2016 Soybean Management by Application of Research and Technology (SMART) Program Summary

MSBP Project Number: 36-2016

Principal Investigator: Dr. Trent Irby (trent.irby@msstate.edu), Extension Soybean Specialist

CONTENTS

The SMART program coordinated by Mississippi State University Extension and supported by the Mississippi Soybean Promotion Board is designed to assist with implementing best management practices and technologies into the farm level. In doing so, the latest research-proven practices can be demonstrated on the farm scale to assist with improving soybean yield and ultimately profitability.

Soybean is an integral component of Mississippi's agriculture production systems. Currently, soybean is third on the list of Mississippi's agricultural commodities. Approximately 2 million acres of soybeans were harvested in Mississippi during 2016 with an average yield of 48 bushels per acre. Soybean productivity has increased over the last 20 years due to a multitude of reasons including, but not limited to, improved management, technology, and seed options. However, potential for improvement of our production systems still remain.

During the 2016 production season, the SMART program consisted of demonstration and training events that promoted ideal practices to Mississippi's soybean producers. This portion of the program is intended to provide you as soybean growers, crop consultants, and other agriculture professionals with the latest information to assist throughout the growing season.

MISSISSIPPI STATE UNIVERSITY EXTENSION

MSPB MISSISSIPPI SOYBEAN PROMOTION BOARD

SOYBEAN VARIETY DEMONSTRATIONS

Purpose: These demonstration fields were designed to determine the performance of the latest, proven soybean varieties across multiple environments and production systems in Mississippi.

Procedure: During 2016, 29 soybean variety demonstration locations were harvested across Mississippi with participation by MSU-ES county and area agents. Soybean varieties planted at each location were selected to be a part of a specific set suitable for the region where the demonstration was located. Specifically, a total of 8 varieties were included in the Roundup Ready (RR) MG Early IV sets, 15 varieties were included in RR MG IV sets, 16 varieties in RR MG V sets, 11 varieties in LibertyLink (LL) MG IV sets, and 9 varieties in LL MG V sets. Of the 29 locations harvested, the variety demonstrations include:

- 1 irrigated RR MG Early IV location
- 6 irrigated RR MG IV locations
- 2 irrigated RR MG V locations
- 4 non-irrigated RR MG IV locations
- 8 non-irrigated RR MG V locations
- 4 irrigated LL MG IV locations
- 4 irrigated LL MG V locations

These locations successfully covered targeted regions of the Mississippi Delta, the Mississippi Prairies (Black Prairie and/or Jackson Prairie), Mississippi Coastal Plains, and the Mississippi Valley Silty Uplands. These locations also represented 5 different row spacings, 3 tillage systems, 14 soil series, and irrigated and non-irrigated production systems ranging through 6 weeks of planting dates.

Results: This information is summarized in the 2016 MSU-ES Soybean Variety Demonstration Program Summary publication. Beyond this publication, the variety demonstration results were used to supplement data from small plot variety testing to develop the MSU-ES Soybean Variety Suggestions for 2017 publication.

SOYBEAN VARIETY SCREENING FOR IRON DEFICIENCY CHLOROSIS (IDC) TOLERANCE

Purpose: Iron deficiency chlorosis (IDC) is an extreme problem in certain soybean production regions of Mississippi. One aspect of management for IDC is through variety selection. However, little data exists with respect to variety tolerance to IDC. Therefore, during 2016 a total of 28 maturity group V varieties were screened for tolerance to IDC.

Procedure: Varieties were planted in a producer field with historic IDC problems. Tolerance scores were assigned to each variety on a scale of 1 to 10 with 1 being completely tolerant and 10 being completely susceptible. The planting of each variety to be screened was replicated three times throughout the test area. Machine harvested yield was collected in order to determine soybean yield for each variety grown in this IDC environment.

Figure 1. Illustration of Tolerance Levels to IDC.

Results: The following table summarizes the IDC Tolerance score and soybean yield in this problem field for the varieties evaluated during 2016. These data are intended to serve as an additional resource for variety selection for soils with a history of problems associated with IDC.

2016 Soybean Variety Response to Iron Deficiency Chlorosis

Brand	Variety	IDC Tolerance Rating Date & Score						Avg. IDC Tolerance Score	Yield (bu/A)
		7/6	7/13	7/22	7/27	8/6	8/17		
Dyna-Gro	S52RY75	2	2	2	2	2	2	2	46.1
Delta Grow	DG5230RR2Y	7	2	2	3	3	2	3	46.0
Univ. of Arkansas	UA 5414RR	2	1	2	2	2	1	2	43.3
Terral	REV 56R63	4	3	3	3	3	2	3	43.2
Terral	REV 52A94	4	4	3	3	3	2	3	39.3
Croplan	R2C5265	2	2	2	3	3	2	2	39.1
Croplan	R2C5225S	5	5	4	4	3	2	4	38.8
Delta Grow	DG5625RR2Y	5	5	4	4	3	2	4	38.5
Pioneer	P52T50R	3	3	3	3	2	2	3	36.4
NK	S55-Q3	4	5	4	6	4	2	4	36.3
Pioneer	P55T81R	4	4	4	5	3	3	4	35.8
Mycogen	5N523R2	5	4	4	5	4	3	4	35.8
Dyna-Gro	S57RY26	6	5	4	5	4	3	5	35.3
Delta Grow	DG5170RR2Y/STS	5	4	4	5	4	3	4	33.9
Progeny	P 5752 RY	5	4	4	5	4	3	4	33.2
Progeny	P 5226 RYS	5	6	5	5	4	3	5	32.7
NK	S56-M8	5	4	5	6	5	4	5	32.2
Terral	REV 57R21	4	4	4	5	4	3	4	29.7
USG	75B75R	6	5	5	6	5	4	5	28.5
Delta Grow	DG5555RR	5	5	6	6	5	4	5	21.7
Dyna-Gro	S56RY84	7	8	7	7	6	6	7	16.7
Credenz	CZ 5375 RY	6	6	6	7	5	5	6	16.1
Terral	REV 51A56	7	8	8	9	9	8	8	7.4
Progeny	P 5555 RY	7	8	7	7	7	6	7	6.0
Delta Grow	DG5580RR2Y	3	7	8	8	8	7	7	5.6
GoSoy	5214GTS	7	6	7	7	7	7	7	3.7
Armor	55-R68	8	8	8	8	8	7	8	0.9
NK	S58-Z4	7	8	8	8	7	7	8	0.8

Tolerance scores were assigned on a scale of 1 to 10 with 1 being completely tolerant and 10 being completely susceptible. These data are intended to serve as an additional resource for variety selection specifically for soils with a history of problems associated with iron deficiency chlorosis. Consult other sources such as results from Official Variety Trials and Demonstration Programs for detailed information regarding variety performance.

