R_5) at narrow row spacing in normal planting. In contrast, they found that seed yield in late planting was highly correlated with TDMD (E-R_5) ($r^2 = 0.81$, $P = 0.001$) as well as TDMD (R_5-R_8) ($r^2 = 0.94$, $P = 0.001$) at narrow row spacing. Furthermore, Wells et al. (1982), Johnson (1987), Board and Tan (1995), and Kumudi (2002) reported that soybean yield was positively related with TDM at the R_5 stage.

In conclusion, our results from a 2-year period indicated that planting dates, plant populations, and cultivars influenced the growth and yield of soybean. The highest soybean yields were obtained from mid-April planting, high plant population and late maturity cultivar. Plantings in mid-April increased seed yield by about 10.0% - 13.5% compared with mid-May plantings. High plant populations produced 17.7% higher seed yield than the low plant population for both experiment years. Significant relationships were found between seed yield and growth dynamics in each planting date. Significant and positive relationships between seed yield and LAI were evident for planting dates at all growth stages in 2005 and 2006. Seed yields at high and low plant populations were negatively and significantly correlated with LAI at the vegetative stage (V_5), but positively and closely related to LAI at reproductive stages (R_4 and R_6) in both experimental years. Relationships between seed yield and LAI with early and late maturity cultivars were significant and positive at all growth stages except V_5 growth stages in both years. Seed yield was positively and significantly correlated with TDM at all growth stages for planting dates, plant populations, and cultivars.

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