MISSISSIPPI SOYBEAN PROMOTION BOARD
55-2017 RISER FINAL REPORT
PLANTING DATE AND MATURITY GROUP

MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 55-2017

FINAL REPORT

Project Title: Row-Crop Irrigation Science Extension and Research (RISER) Program—Planting Date and Maturity Group

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Objective: Determine the effect of planting date and soybean maturity group selection on irrigation application amounts, irrigation water use efficiency, soybean grain yield, and net returns above irrigation costs.

EXECUTIVE SUMMARY

Sustainable water withdrawal from the Mississippi River Valley Alluvial Aquifer (MRVAA) is predicated on optimizing irrigation water use efficiency (IWUE), while concomitantly maintaining or improving on-farm profitability. This research was conducted to determine if soybean planting date and maturity group (MG) interact to effect IWUE and net returns above irrigation costs.

Research was conducted from 2015 through 2017 at the Delta Research and Extension Center, Stoneville, Mississippi on a Dundee silty clay loam. Planting dates for MG III, IV, and V soybean varieties were Early (April 25-27), Mid (May 13-18), and Late (June 1-7).

Irrigation was applied when the weighted average of soil water potential in the 0- to 61-cm rooting depth reached -75 kPa as measured by Watermark Model 200SS soil water potential sensors that were installed at 15-, 30-, and 61-cm depths within one replication. Plots were furrow-irrigated where water was pumped through 30.5-cm-diameter lay-flat poly-ethylene tubing laid perpendicular to the soybean rows. Computerized hole selection was calculated with the Pipe Hole And Universal Crown Evaluation Tool (PHAUCET) version 8.2.20 (USDA-NRCS, Washington, DC). During each irrigation event, 3.9 acre inches of water was applied. Irrigation was terminated at the R6.5 growth stage as recommended by the Mississippi State University Extension Service.

A summary of results is shown below and in the accompanying table.

- Average yields from MG IV varieties were the greatest or equal to the greatest in all planting dates.
- In the late plantings, yields from all MGs were similar across the three years.
- IWUE of MG III varieties was the highest in all planting dates because less irrigation water was applied to these varieties across the three years of the study.

- In the Early and Mid plantings, net returns to irrigation were greatest for MG IV varieties.
- In the Late plantings, net returns to irrigation were similar for all MGs across the three years.

The following conclusions can be drawn from these results.

- Planting date and MG interacted to affect IWUE and net returns above irrigation costs, which means that different MGs must be selected across planting dates to optimize net returns and IWUE. Specifically, these results indicate that IWUE and net returns above irrigation costs are optimized by planting MG IV or V cultivars early, MG IV cultivars mid-season, and MG III cultivars late-season. However, since MG V varieties will be in the field longer and since these results indicate that they have no advantage in any planting date, they should not be considered for irrigated plantings in the Midsouth.
- Currently, Midsouth producers primarily plant MG IV soybean varieties during the early and mid-planting date windows, and these data support the continuation of that paradigm in irrigated plantings. However, these results indicate that MG IV or V cultivars should be replaced in the late planting window by MG III cultivars in order to achieve the greatest IWUE with no yield penalty. These results indicate that this shift will optimize irrigated production in these plantings. These results also confirm that there is no advantage to planting MG V cultivars on any planting date.
- Overall, with the use of planting date and MG selection, Midsouth producers can maintain or improve on-farm profitability, while concurrently easing the region's groundwater shortage problems.

Mean soybean grain yield, irrigation water use efficiency (IWUE), and net return above irrigation costs for a study conducted in Stoneville, MS from 2015 through 2017.

