MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 07-2015 (YEAR 4)
2015 Annual Report

Project Title: Agronomic and Economic Evaluation of Soybean/Corn Rotation with Twin-row Production and Increased Nutrient Management

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BACKGROUND AND OBJECTIVES

Corn and soybean rotations have been occurring around the country, with the most common rotation being one year soybean followed by one year of corn (1/1). The literature is filled with documentation of the "rotation effect", with many potential explanations for it.

In the Mid-south and Southeast, less crop rotation was practiced because of cotton's presence on the farm landscape. Many fields were continuously cropped to cotton for decades. In recent times, corn has replaced cotton, irrigation has replaced dryland or rain-fed production, and soybean has moved from the last crop planted to the early soybean production system (ESPS), with planting in March and April rather than May and June.

Bedding remains the choice for most producers in the Delta on the lighter textured soils. Getting water off (drainage) and getting water on (irrigation) is of primary concern, especially with early planting in both corn and soybean. The twin-row (TR) planting system (two rows planted on the same bed) has helped to combine wide-row and narrower-row technology into a viable alternative for Mid-south production systems. John Deere's introduction of a twin-row planter demonstrates industry's visions for the future as well.

Twin-row production allows for more rapid ground cover and yet maintains adequate waterways for surface drainage and irrigation. On-farm research with corn in the Mississippi Delta has shown significant grain yield increases from increased seeding rates (up to 40,000 plants/acre). Soybean research has also shown advantages to TR production compared to single wide-row systems.

Irrigation has led to a decrease in the fluctuation of grain yields in both corn and soybean, and has led to increases in state average yields. Both crops achieved record yields across the state in 2014 (corn, 185 bu/acre on 485,000 acres harvested, and soybean, 52 bu/acre on 2.2 million acres as reported by NASS). However, both corn and soybean yields were lower in 2015, with corn averaging 175 bu/acre on 490,000 acres harvested and soybean averaging 46 bu/acre on 2.27 million acres.

Yield stability and good prices are keys to successful and prolonged grain production in the Mid-south, and with recent declines in commodity prices, profitability has been challenged. Coupled with increased yield has been increased nutrient uptake and removal. Many producers have felt that fertility has not been an issue in the Mississippi Delta. Unfortunately, that perception has led to nutrient deficiencies in some areas, and nutrient levels are expected to continue to decline.

The purpose of this research has been to combine the technologies coming forward into a management system that can optimize yields and increase profitability. The overall objectives are to determine the agronomic implications of soybean/corn rotations in twin-row planting systems under standard and high management with irrigation on varying soil types, and to evaluate their economic impact on whole-farm enterprise profitability.

REPORT OF PROGRESS/ACTIVITY

Objective 1: Determine the agronomic implications of soybean/corn rotations in twin-row planting systems under standard and high management with irrigation.

Multiple-year field studies were initiated at two locations on the Delta Research and Extension Center near Stoneville, MS to evaluate the agronomic implications of soybean/corn rotations in twin-row planting systems. The first study (Exp. No.: 15-SB31) was established on a Commerce soil ranging in texture from very fine sandy loam to silt loam, with a little silty clay loam. The area had previously been maintained as a corn/cotton (1:1) rotation field prior to 2012, with cotton planted in 2011. Since soybean had not been grown in the field, the soybean seed prior to 2015 had been inoculated (Vault® SP, hopper box treatment) prior to planting to insure adequate nodulation. The second site (Exp. No.: 15-SB32) was established on Sharkey clay previously cropped to soybean (2011). The seed for this area was also inoculated to insure uniformity.