SOYBEAN FUNGICIDE DEMONSTRATIONS

Purpose: These demonstration fields were designed to evaluate the effect of a foliar fungicide application on soybean disease management and yield during the 2016 growing season.

Procedure: A single application of Quadris at 6 fl oz/A, Quadris Top SBX at 7 fl oz/A, and Aproach Prima at 6.4 fl oz/A were applied in large field scale plots. All fungicide treatments included a non-ionic surfactant at a rate of 0.25% v/v. All fungicide applications were applied by airplane at the R3/R4 growth stage. Additionally, all fungicide treatments were compared to an untreated control for comparison. This trial was conducted at three locations in Mississippi during the 2016 growing season. The locations consisted of the following: Hollandale, MS (Washington County), Leland, MS (Washington County), and Canton, MS (Madison County). Both the Hollandale and Leland, MS locations were irrigated, while the Canton, MS location was non-irrigated. Final plant heights along with green stem, shattering, and lodging scores were collected prior to harvest. Soybean yield was collected from each treatment and measured in bushels per acre at all locations.

Figure 1. Trial layout at each location.

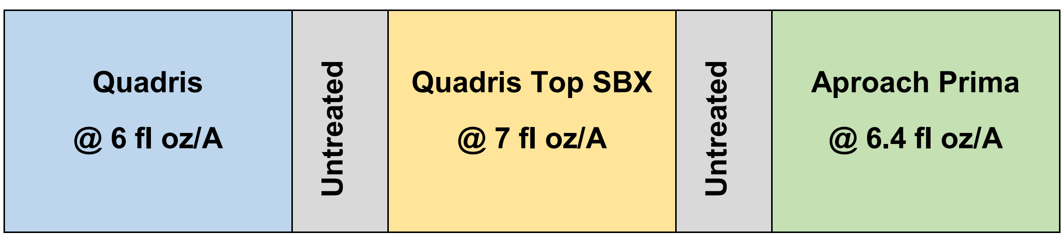
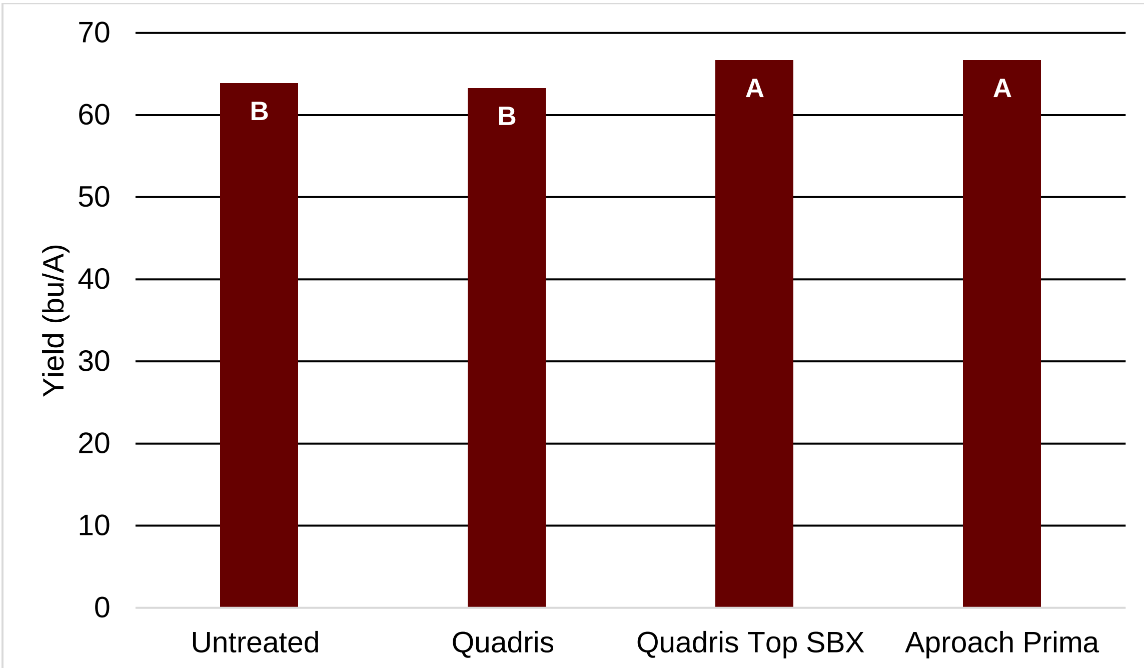


Table 1: Soybean yield following fungicide application at the R3/R4 growth stage at each individual location.

Treatment	Hollandale, MS	Leland, MS	Canton, MS
	---------------------------Yield (bu/ac) ---------------------------		
Untreated	71.8	66.0	53.4
Quadris	71.8	66.0	52.1
Quadris Top SBX	74.2	71.0	55.0
Aproach Prima	75.4	70.0	54.7

Figure 2. Yield differences between fungicide products and the untreated control averaged across all locations



Results: It was observed when all locations were combined that an application of Quadris at 6 fl oz/A provided no yield benefit compared to the untreated check where no fungicide was applied. However, with an application of Quadris Top SBX at 7 fl oz/A or Approach Prima at 6.4 fl oz/A, nearly a four bushel per acre increase in yield was observed. Plant heights, green stem, shattering, and lodging scores were not significant when combined over all locations, therefore these data were not displayed.