Planting date	Maturity Group	Yield*	IWUE*	Net return*
		Bu/acre	*Bu/acre/in.*	*$/acre*
Early	III	60.7 bc	3.47 a	329.89 b
	IV	70.2 a	2.11 cd	420.02 a
	V	68.8 a	2.15 cd	404.67 a
Mid	III	54.7 c	2.49 b	267.66 c
	IV	62.1 ab	1.85 cd	333.66 b
	V	48.2 d	1.43 e	205.43 d
Late	III	40.3 d	2.00 c	126.98 e
	IV	40.7 d	1.85 d	139.42 e
	V	42.1 d	1.47 e	128.80 e

Values in individual columns followed by the same letter are not significantly different at $p \leq 0.05$.

PLANTING DATE AND MATURITY GROUP

ABSTRACT

Sustainable water withdrawal from the Mississippi River Valley Alluvial Aquifer (MRVAA) is predicated on optimizing irrigation water use efficiency (IWUE), while concomitantly maintaining or improving on-farm profitability. This research was conducted to determine if soybean (*Glycine max* L.) planting date and maturity group (MG) interact to effect net returns above irrigation costs and IWUE.

The study was a split-plot arrangement of treatments with four replications of each treatment in a randomized complete block on a Dundee silty clay loam from 2015-2017. The whole plot was planting date (early, middle, late), and the sub-plot was maturity group (MG III, IV, V). Planting date and MG interacted to affect net returns above irrigation costs ($P \leq 0.0001$) and IWUE ($P \leq 0.0001$). Relative to planting MG IV early, later planting, or switching to another MG either had no effect or reduced net returns above irrigation costs up to \$724 ha^{-1}.

Planting date and MG interacted to affect IWUE ($P \leq 0.0001$). In the early planting date, the IWUE of MG IV and V was 38.5% less than that of MG III. Maturity group IV had 25.8% less and 42.4% greater IWUE than MG III and V, respectively, at the mid-planting date. In the late planting date, MG IV had 7.5% less and 26.4% greater IWUE than MG III and V, respectively. These data indicate that net returns above irrigation costs and IWUE are optimized by planting MG IV or V early, MG IV mid-season, and MG III late season. With the use of planting date and MG selection, Midsouth producers can maintain or improve on-farm profitability, while concurrently easing the region's groundwater shortage problems.

INTRODUCTION

The Mississippi River Valley Alluvial Aquifer (MRVAA) is the primary irrigation source for the Midsouth where, over the past three decades, the number of agricultural wells has increased 6.8-fold (Sam Mabry, Personal Communication, 2017). Groundwater levels in the region are declining because agricultural withdrawal from the MRVAA exceeds its recharge rate (Guzman et al. 2014). Optimizing irrigation water use efficiency (IWUE) for the primary row crops in the region is a means to ensure sustainable withdrawal from the MRVAA.

Nationally, Mississippi ranks eighth in terms of irrigated cropland area (USDA NASS 2013) and soybean accounts for 47.3% of the total irrigation water applied to row crops in the state (Massey et al. 2017). From 2002-2013, average season-long irrigation water applied to soybean in Mississippi was 2,800 m^3 ha^{-1}, and irrigation rates increased circa 200 m^3 ha^{-1} y^{-1} (Massey et al. 2017). With approximately 635,000 soybean hectares in the Mississippi Delta, of which 61% are furrow-irrigated (USDA-NASS 2014; Yazoo Mississippi Delta Joint Water Management District 2013), there is critical need for improving IWUE.

Planting early and changing MG as planting windows progress may be a means to maintain or improve net returns above irrigation costs. The early soybean production system (ESPS) improved yield and net returns by shifting Midsouth producers from planting determinate MG V-

VII cultivars in May and June to planting indeterminate MG IV cultivars in April and May (Heatherly 2005). More recently, stability analysis indicated that MG IV and V cultivars had the greatest probability (80%) of achieving yields that exceed 3000 kg ha^{-1} at early planting dates (ranging from 20 March to 31 May) compared to MG III (70%) and MG VI cultivars (50%) (Salmeron et al. 2014). Moreover, for late planting dates (from 4 May to 17 July), MG III and IV cultivars had the greatest probability (62%) of achieving yields > 3000 kg ha^{-1} compared to other MGs in the study (57 and 38% for MG V and VI cultivars). These results are critical to the Midsouth region as producers primarily plant MG IV soybean varieties during the early and mid-planting windows, and MG IV and V cultivars during the late window (Personal communication Trent Irby).