For the sandy loam site (15-SB31), the early nitrogen application was applied on 29 April 2015. Pioneer 2089 YHR corn was planted at 32,500 seeds/acre on 9 April 2015 (15-SB31). Pioneer 48T67L (Liberty-Link, MG 4.8) soybean was planted 6 June 2015 (10-12 seed/ft, 5-6 seed/ft/row) for the sandy loam site. Both corn and soybean were planted with a Monosem twin-row planter following manufacturer recommendations. Soybean planting was delayed compared to plan due to above normal rainfall in April and May and 32 rain events during the two months. After planting and emergence the research areas were managed as single units. For the high fertility treatments, plots received a pre-weighed quantity equal to 60 lb P_2O_5/acre (26.2 lb P/acre) and 60 lb K_2O/acre (50 lb K/acre). All fertilizer P and K was applied to the surface (12 May 2015) for Exp. 13-SB31 and incorporated with cultivation. For corn, an additional 40 lb N/acre was applied as a sidedress on the high fertility treatments (13 May 2015). Standard N fertility received 100 lb N/acre as a sidedress application knifed to both sides of the row.

The second study (Exp. No.: 15-SB32) was established in 2012 on a Sharkey clay soil previously cropped to soybean. The same cultivars of corn and soybean used in the sandy land study were planted on 30 March (corn) and 30 April (soybean) at the rates already mentioned. The preplant N for corn was applied on 30 April with the sidedress N on 13 May. The pre-weighed P and K were applied at the same rates as mentioned above on 13 May 2015. Roll-out poly-pipe was installed in June, but above normal rainfall was received in May (6.96 in). Rainfall from Oct 2014 through Sep 2015 is presented in Table 1. The total for the 12-month period was 0.66 inches below normal. June, July, August, and September had below normal rainfall.

The center two rows of each corn plot were harvested with a commercial combine adapted for plot harvest, and was completed on 27 August 2015 for both studies (Exp. 15-SB31 and Exp. 15-SB32). Samples were taken at harvest to determine harvest moisture, bushel test weight (adjusted for moisture), and Seed Index (100-seed weight).

Soybean harvest was completed on 6 October 2015 for both studies (Exp. 15-SB31 and Exp. 15-SB32). Soybean harvests were made with a Kincade MF-8XP plot combine and samples collected for moisture, bushel test weight, and seed index. Both corn and soybean yields and other measurements were corrected to a standard moisture (Corn = 15.5%; Soybean = 13%).

Grain yields from each test were summarized and means are presented in Table 2 (15-SB31) and Table 6 (15-SB32). Corn yields on the sand ranged from 124 to 209 bu/acre with some difference due to the higher fertility (means across replications only). The high fertility resulted in yields that were 18 to 45 bu/acre higher depending upon whether the corn followed one or two years of soybean (Table 2). Soybean yields ranged from 43.9 to 51.5 bu/acre with no difference related to rotation or fertility. Soybean yields were lower than in the previous year, likely related to later palnting but also to a different cultivar than the previous year. Soybean bushel test weight and Seed Index were also not impacted by rotation or fertility.

On the Sharkey clay site (Exp. 15-SB32), corn yields ranged from 155 to 191 bu/acre with an average of 175 bu/acre. There was an average 9 to 11 bu/acre higher yield with additional fertility but the difference was not significant at the 5% level (Table 6). However, it would have been significant at the 10% level. There was also significant fertility effect on Seed Index, with a higher seed index at the higher fertility level as in the previous year.

Soybean yields ranged from 48.3 to 56.7 bu/acre with no difference due to fertility (Table 6). The sandy site had to be replanted for both corn and cotton in 2015. Corn was mis-planted initially and was delayed until the original stand could be destroyed and then replanted. The soybeans were planted into relatively dry soil and a non-uniform stand had to be destroyed and re-planted.

Table 1: Summary of rainfall for Stoneville, Mississippi, October 1, 2014 through September 31, 2015.