NEMATICIDE SEED TREATMENT DEMONSTRATIONS

Purpose: These demonstration fields were designed to evaluate the effect of nematicide seed treatments on soybean cyst nematode management and soybean yield during the 2016 growing season.

Procedure: In 2016, three seed treatments, Clariva Complete Beans, ILeVo seed treatment, and CruiserMaxx Vibrance Beans, were applied to a soybean variety with tolerance to soybean cyst nematode (SCN) (NK S55-Q3). Treatments were planted at two locations in Prentiss County, Mississippi in fields that have historically had soybean cyst nematode populations. Treatments were replicated 4 times at one location and 2 times at the other Prentiss County location. Nematode samples collected at both locations confirmed that fields had exceeded threshold levels of soybean cyst nematodes at the time of planting. Currently, the threshold level for soybean cyst nematode is 1 per pint of soil. Nematode samples and yield were collected at the end of the growing season to determine the effectiveness of each seed treatment.

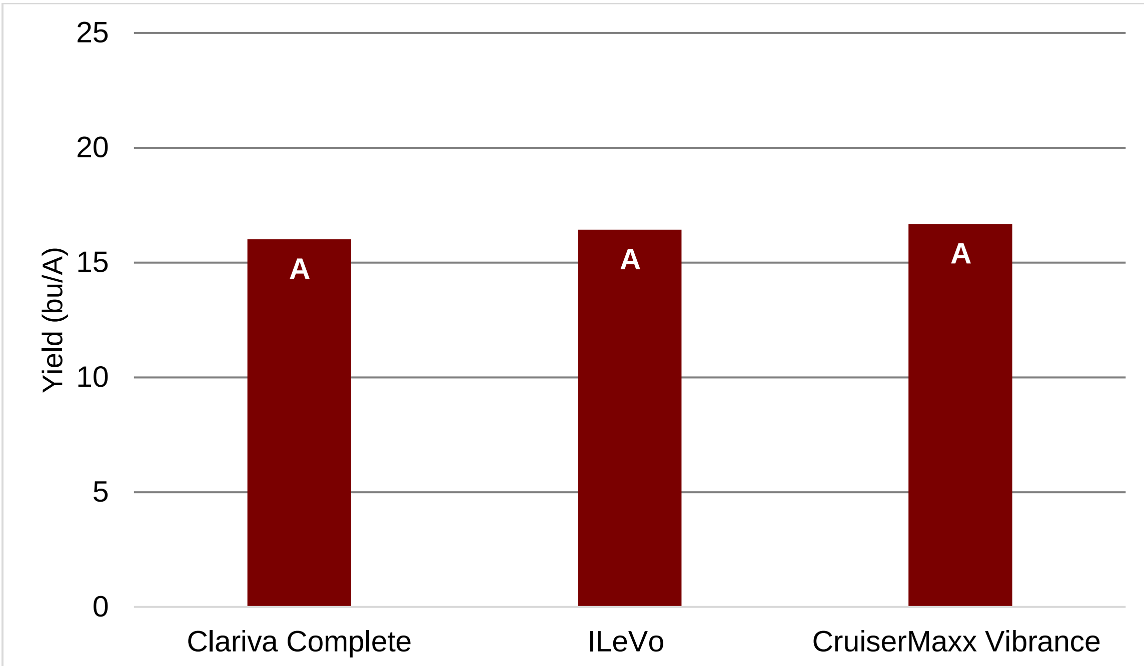
Table 1. Seed treatments used at each Prentiss County location.

Seed Treatment	Active Ingredient
Clariva Complete	*Pasteuria nishizawae* + thiamethoxam + mefenoxam + fludioxonil + sedaxane
ILeVo	fluopyram
CruiserMaxx Vibrance	thiamethoxam + mefenoxam + fludioxonil + sedaxane

Table 2. Soybean Cyst Nematode (SCN) populations at planting and after harvest.

Location	SCN Population At Planting			SCN Population after Harvest		
	Clariva Complete Beans	Illevo Seed Treatment	CruiseMaxx Vibrance	Clariva Complete Beans	Illevo Seed Treatment	CruiseMaxx Vibrance
	------------------------ encysted female SCN per pint of soil ------------------------					
Field 1	47	47	47	89	61	101
Field 2	39	39	39	32	36	32

Figure 1. Yield differences observed between nematicide seed treatments.



Results: Yield collected was low across all treatments due to shattering caused by a delayed harvest (equipment malfunction delay). No yield benefit was observed with the addition of a nematicide seed treatment to a soybean variety containing tolerance to this pest. Additionally, no nematicide seed treatment affected SCN development at both locations, as population levels remained well above threshold (Table 2). These seed treatment options will be further evaluated during 2017 when applied to a soybean variety not containing tolerance to SCN.

FERTILITY DEMONSTRATIONS – PHOSPHOROUS

Purpose: This demonstration field was designed to evaluate the effect of phosphorous fertilizer (0-46-0) on soybean yield when applied at various rates.

Procedure: This demonstration was conducted in Cleveland, MS during the 2016 growing season on 38 inch twin row planted soybeans. Phosphorous (0-46-0) was applied at three different rates (Table 1) with an untreated check where no phosphorous was applied included for comparison. Rates were structured to represent a low application rate (87 pounds per acre), a maintenance application rate (174 pounds per acre) and a build application rate (261 pounds per acre). Soil samples were collected at both the beginning of the growing season and at harvest, along with soybean yield to determine the effectiveness of the phosphorous applications.

Table 1. Amount of P_2O_5 applied in the form of 0-46-0 fertilizer for each treatment.