Maturity group may also affect irrigation requirements throughout the growing season. Edwards et al. (2003) reported that nonirrigated MG I-IV soybean had similar yields as those under irrigation in the southeastern United States, yet Wegerer (2012) identified irrigated MG IV to have superior yield, weed control, and irrigation attributes compared to irrigated MGs II and III. However, MG IIs and IIIs return more yield per ha mm of water applied than later-maturing varieties due to shorter seed-fill durations (Wegerer et al. 2015; Edwards et al. 2003).

Current production practices in the Midsouth utilize the ESPS, and the most commonly planted varieties are indeterminate MG IVs and Vs (Heatherly 2005). For local producers to adopt a practice, specifically best irrigation water management strategies, on-farm profitability must be maintained or improved (Kay et al. 2015). Thus, evaluating new practices must be done by selecting the strategies that maximize on-farm profitability, and then selecting for the highest IWUE among those strategies. The objective of this study was to determine if planting date and MG interact to affect net returns above irrigation costs and IWUE in a sensor-based irrigation program.

MATERIALS AND METHODS

Site Description and Experimental Design

Research was conducted from 2015 through 2017 at the Delta Research and Extension Center, Stoneville, Mississippi on a Dundee silty clay loam (Fine-silty, mixed, active, thermic Typic Endoaqualfs). Plots were 4.04-m wide by 10.9-m long, and were seeded with a John Deere Maxemerge 4-row planter at a depth of 3 cm and a rate of 345,800 seeds ha^{-1}. The experiment was a split-plot arrangement of treatments in a randomized complete block with four replications. The whole plot was planting date (Early, Mid, Late), and the sub-plot was maturity group (MG III, IV, V) (Table 1). Some cultivars changed from year to year, but replacement cultivars were of similar maturity (Table 2). All soybean cultivars had an indeterminate growth habit.

Sensor Based Scheduling

Irrigation was applied when the weighted average of the soil water potential in the 0- to- 61-cm rooting depth reached -75 kPa as measured by Watermark Model 200SS soil water potential sensors (Irrometer Company Inc., Riverside, CA) that were installed at 15, 30, and 61-cm depths within one replication. Irrigation was terminated at the R6.5 growth stage as recommended by the Mississippi State University Extension Service.

Irrigation Delivery

Plots were furrow-irrigated where water was pumped through 30.5-cm-diameter lay-flat poly-ethylene tubing (Delta Plastics, Little Rock, AR) laid perpendicular to the soybean rows. Computerized hole selection was calculated with the Pipe Hole And Universal Crown Evaluation Tool (PHAUCET) version 8.2.20 (USDA-NRCS, Washington, DC). Input parameters for computerized hole selection were implemented as described by Bryant et al. (2017). Flow rate at the field inlet was determined with a M^{c}Crometer flow tube with attached M^{c}Propeller bolt-on saddle flowmeter (M^{c}Crometer Inc., Hemet, California). During each irrigation event, 24.7-cm ha^{-1} of water was applied at 11.3 L min^{-1} furrow^{-1}.

Agronomic practices outside of irrigation scheduling were conducted according to Mississippi State University Extension Service recommendations for regional producers (Catchot 2017; Bond et al. 2017). Growth stage for each treatment was determined weekly. The center two rows of each plot were mechanically harvested at physiological maturity when seed moisture was between 15-25%, and yields were determined with a calibrated yield monitor (Ag Leader Technology, Ames, Iowa).

Irrigation water use efficiency was calculated as described by Vories et al. (2005):

$$IWUE = \frac{Y}{IWA}$$

where IWUE is irrigation water use efficiency (kg/ha-mm), Y is soybean grain yield (kg/ha), and IWA is irrigation water applied (ha-mm).

