MISSISSIPPI SOYBEAN PROMOTION BOARD
PROJECT NO. 66-2017
FINAL REPORT

Title: **On-Farm, Field Scale Evaluations of Soybean Row Spacings and Seeding Rates**

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EXECUTIVE SUMMARY

Field studies were established at Hollandale and Stoneville, Miss. in 2016 and at Stoneville in 2017. Cooperating farmers performed all field operations. Objectives were to 1) determine the interaction of row spacing and seeding rate for furrow-irrigated soybean production on soybean yield, 2) quantify the effects of multiple row spacing and seeding rate combinations on soybean physiological characteristics such as plant stands, light interception, and yield components, and 3) quantify the effect of furrow irrigation on soybean water status and water use for multiple soybean row spacings.

Narrow (20 in.), wide (40 in.), and twin rows were planted at rates of 100, 140, and 180 thousand seeds/acre in order to determine if there was an interaction between row spacing and seeding rate. Canopy closure was measured throughout the growing season at all sites to determine rates of canopy closure for the different row spacings. Yields were determined at each location, and partial budget analyses were used to determine the cost-effectiveness of purchasing a new planter to plant at a different row spacing.

In all three site-years, narrow rows resulted in greater yield than the wide rows. In two of the three site years, twin rows also yielded greater than the wide rows. Yield increases ranged from 9-13%. Yield from the wide rows at Hollandale was about 62 bu/acre, whereas yield from the twin and narrow rows was about 69 and 70 bu/acre, respectively. At Stoneville, wide row yields were about 75 and 66 bu/acre in 2016 and 2017, respectively. Yields from the narrow rows in those two years at Stoneville were about 86 and 73 bu/acre, respectively. The yield increases appear to be the result of the increased light interception that occurred in the narrow rows because of their quicker canopy closure.

Using the yield increases measured in this irrigated study, economic analyses indicates that buying a narrow-row or twin-row planter would be economically advantageous. The yield increase resulting from the switch to a narrow row system would more than cover the costs of the purchase of a new narrow- or twin-row planter and would result in increased profits for the farmer who irrigates.

It is important to keep in mind that these results are only valid for cracking clay soils (Sharkey, Tunica) that are common and widespread in the Mississippi Delta, and successful narrow row soybean will be more successful when these narrow rows are planted on wide beds. For the middle two rows of soybeans planted on wide beds to get sufficient water from furrow irrigation, the water needs to move laterally across the beds, and this will occur on the cracking clay soils. However, on sandy soils such as Dundee and Commerce, lateral movement of water is limited, thus making a wide bed arrangement unfeasible on these soils.

The Mississippi recommended soybean seeding rate of 140 thousand/acre resulted in the greatest seed yield in all row spacings.

BACKGROUND

The production of furrow-irrigated soybean on wide (38-40 inch) raised beds in Mississippi is a standard practice in the Mississippi Delta. However, wide beds can delay row closure and limit light interception necessary for maximum soybean yields if planted in single rows on the beds. This has caused more and more soybean producers to move to twin-row planting patterns.

Twin row soybean production results in faster rates of canopy closure which can improve soybean yield. Twin row planting also results in more equidistant plant plant spacing which can allow for higher seeding rates, which may also help to increase soybean yield.

Some growers in the Mississippi Delta have moved to narrow-row systems (19-20-inch-wide rows on 76-80-inch-wide beds). Narrow row soybean production promotes even earlier canopy closure and the more equidistant planting pattern may allow for increased seeding rates. The narrow rows and resulting canopy cover can also help to limit growth of troublesome weeds like Palmer amaranth.

Narrow-row production for furrow-irrigated soybean production in the Mississippi Delta presents some challenges and opportunities. The creation of wide beds necessary for narrow row production also presents challenges. One of the challenges is irrigation management. In order for the middle rows on wide beds to be irrigated properly, irrigation water needs to be able to move laterally into the bed from the water furrow, meaning narrow-row, wide-bed production is only suitable on cracking clay soils. However, soybean irrigation on wide beds may decrease the time that the soybean root zone is inundated with water, which may help to improve soybean yield and help water get across the field faster, thus decreasing watering time.

OBJECTIVES

Objective 1: Determine the interaction of row spacing and seeding rate for furrow-irrigated soybean production on soybean yield.

Objective 2: Quantify the effects of multiple row spacing and seeding rate combinations on soybean physiological characteristics such as plant stands, light interception, and yield components.

Objective 3: Quantify the effect of furrow irrigation on soybean water status and water use for multiple soybean row spacings.