Rates (lb/A):	P_2O_5	0-46-0
Check	0	0
Low	40	87
Maintenance	80	174
Build	120	261

Figure 1. Trial layout.

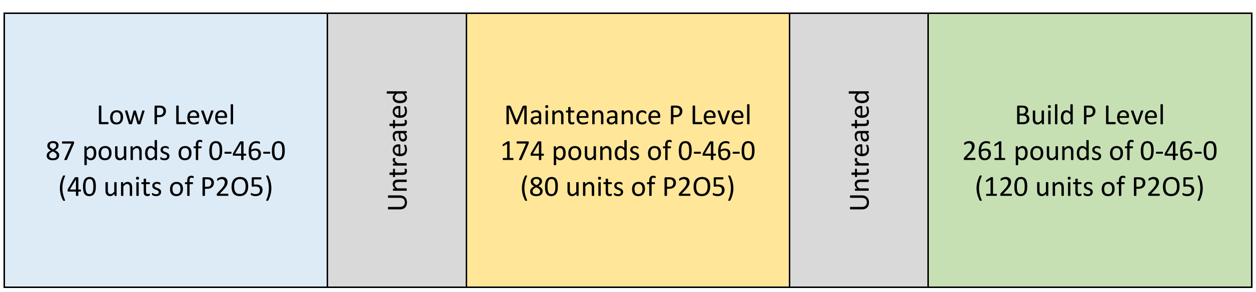


Table 2. Plant heights and yield collected.

Rates (lb/A):	Plant Heights (cm)	Yield (bu/A)
Check	76.2	76.9
Low	73.7	62.8
Maintenance	81.3	78.2
Build	86.4	75.6

Table 3. Soil sample results from samples collected prior to planting and samples collected at harvest.

Rates (lb/A):	Initial Soil Samples (field avg)	Harvest Soil Samples
	-------------------Nutrient Availability Index (lb/A)-------------------	
Check	36	34
Low	36	30
Maintenance	36	43
Build	36	139

Results: Plant height and yield (Table 2) were inconclusive, likely due to variabilities in the field. The untreated areas of the field were selected at random and it would seem that the untreated areas contained more available P than did the treated area for the Low level treatment. Soil sample results (Table 3) did show that the greater the rate of phosphorus applied the greater the amount that remained in the soil at harvest, as expected. Similar demonstrations will be conducted in 2017 to add to this data set in order to have more conclusive data in the future.

FERTILITY DEMONSTRATIONS – POTASSIUM

Purpose: This demonstration field was designed to evaluate the effect of potassium fertilizer (0-0-60) on soybean yield when applied at various rates.

Procedure: This demonstration trial was conducted during the 2016 growing season in Prentiss County near Baldwyn, Mississippi on 38 inch single row planted soybeans. Potassium (0-0-60) was applied at three rates (Table 1) along with an untreated check where no potassium was applied for comparison. Rates were structured to represent a low application rate (100 pounds per acre), a maintenance application rate (150 pounds per acre) and a build application rate (200 pounds per acre). Soil samples were collected prior to planting and at harvest. Soybean yield was collected to determine the effectiveness of the potassium applications.

Table 1. Amount of K_2O applied in the form of 0-0-60 fertilizer for each treatment.

Rates (lb/A):	K_2O	0-46-0
Check	0	0
Low	60	100
Maintenance	90	150
Build	120	200

Figure 1. Trial layout.

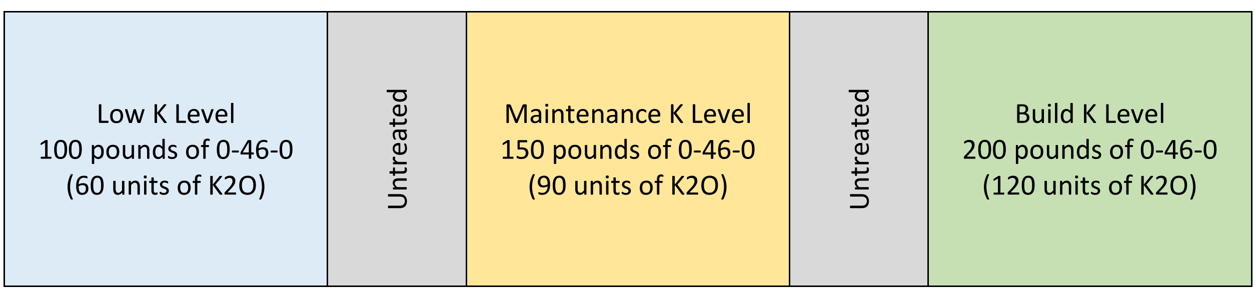


Figure 2. Yield differences observed among different application rates of potassium fertilizer.