Day of	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	May 2015	Jun 2015	Jul 2015	Aug 2015	Sep 2015	TOTAL RAIN
Mon	--------	--------	--------	--------	--------	--------	in.	--------	--------	--------	--------	--------	
1	0.00	0.00	0.00	0.00	0.05	0.00	0.80	0.00	0.40	0.37	0.00	0.06	
2	0.00	0.00	0.15	2.59	0.25	1.06	0.05	0.00	0.00	0.00	0.00	0.00	
3	0.96	0.00	0.05	0.02	0.00	0.04	0.01	0.00	0.00	0.00	0.00	0.00	
4	0.01	0.00	0.00	0.88	0.00	0.12	0.15	0.00	0.00	0.47	0.00	0.00	
5	0.00	0.00	0.15	0.00	0.00	0.30	0.00	0.00	0.00	1.57	0.00	0.03	
6	0.06	0.48	2.00	0.00	0.00	0.00	0.11	0.00	0.00	0.36	0.00	0.00	
7	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	
9	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	
10	0.00	0.00	0.00	0.00	0.00	1.12	2.42	0.05	0.00	0.00	0.00	0.00	
11	0.27	0.00	0.00	0.08	0.00	0.02	0.00	0.09	0.00	0.00	0.00	0.01	
12	2.36	0.02	0.05	0.64	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	
13	0.84	0.00	0.05	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	
14	1.90	0.00	0.00	0.00	0.00	1.18	0.13	0.00	0.26	0.00	0.00	0.00	
15	0.00	0.00	0.16	0.03	0.00	0.03	0.11	0.00	0.31	0.00	0.00	0.00	
16	0.00	0.34	0.10	0.02	0.47	0.00	0.00	0.41	0.00	0.00	0.00	0.00	
17	0.00	1.35	0.00	0.00	0.75	0.00	0.11	1.10	0.00	0.00	0.50	0.00	
18	0.00	0.00	0.18	0.00	0.00	0.00	0.05	2.37	0.00	0.00	0.01	0.00	
19	0.00	0.00	0.00	0.00	0.00	1.13	0.32	0.28	0.00	0.00	0.00	0.00	
20	0.00	0.00	0.00	0.00	0.00	0.07	0.47	0.00	0.01	0.00	0.13	0.00	
21	0.00	0.01	0.00	0.00	0.19	0.15	0.00	0.02	0.00	0.00	0.01	0.12	
22	0.00	0.03	0.06	0.00	0.84	1.40	0.00	0.00	0.00	0.00	0.05	0.00	
23	0.00	0.00	0.01	1.37	0.87	0.20	0.10	0.00	0.00	0.12	0.00	0.00	
24	0.00	0.66	0.00	0.06	0.15	0.00	0.04	0.00	0.00	0.00	0.03	0.00	
25	0.00	0.00	0.25	0.00	0.50	0.00	1.33	0.40	0.75	0.00	0.00	0.00	
26	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.72	0.00	0.28	0.00	0.00	
27	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.15	0.47	0.00	0.00	0.00	
28	0.00	0.00	1.15	0.00	0.00	0.00	0.00	0.62	0.05	0.00	0.00	0.00	
29	0.28	0.00	0.36	0.00		0.00	0.11	0.01	0.00	0.00	0.00	0.00	
30	0.00	0.01	0.01	0.00		0.01	0.00	0.25	0.32	0.00	0.00	0.03	
31	0.00		0.00	0.00		0.00		0.48		0.00	0.00		
TOT	6.69	2.90	4.77	5.69	4.72	7.31	6.33	6.96	2.57	3.17	0.73	0.79	52.63
Norm	3.32	5.20	5.45	5.42	4.46	5.63	5.44	5.25	4.02	3.86	2.05	3.19	53.29
Diff	3.37	-2.30	-0.68	0.27	0.26	1.68	0.89	1.71	-1.45	-0.69	- 1.32	- 2.40	- 0.66
Event	9	8	16	9	10	16	17	15	8	6	6	7	