Economic Analysis

The model used to estimate irrigation costs in this research incorporates irrigation enterprise budgets developed utilizing the Mississippi State University Budget Generator. The model develops estimates of total receipts, total direct expenses, total fixed expenses, total specified expenses, and net returns above total specified expenses on a per hectare basis. The cost estimates are adjusted on an annual basis for the 2015, 2016, and 2017 crop years for changes in variable input costs other than diesel prices. Soybean prices are held constant at $10.00 per bushel. Assumptions related to equipment utilized in each enterprise budget are reported in Table 3. The values for purchase price and fuel consumption are based on personal communications with Mississippi Delta region irrigation equipment input and service providers.

Statistical Analysis

Using the GLIMMIX procedure of SAS (Statistical Analytical System Release 9.4; SAS Institute Inc., Cary, North Carolina), an initial analysis was conducted with year, planting date, and maturity group serving as fixed effects and replication within year, replication by planting date within year, variety within year and maturity group, and planting date by variety within year and maturity group serving as random terms. For soybean grain yield, total irrigation water applied, IWUE, and economic net return, F-values were small compared to the planting date and maturity group interaction values, so a second analysis was conducted with year serving as a component of error. In the second analysis, planting date and maturity group served as fixed effects and year, replication within year, year by planting date, replication by planting date within year, year by maturity group within planting date, and planting date by variety within year by maturity group served as random terms. Degrees of freedom were estimated using the Kenward-Roger method. Means were separated using the LSMEANS statement. Differences were considered significant for $\alpha=0.05$.

RESULTS AND DISCUSSION

Seasonal Rainfall

Seasonal rainfall varied by year during the study as compared to the 10-year average rainfall (YAR) amounts (Table 4). The 2015 growing season was characterized as hot and dry and had 13.5%, 22.1%, and 73.7% less rainfall during the months of June, July, and August, respectively, compared to the 10 YAR. These conditions resulted in water deficits during critical reproductive growth stages for soybean planted in early and mid-planting dates, and the frequency of irrigation reflect this (Table 5). In contrast, the 2016 and 2017 growing seasons had higher amounts of rainfall than the 10 YAR, with the months of June, July, and August averaging 112%, 32.5%, and 188% more rainfall, respectively, across both years.

Soybean Grain Yield

Planting date and MG interacted to affect soybean grain yield ($P \leq 0.0001$) (Table 6). In the early planting date, yield for MG IV and V cultivars was at least 11.9% greater than MG III cultivars. Maturity group IV cultivars yielded 12.1% and 22.4% greater than MG III and V cultivars, respectively, at the mid-planting date. In the late planting date, yield was not different among MGs. Yield for MG III and IV cultivars was stable through the mid-planting date window, but delaying planting until the late window reduced yield by at least 33.4% compared to the early planting. Yield for MG V cultivars decreased 29.9% from early to mid-planting dates, but did not change from the mid to late planting date.

Irrigation Water Use Efficiency

Planting date and MG interacted to affect IWUE ($P \leq 0.0001$) (Table 6). In the early planting date, the IWUE of MG IV and V cultivars was 38.5% less than that that of MG III cultivars. Maturity group IV cultivars had 25.8% less and 42.4% greater IWUE compared to MG III and V cultivars, respectively, within the mid-planting date. In the late planting date, MG IV cultivars had 7.5% less and 26.4% greater IWUE than MG III and V cultivars, respectively. Compared to the early planting date, IWUE for MG III cultivars decreased 28.3% and 42.4% for the mid and late planting dates, respectively. Irrigation water use efficiency for MG IV cultivars did not change due to planting date. Compared to the early planting date, IWUE for MG V cultivars decreased 33.3% from an early to mid-planting date, but did not change from the mid to late planting date.