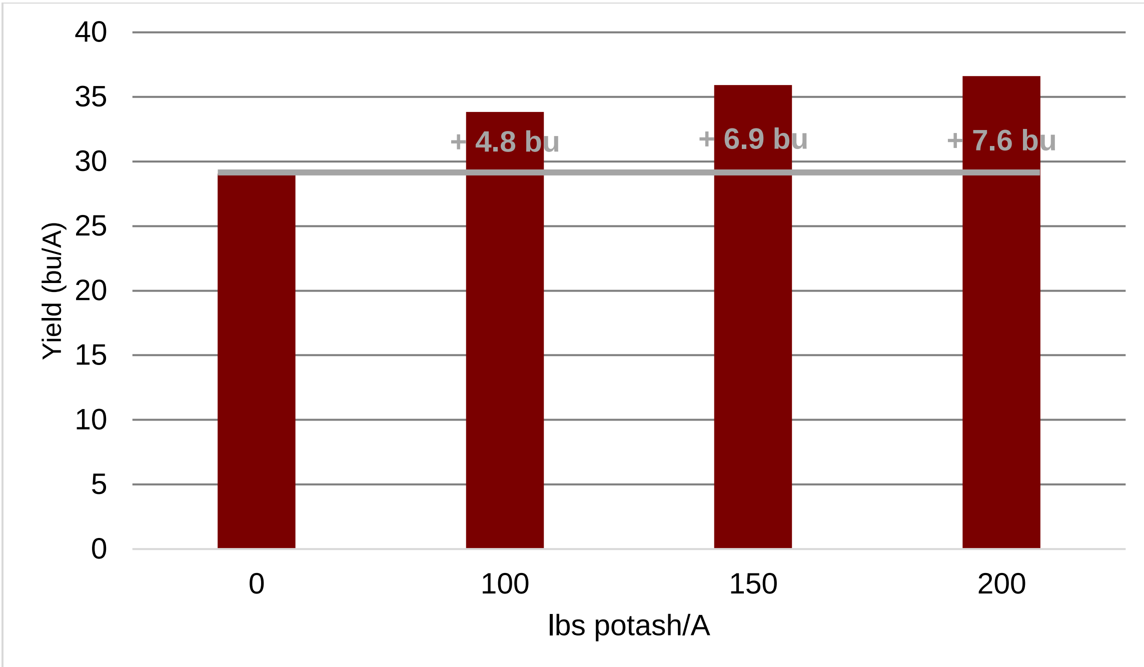


Table 2. Soil sample results from initial soil samples prior to planting and soil samples collected at harvest.

Rates (lb/A):	Initial Soil Samples (field avg)	Harvest Soil Samples
	-------------------Nutrient Availability Index (lb/A)-------------------	
Check	96	48
Low	96	63
Maintenance	96	74
Build	96	100

Results: In 2016, the addition of potassium fertilizer (0-0-60) produced greater yields compared to treatments that received no potassium fertilizer at the demonstration trial location in Prentiss County. Soybean yield increased as the application rate of potassium increased (Figure 2). Where 200 pounds of potassium was applied, there was a 7.6 bushel yield increase. Additionally, the amount of potassium that remained in the soil also increased with increasing application rates of potassium, as expected. This demonstration will be conducted in the same location in Prentiss County during the 2017 growing season for further observation.

EVALUATION OF PLANTING DATE, ROW SPACING AND SEEDING RATE ON SOYBEAN DEVELOPMENT AND YIELD (STUDENT PROJECT)

Purpose: To evaluate the effects of row spacing, planting date and seeding rate on non-irrigated soybean growth, development and yield.

Procedure: Experiments were conducted at two locations in Mississippi during the 2016 growing season. These locations were the R.R. Foil Plant Science Research Center near Starkville, MS and the Delta Research and Extension Center in Stoneville, MS. These sites were planted with an indeterminate maturity group 4 soybean variety. The seed was planted with a plot planter using 5 different seeding rates. These seeding rates were 80K; 100K; 120K; 140K; and 160K seeds per acre. Seeding rates were planted across 3 planting dates with targeted plantings during April, May, and June to represent early-, mid-, and late-season planting dates. Row spacings consisted of 15 (ultra-narrow), 30 (narrow), and 38 (wide) inch rows planted in 40 foot plot lengths. Data collection included stand counts, weekly growth stages, canopy closure dates, plant heights, and yield. Stand counts were recorded after emergence and again at harvest to monitor the plant population. Plant heights were recorded at canopy closure and again at the R5.5 growth stage. In addition, final node counts were recorded prior to harvest. The center two rows of each plot were machine harvested to determine final soybean yield.

Figure 1: Pictures that illustrate the different row spacings and planting dates at 120,000 seeds/ac.

Ultra-narrow row spacing, planted in mid-April at 120,000 seeds/A.

Ultra-narrow row spacing, planted in mid-May at 120,000 seeds/A.

Ultra-narrow row spacing, planted in mid-June at 120,000 seeds/A.

Narrow row spacing, planted in mid-April at 120,000 seeds/A.

Narrow row spacing, planted in mid-May at 120,000 seeds/A.

Narrow row spacing, planted in mid-June at 120,000 seeds/A.

Wide row spacing, planted in mid-April at 120,000 seeds/A.

Wide row spacing, planted in mid-May at 120,000 seeds/A.

Wide row spacing, planted in mid-June at 120,000 seeds/A.

Figure 2: Soybean yield by row spacing averaged across planting date and seeding rate at all locations.

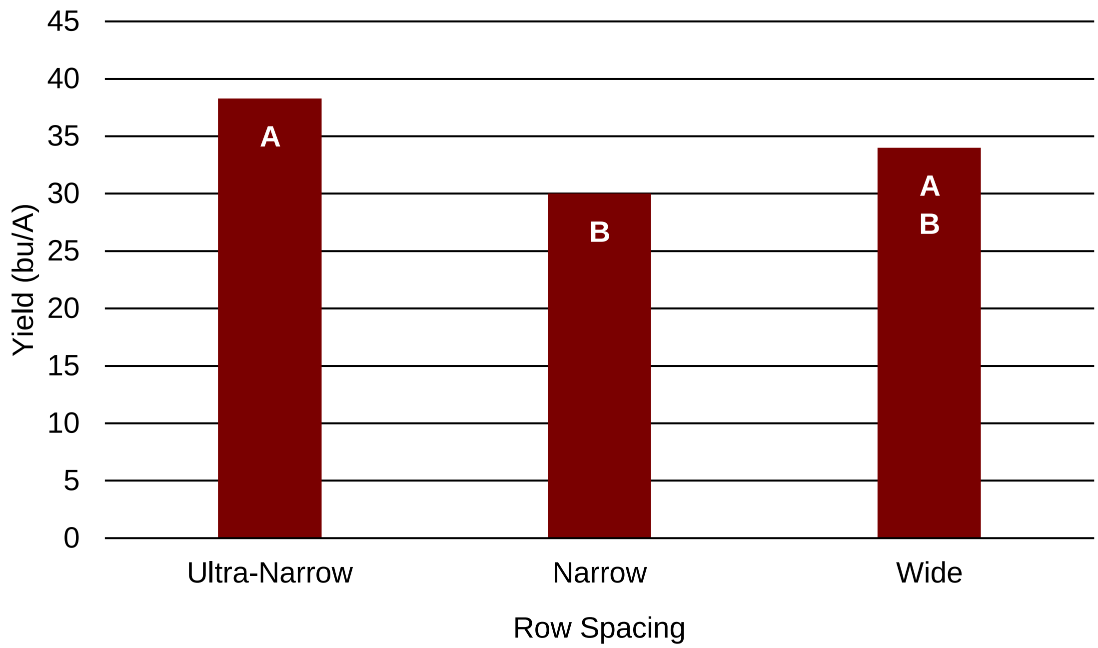


Figure 3: Soybean yield by seeding rate averaged across row spacing and planting date at all locations.