Soil samples were collected following harvest to monitor soil nutrient status and were analyzed by the Mississippi State University Soil Testing and Plant Analysis Laboratory. After soil samples were taken, the sites area received fall tillage and land preparation. A fall residual herbicide application was included to guard against potential pigweed and Italian ryegrass buildup during the winter months. Both corn and soybean areas are being managed to control glyphosate resistant weeds and other potential weed problems. Soil nutrient status has been summarized for each study (Table 3 [15-SB31] and Table 7 [15-SB32]. At the sandy loam site, soil pH averaged 6.3 with P at 107 lb P/acre and K at 394 lb K/acre, up from the previous year. Soil test levels associated with treatments are shown in Tables 4 and 5 (Exp. 15-SB31) and Tables 8 and 9 (Exp. 15-SB32). In some years, there has been a trend toward lower pH where corn had been grown compared to where only soybean has been grown. No soil factors were significantly impacted by treatment as would be expected. Soil test levels will be monitored each season following harvest in order to evaluate the effects of the cropping systems on soil nutrient supply. Soil fertility levels and pH continue to be high for the Sharkey clay site (Tables 8 and 9). As one should expect with such high levels, adding additional nutrients (P and K) should not impact yields with the rates low relative to soil test levels. Both P and K levels on the clay site (15-SB32) are classed as very high and would not have any P or K recommended. The applications will be continued as per the protocol for the studies but demonstrate that yearly fertilizer applications are not needed when soil test levels are high.

Objective 2: Evaluate the economic impact of the rotation systems and fertilizer management on whole-farm enterprise profitability.

The economic evaluation will follow as more information is collected. Fertilizer costs have been up with nitrogen running 40 to 60 cents/lb depending on the N source and varies on an annual basis and on a seasonal basis. Recent price quotes showed potassium (0-0-60) at $460-470/ton and phosphorus (0-46-0) at $465-475/ton. With current prices for grain crops falling sharply in the last two years, profitability for both corn and soybean are declining. The project should be able to account for the profitability in crop rotations as the studies progress. Corn is a higher consumer of P than soybean or cotton, so soil test P is quite important. The high pH on the Sharkey clay is not a real detriment to production at this time, however, with continued irrigation, the pH could continue to creep upward. The liming effect from well water in the Mississippi Della has been reported to be 300 to 1000 lb lime/acre per year. With the higher N rates for corn (acid forming fertilizer sources) the pH may actually fall with time. Corn acreage has been projected to increase in 2016 while soybean acreage is projected to decline. Corn planting has been delayed for most areas due to rainy weather with more than 18 inches recorded in March, 2016.

IMPACTS AND BENEFITS TO MISSISSIPPI SOYBEAN PRODUCERS

With 2.0 million acres of soybean and 800,000 acres of corn (projected for 2016, USDA Planting Intentions) it should be possible to establish either a 1/1 or 2/1 (soybean/corn) rotation on much of the irrigated corn/soybean acreage in Mississippi. Corn production may be limited on the non-irrigated soils but with the right rainfall tremendous dryland yields have been made. The adoption of crop rotation would enable producers to increase soybean yields, increase corn yields, and also increase profitability. The use of rotation could greatly impact the spread of resistant weeds by offering multiple crops for rotating herbicides. With fertility management, the key is to success lies in soil testing and sound fertility practices. With the high yields harvested under irrigated conditions, nutrient removal of N, P, K, and S is great for both corn and soybean as compared to cotton. As producers make the shift to grain crops, more pressure has been placed on the soil. At the same time, at extremely high nutrient levels, the soils can be mined with no adverse effect on yield.

END PRODUCTS - COMPLETED OR FORTHCOMING

This was the fourth year of a 6-year rotation project so only limited rotation information is available (1:1 rotation). The production on the sandy soil was lower than previous years due to the late planting date with more variability than other years (Table 10). Corn yields were better on the clay site in 2015 and better than in both 2013 and 2014. Rainfall and temperatures can greatly impact planting and harvesting and is more of a problem on the clay. Even with small combines if can be difficult to get across a muddy field. To date, high P and K levels on the clay site would not lend itself to fertilizer response. Increased fertility has resulted in increased yield for corn in 2013 and 2015 for the sandy site and only in 2014 for the clay site (likely related to increased N).

Table 10: Summary of rotation effect on yields for corn and soybean in a 1:1 rotation with twin-row planting systems at the Delta Research and Extension Center, Stoneville, MS.