REPORT OF PROGRESS AND ACTIVITIES

Field-scale studies were established at two locations in 2016 and one location in 2017. Cooperating farmers performed all field operations. Narrow (20 in.), wide (40 in.), and twin rows were planted at seeding rates of 100,000, 140,000, and 180,000 seeds/acre in order to determine if there was an interaction between row spacing and seeding rate. Canopy closure was measured throughout the growing season at all sites to determine rates of canopy closure for the different row spacings. Yields were determined with a commercial combine and weigh wagon. Each location was analyzed separately and partial budget analyses were used to determine the cost-effectiveness of purchasing a new planter to plant at a different row spacing.

This study was successfully completed in 2017. The graduate student working on the project, Richard Smith, did a great job with the project. Richard accepted a Ph.D. position at Purdue and will be working on a precision agriculture project with soybeans there. The project is currently being prepared for publication in Agronomy journal.

In all three site-years, the narrow rows resulted in greater yield than the wide rows (see graphs and tables). In two of the three site years, the twin rows also yielded greater than the wide rows. Yield increases ranged from 9-13%. The yield increase appears to be the direct result of increased light interception throughout the growing season for both the narrow and twin rows.

Using the yield increases measured in this irrigated study, economic analyses indicates that buying a narrow row or twin row planter would be economically advantageous. The yield increase resulting from the switch to a narrow row system in this study would more than cover the costs of the purchase of a new narrow or twin row planter and lead to increased profits for the farmer who irrigates.