Net Returns Above Irrigation Costs

Planting date and MG interacted to affect net returns above irrigation costs ($P \leq 0.0001$) (Table 6). In the early planting date, the net returns above irrigation costs for MG IV and V cultivars was 20.0% greater than that of MG III cultivars. Maturity group IV cultivars had 19.8% and 38.4% greater net return above irrigation costs than MG III and V cultivars, respectively, at the mid-planting date. Net returns above irrigation costs were not different among MGs in the late planting date. Planting during the mid or late window, rather than early, decreased net returns above irrigation costs for all MGs by 18.9 to 61.5%. Interestingly, MG V culitvars were most sensitive to delayed planting. For example, delaying the planting of MG V cultivars by 20-d decreased net returns above irrigation costs 49.2% compared to 20% for MG III and IV cultivars.

DISCUSSION

The objective of this research was to determine if planting date and MG interact to affect IWUE and net returns above irrigation costs. Our research indicate that planting date and MG interact to affect both, and that MG selection must change as planting date progresses. Presently, Midsouth producers primarily plant MG IV soybean varieties during the early and mid-planting window, and MG IV or V during the late window (Personal communication Trent Irby). This research indicates that to optimize Midsouth soybean production, a radical shift in MG selection by planting date is required.

For all MGs, net returns above irrigation costs and IWUE were greater during early rather than later planting dates. Others noted that net returns were maximized for MG III, IV, and V varieties when planted at mid-April in the Midsouth (Salmeron et al. 2014). Higher yields and net returns for these MGs planted early rather than later is attributed to an increased photoperiod (Chen and Wiatrak, 2010; Purcell et al. 2002), increased leaf area index and radiation interception (Egli et al. 1987), reduced risk of late-season effects caused by insect pests (Baur et al. 2000; Gore et al. 2006), and improved drought avoidance (Heatherly et al. 1998; Boykin 2002; Heatherly and Spurlock 2002). Aside from August 2015, rainfall amounts during critical reproductive periods for soybean planted in April were equivalent or exceeded the 10 YAR amounts, and the greater IWUE during the early planting date reflect this (Table 5). Yet, as planting date progressed, yield, net returns above irrigation costs, and IWUE were adversely affected for all MGs.

Net returns above irrigation costs and IWUE are optimized in the early planting window by planting MG IV or V cultivars rather than MG III cultivars. The IWUE for MG III cultivars was superior to that of later-maturing varieties, but they should not be planted during the early window due to lower net returns above irrigation costs (Kay et al. 2015). Others noted similar yield potentials between early-planted indeterminate MG IV and V cultivars, and that these cultivars have a greater yield potential than MG III cultivars (Wegerer et al. 2015; Popp et al. 2006; Salmeron et al. 2014). The superior yield and net returns for later planted early-maturing cultivars is attributed to a larger amount of radiation intercepted during reproductive growth (Egli and Bruening, 2000; Kantolic et al. 2013).

For the mid-planting window, net returns above irrigation costs and IWUE are optimized for the Midsouth only by planting MG IV cultivars. As in the early planting window, the IWUE for MG III cultivars was greater than that of MG IV cultivars, but the net returns above irrigation costs were \$162 ha^{-1} less than that of MG IV cultivars. Others noted superior yields and economic benefits for MG IV cultivars relative to earlier or later maturing cultivars when planted in May (Heatherly 2005; Salmeron et al. 2014; Salmeron et al. 2016; Popp et al. 2006). Greater yields and net returns for MG IV cultivars relative to other MGs within the mid-planting window are attributed to better synchronization of reproductive growth with optimum environmental conditions (Chen and Wiatrak, 2010; Purcell et al. 2002; Egli et al. 1987).