Crop Sequence	Fert	Corn Yield (bu/acre @15.5%)				Soybean Yield (bu/acre @13.0%)			
		2012	2013	2014	2015	2012	2013	2014	2015
SB31 (Sand)									
CR-SB	STD	196.8	----	195.9	----	----	75.8	----	49.3
SB-CR	STD	----	211.0	----	139.0	52.0	----	58.5	----
CR-SB	HI	204.9	----	212.1	----	----	74.7	----	49.9
SB-CR	HI	----	230.8	----	184.1	54.3	----	61.7	----
LSD (0.05)		7.8	9.9	31.7	35.0	1.7	4.0	2.6	4.3
Prob. > F		0.1056	0.0022	0.1801	0.0232	0.0394	0.1160	0.1823	0.8877
SB32 (Clay)									
CR-SB	STD	178.4	----	121.5	----	----	63.6	----	50.7
SB-CR	STD	----	142.3	----	173.9	57.0	----	50.9	----
CR-SB	HI	189.6	----	149.9	----	----	63.6	----	53.2
SB-CR	HI	----	155.9	----	184.8	57.5	----	51.1	----
	LSD (0.05)	17.7	35.9	21.4	13.4	4.7	5.6	4.6	4.6
	Prob. > F	0.1615	0.4575	0.0132	0.0741	0.9825	0.1440	0.5150	0.4836

Table 2 (15-SB31-1): Summary of yield, bushel test weight, and seed index for field evaluation of crop rotations systems for corn and soybean in twin-row planting systems with standard and high fertility management. Sandy loam (DREC Field 12E). M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS. 2015

	Treatments 1/			Grain Yield 2/		Bushel 2/			
Trt.	Crop	2015		Corrected		Test Weight		Seed Index 2/	
No.	Rotation	Crop	Fertility	(bu/acre)		(lb/bu)		(g/100 seed)	
1	CR-SB	SB	Standard	----		----		----	
2	SB-CR	CR	Standard	139.0	b 3/	52.3	b 3/	31.9182	3/
3	CR-SB-SB	CR	Standard	179.1	a	53.7	a	33.6323	
4	SB-CR-SB	SB	Standard	----		----		----	
5	SB-SB-CR	SB	Standard	----		----		----	
6	CR-SB	SB	High	----		----		----	
7	SB-CR	CR	High	184.1	a	53.8	a	33.6627	
8	CR-SB-SB	CR	High	197.1	a	54.0	a	34.6557	
9	SB-CR-SB	SB	High	----		----		----	
10	SB-SB-CR	SB	High	----		----		----	
			LSD (0.05) 3/	35.0		1.1		2.0232	
			Prob > F	0.0232	*	0.0200	*	0.0749	ns
			C. V. (%)	9.59		2.25		3.72	
1	CR-SB	SB	Standard	49.3	4/	59.3	4/	15.7566	4/
2	SB-CR	CR	Standard	----		----		----	
3	CR-SB-SB	CR	Standard	----		----		----	
4	SB-CR-SB	SB	Standard	48.6		59.2		15.6137	
5	SB-SB-CR	SB	Standard	47.5		59.5		15.5418	
6	CR-SB	SB	High	49.9		59.6		15.4954	
7	SB-CR	CR	High	----		----		----	
8	CR-SB-SB	CR	High	----		----		----	
9	SB-CR-SB	SB	High	49.0		59.5		15.4826	
10	SB-SB-CR	SB	High	49.3		59.6		15.2073	
			LSD (0.05)	4.3		0.47		0.5471	
			Prob > F	0.8877	ns	0.5456	ns	0.4501	ns
			C. V. (%)	8.43		0.75		5.13	

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD)

2/ Grain yields and other components corrected to 15.5% (corn) or 13% (soybean)

3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant. (*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

4/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant. (*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

Table 3 (15-SB31-2): Average Soil Test Results from Field 12E (DREC) Field evaluation of corn/soybean rotation in twin-row production system at varying fertility levels - Sandy loam soil. M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS. 2015