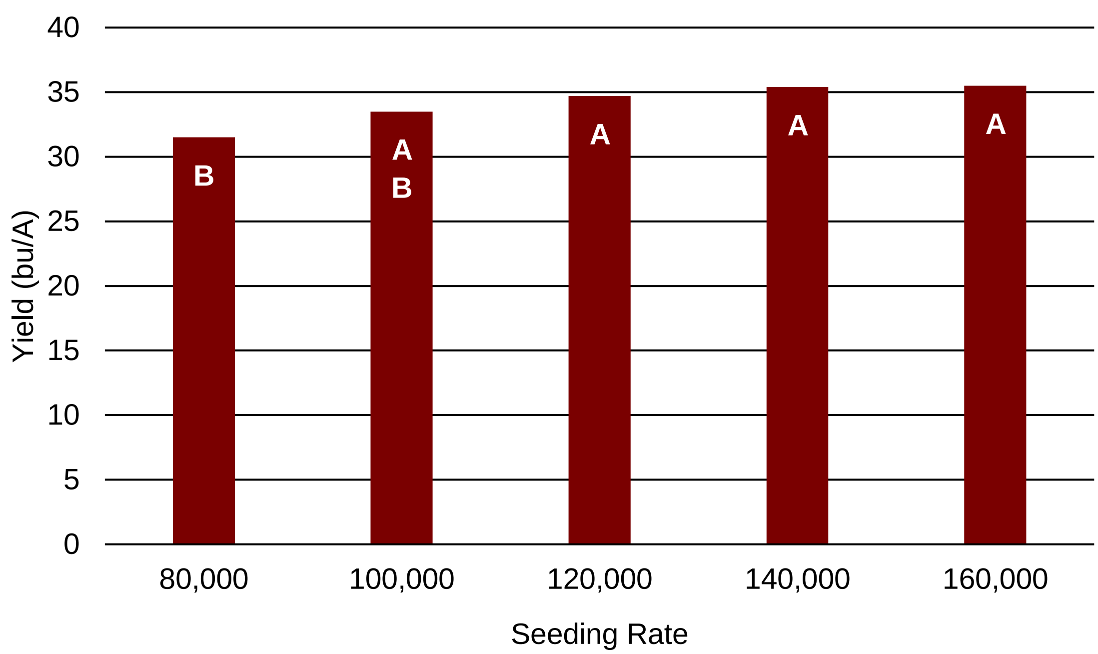
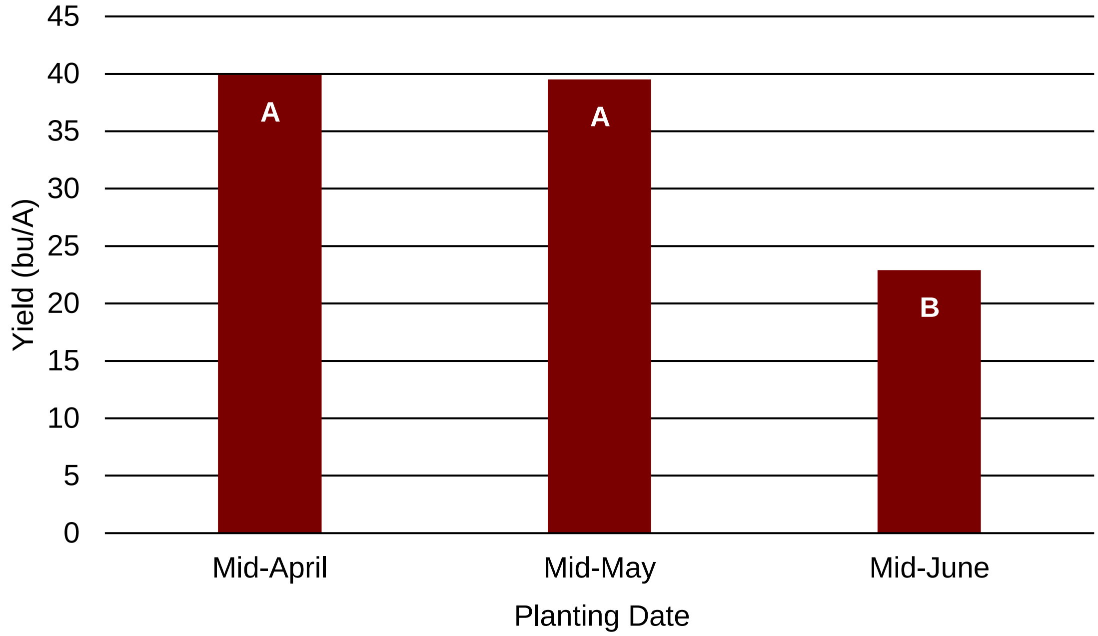


Figure 4: Soybean yield by planting date averaged across row spacing and seeding rate at all locations.



Results: No differences, with respect to soybean yield, were observed between ultra-narrow and wide row spacings while soybean planted in ultra-narrow rows yielded greater than narrow row spacings (Figure 2). Soybean planted in Mid-May and mid-April resulted in greater yields than soybean planted in mid-June (Figure 3). Soybean yields were greater for seeding rates of 120,000 to 160,000 seeds/A, when compared to 80,000 seeds/A (Figure 4). This study will be conducted during the 2017 growing season as well in order to further evaluate these management strategies in non-irrigated soybean production.