Net returns above irrigation costs and IWUE are optimized in the late window by planting MG III cultivars rather than MG IV or V cultivars. Similar yields among MG III, IV, and V cultivars when planted in the late window have been observed (Heatherly 2005; Salmeron et al. 2016). However, MG III cultivars returned more yield per ha mm of water applied than later-maturing cultivars, which is consistent with the literature (Wegerer et al. 2015; Heatherly 2005; Edwards et al. 2003). The greater IWUE for MG III cultivars is due to their shorter seed-fill duration, enabling them to reach physiological maturity at least 10-d earlier than later maturing varieties (Table 1) (Wegerer et al. 2015; Edwards et al. 2003).

CONCLUSIONS

The objective of this study was to determine if soybean planting date and MG interact to affect soybean grain yield, IWUE, and net returns above irrigation costs. Planting date and MG interacted to affect net returns above irrigation costs and IWUE, which means that different MGs must be selected across planting dates to optimize net returns and IWUE. Specifically, our data indicate that net returns above irrigation costs and IWUE are optimized by planting MG IV or V cultivars early, MG IV cultivars mid-season, and MG III cultivars late season. Currently, Midsouth producers primarily plant MG IV soybean varieties during the early and mid-planting window and MG IV or V cultivars during the late window (Personal communication Trent Irby). This research indicates that to optimize Midsouth soybean production, a radical shift in MG selection by planting date is required. Overall, with the use of planting date and MG selection, regional producers can maintain or improve on-farm profitability, while concurrently easing the region's groundwater shortage problems.

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Table 1. Soybean planting and harvest dates by year for a study conducted in Stoneville, MS.

PD[1]	**MG[2]**	**2015**		**2016**		**2017**	
		Planting	**Harvest Date**	**Planting**	**Harvest Date**	**Planting**	**Harvest Date**
Early	**III**	27-April	22-August	27-April	25-August	25-April	23-August
	IV	27-April	9-September	27-April	10-September	25-April	8-September
	V	27-April	15-September	27-April	16-September	25-April	14-September
Mid	**III**	13-May	2-September	16-May	30-August	18-May	30-August
	IV	13-May	17-September	16-May	19-September	18-May	20-September
	V	13-May	28-September	16-May	29-September	18-May	28-September
Late	**III**	1-June	16-September	7-June	19-September	5-June	14-September
	IV	1-June	26-September	7-June	29-September	5-June	27-September
	V	1-June	1-October	7-June	3-October	5-June	1-October

[1]Planting Date
[2]Maturity Group

Table 2. Soybean cultivars used in 2015, 2016, and 2017 by maturity group (MG) for a study conducted in Stoneville, MS.

MG[1]	**2015**		**2016**		**2017**	
	Company	**Cultivar**	**Company**	**Cultivar**	**Company**	**Cultivar**
III	Asgrow	AG3832	Asgrow	AG3832	Asgrow	AG39X7
	Mycogen	5N40	Mycogen	5N40	Mycogen	5N40
	Pioneer	P93Y92	Pioneer	P38T61	Pioneer	P38T61
IV	Asgrow	AG4632	Asgrow	AG4632	Asgrow	AG4632
	Mycogen	5N451	Mycogen	5N451	Mycogen	5N451
	Pioneer	P47T36	Pioneer	P47T36	Pioneer	P47T36
V	Asgrow	AG5335	Asgrow	AG5335	Asgrow	AG5335
	Mycogen	5N52	Mycogen	5N52	Mycogen	5N52
	Pioneer	P53T73	Pioneer	P53T18	Pioneer	P53T18

[1]Maturity Group

Table 3. Summary of estimated irrigation costs per hectare for full-season soybean irrigated with roll-out pipe, 65-hectare system, for the Delta area, Mississippi, 2017.

Item	Unit	Price	Quantity	Amount
Direct Expenses		$/ha		$/ha
Irrigation Supplies	hectare	20.38	1.00	20.38
Soil Moisture Sensors	hectare	0.64	1.00	0.64
Irrigation Labor	hour	22.38	0.8954	8.15
Operator Labor	hour	33.37	0.1939	2.62
Diesel Fuel	gal	4.45	19.90	35.86
Repair and Maintenance	hectare	18.48	1.00	18.48
Interest on Op. Cap.	hectare	1.36	1.00	1.36
Total Direct Expenses				**87.49**

Table 4. Rainfall (cm) amounts for March through October in 2015, 2016, 2017, and 10-year average at Stoneville, MS.