Soil Test Information			Soil Test Range		
Soil Test	Obs	Units	Low	High	Average
pH (water)	160		5.3	6.7	6.3
Phosphorus	160	lb P/acre	69	202	107
Potassium	160	lb K/acre	286	529	394
Exchangeable H	160	meq/100g	0.70	2.00	1.23
Exchangeable K	160	meq/100g	0.37	0.68	0.51
Exchangeable Ca	160	meq/100g	5.05	10.25	7.73
Exchangeable Mg	160	meq/100g	1.38	2.80	2.13
Exchangeable Na	160	meq/100g	0.03	0.12	0.04
Cation Exchange Capacity	160	meq/100g	7.95	14.91	11.64
Organic Matter	160	%	0.54	1.42	0.95
Organic Sulfur	160	lb S/acre	78	204	137
Sulfate Sulfur	160	lb S/acre	4.7	17.0	8.3
Zinc	160	lb Zn/acre	1.6	8.8	2.3

Analyses completed by Soil Testing and Plant Analysis Laboratory at Mississippi State University. Composited sample from 8-10 cores per plot

Table 4 (15-SB31-3). Summary of 2015 soil test results from a Field Evaluation of Corn/Soybean Rotations in a Twin-row Planting System with Varying Fertility. Sandy Loam (DREC Field 12E)
M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS.

Treatments [1/]				Soil Test Analysis [2/]			
Trt. No.	Crop Rotation	2015 Crop	Fertility	pH	Phosphorus (lb P/acre)	Potassium (lb K/acre)	Organic Matter (%)
1	CR-SB	SB	Standard	6.34 [3/]	108 [3/]	417 [3/]	0.96 [3/]
2	SB-CR	CR	Standard	6.32	105	381	0.92
3	CR-SB-SB	CR	Standard	6.28	113	401	0.99
4	SB-CR-SB	SB	Standard	6.25	112	400	0.93
5	SB-SB-CR	SB	Standard	6.28	104	392	0.96
6	CR-SB	SB	High	6.36	107	394	0.92
7	SB-CR	CR	High	6.35	106	398	0.91
8	CR-SB-SB	CR	High	6.29	105	388	0.96
9	SB-CR-SB	SB	High	6.24	109	398	0.95
10	SB-SB-CR	SB	High	6.28	102	375	0.99
			LSD (0.05) [3/]	0.09	8	26	0.06
			Prob > F	0.0757 ns	0.2204 ns	0.1537 ns	0.1098 ns
			C. V. (%)	3.49	20.54	12.22	11.40

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD).
2/ Soil analyses completed by Soil testing and Plant Analysis Laboratory, Mississippi State University Extension Service
3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant. (*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

Table 5 (15-SB31-4). Summary of 2015 soil test results from a Field Evaluation of Corn/Soybean Rotations in a Twin-row Planting System with Varying Fertility. Sandy Loam (DREC Field 12E)
M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS.

Treatments [1/]				Soil Test Analysis [2/]			
Trt. No.	Crop Rotation	2015 Crop	Fertility	CEC meq/100g	Organic-S (lb S/acre)	Sulfate-S (lb S/acre)	Zinc (lb Zn/acre)
1	CR-SB	SB	Standard	11.86 [3/]	138 [3/]	8.5 [3/]	2.9 [3/]
2	SB-CR	CR	Standard	11.46	133	8.1	2.2
3	CR-SB-SB	CR	Standard	11.64	142	9.0	2.4
4	SB-CR-SB	SB	Standard	11.83	134	8.7	2.3
5	SB-SB-CR	SB	Standard	11.60	139	8.0	2.2
6	CR-SB	SB	High	11.44	133	8.2	2.2
7	SB-CR	CR	High	11.52	131	8.5	2.3
8	CR-SB-SB	CR	High	11.70	138	8.1	2.2
9	SB-CR-SB	SB	High	11.67	137	8.1	2.3
10	SB-SB-CR	SB	High	11.69	143	7.9	2.3
			LSD (0.05) [3/]	1.59	14	1.5	0.3
			Prob > F	0.3962 ns	0.1229 ns	0.4430 ns	0.3423 ns
			C. V. (%)	5.08	11.40	14.36	23.03

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD).
2/ Soil analyses completed by Soil testing and Plant Analysis Laboratory, Mississippi State University Extension Service
3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant.
(*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

Table 6 (15-SB32-1): Summary of yield, bushel test weight, and seed index for field evaluation of crop rotations systems for corn and soybean in twin-row planting systems with standard and high fertility management. Clay (DREC Field 17AA). M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS.