EVALUATION OF OPTIMAL SEEDING RATE AND PLANTING APPROACH FOR REPLANT SITUATIONS IN SOYBEAN (STUDENT PROJECT)

Purpose: To determine the optimal replant seeding rate for various levels of reduced soybean populations.

Procedure: Experiments were conducted at two locations in Mississippi during 2016. These locations were the R.R. Foil Plant Science Research Center near Starkville, MS and the Delta Research and Extension Center in Stoneville, MS. The seed was planted with a plot planter at a seeding rate of 130,000 seeds/A using an indeterminate maturity group 4 variety. Treatments at the initial planting date included combinations of Roundup Ready 2 Xtend and LibertyLink soybean seed. Percentages of RR2X/LL were as follows 100/0, 75/25, 50/50, 25/75 and 0/100 (Table 1), with the 100/0 representing a successful initial stand establishment and the 0/100 representing removal of a failed stand with complete replanting. Therefore, treatments represented a successful initial stand establishment, a complete replant, and combinations of replanting into sub-optimal stands ("spot" planting). In order to simulate a failed stand, plots were sprayed with glyphosate, at the V1 growth stage to eliminate the LL variety, which were randomly distributed throughout the row. Plots were replanted approximately 2 weeks after the initial planting date. The replant percentages of RR2X were 100, 75, 50, 25 and 0, resulting in 25 total treatments with all replants being planted into the existing plots from the initial planting. Test plots measured four, 38 inch rows wide by 40 feet in length. All treatments were irrigated as needed and replicated 4 times. Data collection included stand counts, weekly growth stages, canopy closure dates, plant heights, and yield. Stand counts were recorded after emergence and again at harvest to monitor the plant population. Plant heights were recorded at canopy closure and again at the R5.5 growth stage. In addition, final node counts were recorded prior to harvest. The center two rows of each plot were machine harvested to determine final soybean yield.

Table 1. Treatments further described.

Initial RR2X/LL %	Replant Percentage %				
	0	25	50	75	100
100/0	100/0	100/25	100/50	100/75	100/100
75/25	75/0	75/25	75/50	75/75	75/100
50/50	50/0	50/25	50/50	50/75	50/100
25/75	25/0	25/25	25/50	25/75	25/100
0/100	0/0	0/25	0/50	0/75	0/100

Figure 1. Pictures illustrating the sub-optimal stands following the different percentages of removal from the initial planting.

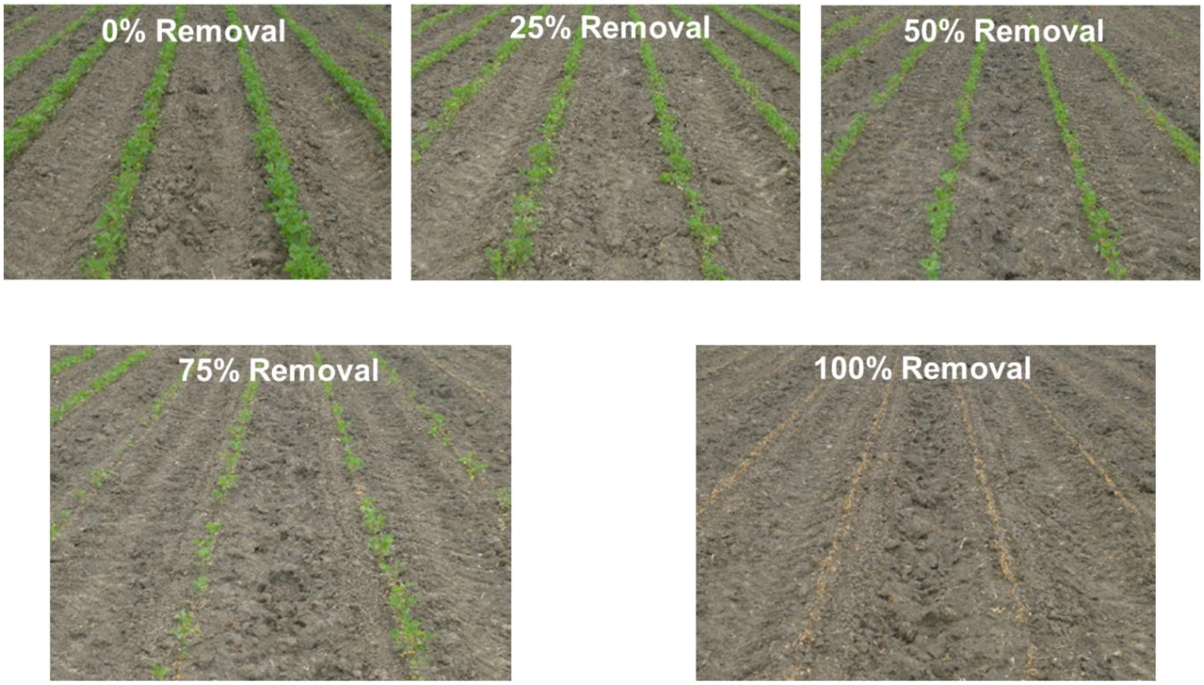
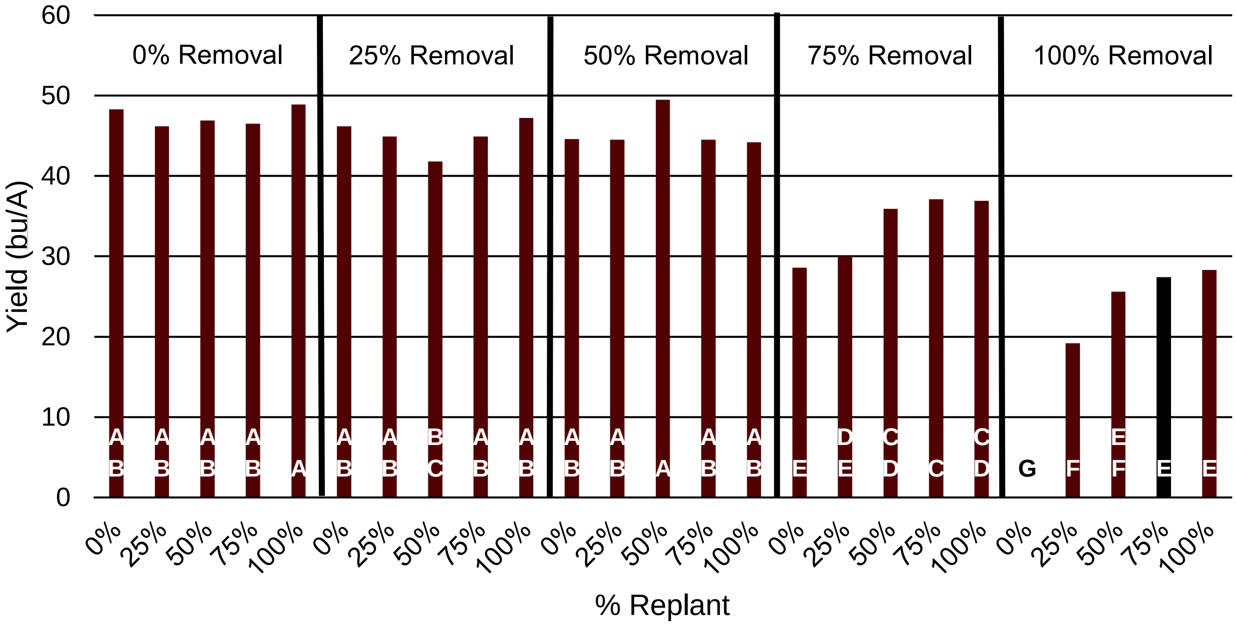