Month	2015	2016	2017	10 Year Average
March	18.57	46.91	7.57	14.22
April	16.08	10.95	16.84	14.22
May	17.68	8.28	12.40	13.11
June	6.53	12.85	19.28	7.54
July	8.05	16.59	10.95	10.34
August	1.85	13.92	27.28	7.06
September	2.01	0.86	4.29	9.53
October	13.94	0.51	0.56	13.49
Total	**84.71**	**110.87**	**96.62**	**89.51**

Table 5. Irrigation water applied (cm ha^{-1}) at specific growth stages by year for a study conducted in Stoneville, MS from 2015 through 2017.

2015

Planting Date	MG[1]	Growth Stage							Total
		VN	R1	R2	R3	R4	R5	R6	
Early	III					24.7	24.7		**49.4**
	IV						49.4	74.1	**123.5**
	V					24.7	123.5	49.4	**172.9**
Mid	III			24.7	24.7	24.7	98.8	24.7	**197.6**
	IV				24.7	74.1	98.8	74.1	**271.7**
	V				24.7	24.7	98.8	49.4	**197.6**
Late	III			24.7		98.8	98.8	24.7	**247.0**
	IV				49.4	49.4	49.4	49.4	**197.6**
	V			24.7	98.8	74.1	74.1	24.7	**296.4**

2016

Planting Date	MG	Growth Stage							Total
		VN	R1	R2	R3	R4	R5	R6	
Early	III				24.7	24.7	49.4	24.7	**123.5**
	IV			24.7	24.7	24.7	49.4		**123.5**
	V			24.7			49.4		**74.1**
Mid	III			24.7	24.7	24.7	49.4		**123.5**
	IV		24.7			49.4			**74.1**
	V		24.7			49.4	24.7		**98.8**
Late	III	24.7					24.7		**49.4**
	IV			24.7		24.7		24.7	**74.1**
	V	49.4		24.7	24.7	24.7		24.7	**148.2**

2017

Planting Date	MG	Growth Stage							Total
		VN	R1	R2	R3	R4	R5	R6	
Early	III						24.7		**24.7**
	IV						49.4		**49.4**
	V						49.4		**49.4**
Mid	III						24.7		**24.7**
	IV						49.4		**49.4**
	V						49.4		**49.4**
Late	III					24.7			**24.7**
	IV				24.7				**24.7**
	V			24.7					**24.7**

[1]Maturity Group

Table 6. Mean±SEM soybean grain yield (kg ha^{-1}), irrigation water use efficiency (kg ha^{-1} mm^{-1}), and net return above irrigation costs (\$ ha^{-1}) for a study conducted in Stoneville, MS from 2015 through 2017.

Planting Date	MG[1]	Yield	IWUE[2]	Net Return
Early	III	4079(135) bc	9.2(1.1) a	814.54(51.28) b
Early	IV	4719(161) a	5.6(0.6) cd	1037.09(56.57) a
Early	V	4625(153) a	5.7(0.5) cd	999.18(53.64) a
Mid	III	3674(93) c	6.6(1.1) b	660.90(32.67) c
Mid	IV	4176(145) ab	4.9(0.5) cd	823.84(50.70) b
Mid	V	3241(90) d	3.8(0.4) e	507.24(31.68) d
Late	III	2710(115) d	5.3(0.7) c	313.54(42.76) e
Late	IV	2737(139) d	4.9(0.5) d	344.25(48.90) e
Late	V	2831(141) d	3.9(0.6) e	318.02(49.38) e

[1]Maturity Group
[2]Irrigation Water Use Efficiency
* Values in a column followed by the same letter are not significantly different at $P \leq 0.05$