Trt. No.	Treatments 1/ Crop Rotation	2015 Crop	Fertility	Grain Yield 2/ Corrected (bu/acre)		Bushel 2/ Test Weight (lb/bu)		Seed Index 2/ (g/100 seed)	
1	CR-SB	SB	Standard	----		----		----	
2	SB-CR	CR	Standard	173.9	3/	55.3	3/	31.9091	b 3/
3	CR-SB-SB	CR	Standard	166.4		54.8		32.2042	b
4	SB-CR-SB	SB	Standard	----		----		----	
5	SB-SB-CR	SB	Standard	----		----		----	
6	CR-SB	SB	High	----		----		----	
7	SB-CR	CR	High	184.8		55.2		33.5661	a
8	CR-SB-SB	CR	High	175.1		55.1		33.4893	a
9	SB-CR-SB	SB	High	----		----		----	
10	SB-SB-CR	SB	High	----		----		----	
			LSD (0.05) 3/	13.4		1.4		1.2642	
			Prob > F	0.0741	ns	0.8682	ns	0.0304	*
			C. V. (%)	10.20		1.65		3.96	
1	CR-SB	SB	Standard	50.7	4/	57.7	4/	15.0615	4/
2	SB-CR	CR	Standard	----		----		----	
3	CR-SB-SB	CR	Standard	----		----		----	
4	SB-CR-SB	SB	Standard	53.4		57.8		15.3451	
5	SB-SB-CR	SB	Standard	52.2		57.9		15.0786	
6	CR-SB	SB	High	53.2		57.8		15.1819	
7	SB-CR	CR	High	----		----		----	
8	CR-SB-SB	CR	High	----		----		----	
9	SB-CR-SB	SB	High	53.5		57.9		15.4663	
10	SB-SB-CR	SB	High	52.6		58.1		15.2297	
			LSD (0.05)	4.6		0.58		0.4243	
			Prob > F	0.4836	ns	0.5973	ns	0.1291	ns
			C. V. (%)	10.71		0.58		1.44	

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD)

2/ Grain yields and other components corrected to 15.5% (corn) or 13% (soybean)

3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant. (*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

4/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant. (*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

Table 7 (15-SB32-2): Average Soil Test Results from Field 17AA (DREC) Field evaluation of corn/soybean rotation in twin-row production system at varying fertility levels - Clay. M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS. 2015

Soil Test Information			Soil Test Range		
Soil Test	Obs	Units	Low	High	Average
pH (water)	160		6.3	7.7	7.3
Phosphorus	160	lb P/acre	86	353	169
Potassium	160	lb K/acre	543	1520	702
Exchangeable H	160	meq/100g	0.00	3.20	0.13
Exchangeable K	160	meq/100g	0.70	1.95	0.90
Exchangeable Ca	160	meq/100g	24.83	30.50	27.70
Exchangeable Mg	160	meq/100g	6.75	14.59	11.45
Exchangeable Na	160	meq/100g	0.12	0.28	0.20
Cation Exchange Capacity	160	meq/100g	36.18	45.39	40.39
Organic Matter	160	%	1.39	3.03	2.14
Organic Sulfur	160	lb S/acre	200	436	308
Sulfate Sulfur	160	lb S/acre	16.5	55.2	32.6
Zinc	160	lb Zn/acre	3.3	11.2	5.2

Analyses completed by Soil Testing and Plant Analysis Laboratory at Mississippi State University. Composited sample from 8-10 cores per plot

Table 8 (15-SB32-3). Summary of 2015 soil test results from a Field Evaluation of Corn/Soybean Rotations in a Twin-row Planting System with Varying Fertility. Clay (DREC Field 17AA)
M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS.