Figure 2: Soybean yield averaged across locations.



Results: Removal of 50% or less of soybean plants, over all replanting percentages, resulted in greater soybean yields, when compared to greater than 50% of plants being removed over all planting percentages. In other words, “spot” planting into reduced stands where no more than ½ of the initial stand was lost provided no yield benefit. Soybean yield for the treatment representing a successful initial stand establishment was greater than the treatment with complete removal and replant, demonstrating the value of planting date with respect to soybean yield. This study will be conducted again during the 2017 growing season to further evaluate considerations for replant decisions.

EVALUATION OF MANAGEMENT STRATEGIES FOR IRON DEFICIENCY CHLOROSIS (IDC) IN SOYBEAN (STUDENT PROJECT)

Purpose: To evaluate management strategies for Iron Deficiency Chlorosis (IDC) on non-irrigated soybean growth, development and yield.

Figure 1. Common symptoms of Iron Deficiency Chlorosis

Procedure: Experiments were conducted at two locations in Mississippi during the 2016 growing season. These locations were the Black Belt Experiment Station near Brooksville, MS and an off station location near Prairie, MS. These sites were planted with an indeterminate maturity group 5 soybean variety with known vulnerability to Iron Deficiency Chlorosis (IDC). Plots were planted at a seeding rate of 120,000 seeds per acre on 30 inch rows. Plots were 4 rows wide by 40 feet long. The center two rows were treated while leaving running checks on rows 1 & 4. Treatments included 3 products, 3 application timings, and 4 rates. The products were: Iron Plus (5% Iron) by Delta Ag, Sequestar 13.2% EDTA by Brandt, and Sequestar 6% EDDHA by Brandt. Each product was applied at a rate of 0.6, 0.12, 0.18, and 0.24 lb ai/A. Each rate was applied foliar, in-furrow and as a split application. Each timing was treated as a separate experiment. Data collected included: stand counts, weekly IDC ratings, canopy closure dates, plant heights/nodes, and yield. Stand counts were recorded after emergence and again at harvest to monitor the plant population. Plant heights and node counts were recorded at the R5.5 growth stage. The center two rows of each plot were machine harvested to determine final soybean yield.

Figure 2. Visual differences between treated rows and untreated rows when EDDHA is applied in-furrow.

Table 1. Yield response to foliar applied iron products

	Sequestar 6%	Sequestar 13.2%	Iron Plus	Untreated
Rate (lb ai/A)	--------------------------------Yield bu/A--------------------------------			
0.06	15.5 AB	12.2 B	15.9 AB	16.2 AB
0.12	15.2 AB	13.8 AB	17.8 A	
0.18	15.1 AB	16.1 AB	18.8 A	
0.24	16.3 AB	16.9 AB	17.5 A	

Table 2. Yield response to in-furrow iron products

	Sequestar 6%	Sequestar 13.2%	Iron Plus	Untreated
Rate (lb ai/A)	--------------------------------Yield bu/A--------------------------------			
0.06	11.1 BCD	11.7 BCD	10.2 D	14.7 ABCD
0.12	18.8 A	16.9 AB	13.3 ABCD	
0.18	12.4 BCD	10.8 D	11.1 CD	
0.24	13.11 ABCD	16.8 ABC	11.2 BCD	

Table 3. Yield response to split applied iron products

	Sequestar 6%	Sequestar 13.2%	Iron Plus	Untreated
Rate (lb ai/A)	---------------------------------Yield bu/A---------------------------------			
0.06	22.8 ABC	20.5 C	23.4 ABC	22.5 ABC
0.12	24.3 A	22.5 ABC	20.8 BC	
0.18	24.8 A	22.5 ABC	22.4 ABC	
0.24	24.1 ABC	22.9 ABC	24.9 AB	

Results: Results show no difference in soybean yield for any treatment. While separation of means were present, they did not occur at a significant level. These experiments will be further evaluated and replicated to examine these treatments. While IDC can be variable from year to year and field to field, it is important to get a large dataset for conclusive results.