Treatments [1/]				Soil Test Analysis [2/]							
Trt. No.	Crop Rotation	2015 Crop	Fertility	pH		Phosphorus (lb P/acre)		Potassium (lb K/acre)		Organic Matter (%)	
1	CR-SB	SB	Standard	7.3	[3/]	161	cde [3/]	707	[3/]	2.11	[3/]
2	SB-CR	CR	Standard	7.3		148	de	680		2.16	
3	CR-SB-SB	CR	Standard	7.4		147	e	662		1.95	
4	SB-CR-SB	SB	Standard	7.3		174	abc	725		2.15	
5	SB-SB-CR	SB	Standard	7.3		172	bc	687		2.16	
6	CR-SB	SB	High	7.2		183	abc	710		2.16	
7	SB-CR	CR	High	7.2		160	cde	719		2.32	
8	CR-SB-SB	CR	High	7.4		184	ab	737		2.19	
9	SB-CR-SB	SB	High	7.3		196	a	708		2.18	
10	SB-SB-CR	SB	High	7.4		170	bcd	685		2.00	
			LSD (0.05) [3/]	0.2		23		68		0.34	
			Prob > F	0.2060	ns	0.0024	**	0.4911	ns	0.6656	ns
			C. V. (%)	2.90		23.42		15.18		13.17	

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD).
2/ Soil analyses completed by Soil testing and Plant Analysis Laboratory, Mississippi State University Extension Service
3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant.
(*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)

Table 9 (15-SB32-4). Summary of 2014 soil test results from a Field Evaluation of Corn/Soybean Rotations in a Twin-row Planting System with Varying Fertility. Clay (DREC Field 17AA)
M. Wayne Ebelhar, Delta Research and Extension Center, Stoneville, MS.

	Treatments [1/]			Soil Test Analysis [2/]							
Trt. No.	2015 Rotation	Crop	Fertility	CEC meq/100g		Organic-S (lb S/acre)		Sulfate-S (lb S/acre)		Zinc (lb Zn/acre)	
1	CR-SB	SB	Standard	40.30	abc [3/]	304	[3/]	32.8	[3/]	5.3	[3/]
2	SB-CR	CR	Standard	40.50	abc	312		32.1		5.0	
3	CR-SB-SB	CR	Standard	41.07	a	281		31.5		5.5	
4	SB-CR-SB	SB	Standard	39.49	c	310		31.8		5.2	
5	SB-SB-CR	SB	Standard	41.08	a	311		33.4		5.2	
6	CR-SB	SB	High	40.33	abc	310		32.7		5.2	
7	SB-CR	CR	High	40.80	ab	334		32.9		5.1	
8	CR-SB-SB	CR	High	39.67	c	315		30.7		5.2	
9	SB-CR-SB	SB	High	39.90	bc	314		33.0		5.3	
10	SB-SB-CR	SB	High	40.72	ab	288		34.7		5.2	
			LSD (0.05) [3/]	1.05		49		4.2		0.4	
			Prob > F	0.0401	*	0.6666	ns	0.7984	ns	0.7170	ns
			C. V. (%)	4.06		13.14		19.54		16.22	

1/ Corn/Soybean Rotations are CR/SB (1:1) or CR/SB/SB (1:2). All rotations planted each year. Fertility: Standard = Soil Test Recommendation or None; High = Corn: 40 lb N/acre, 26.2 lb P/acre, 50 lb K/acre; Soybean: 26.2 lb P/acre, 50 lb K/acre. Standard N rate for Corn= 220 lb N/acre applied 120 lb N/acre (PP) and 100 lb N/acre (SD).
2/ Soil analyses completed by Soil testing and Plant Analysis Laboratory, Mississippi State University Extension Service
3/ Means of 4 replications and 4 subsamples (n=16). Means followed by the same letter are not significantly different at the 5% level as determine by Fisher's Protected LSD. No letters are used where differences are non-significant.
(*** = <0.0001, ** = 0.0001 - 0.01, * = 0.01 - 0.05, ns = not significant)