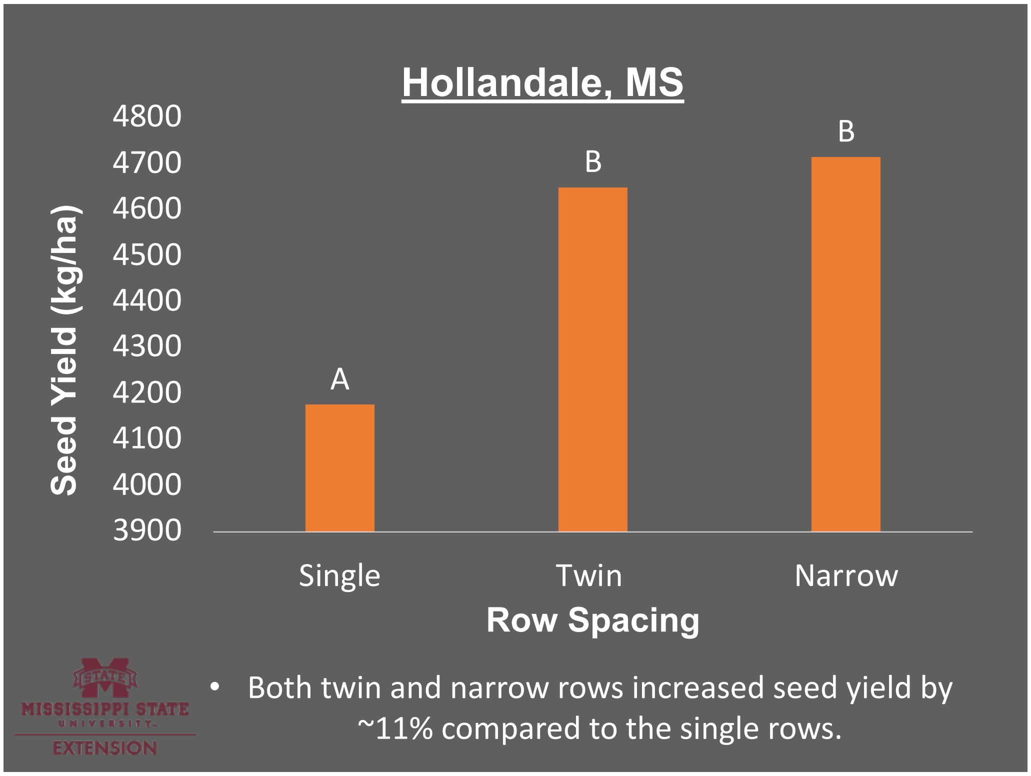
IMPACTS AND BENEFITS TO MISSISSIPPI SOYBEAN PRODUCERS

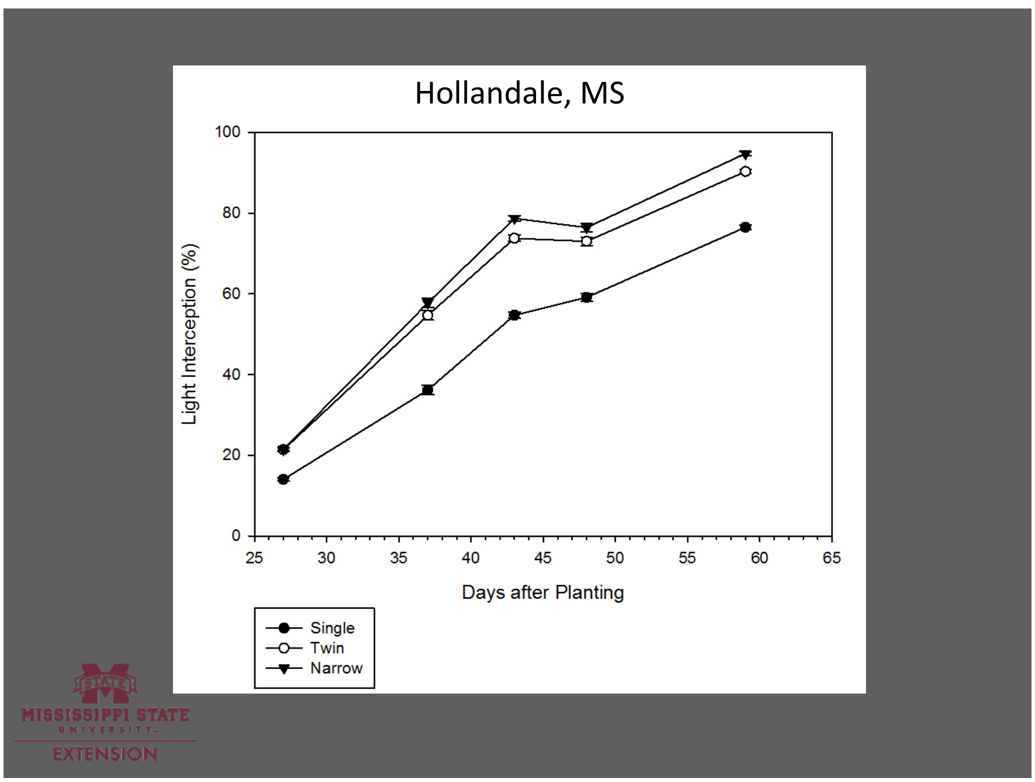
It is important to keep in mind that these results are only valid for cracking clay soils (Sharkey, Tunica) that are common and widespread in the Mississippi Delta, and successful narrow row soybean will be more successful when these narrow rows are planted on wide beds. For the middle two rows of soybeans planted on wide beds to get sufficient water from furrow irrigation, the water needs to move laterally across the beds, and this will occur on the clay soils. However, on sandy soils such as Dundee and Commerce, lateral movement of water is limited, thus making a wide bed arrangement unfeasible on these soils.

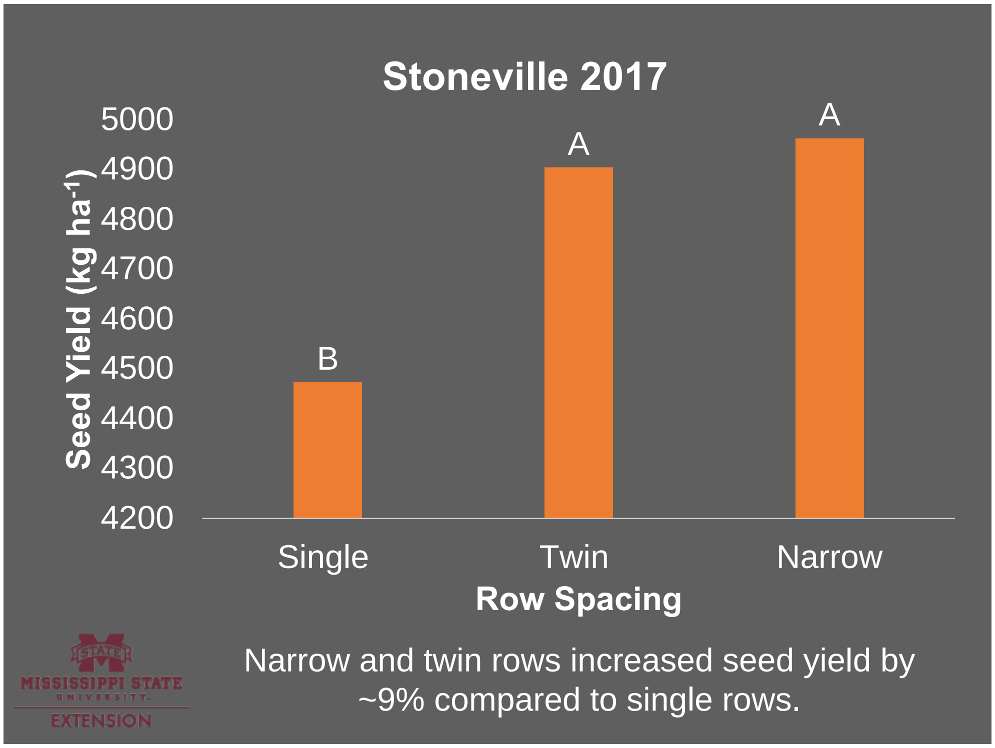
It is also important to keep crop rotation in mind when considering a narrow-row, wide-bed soybean planting system. There has been limited research on narrow-row furrow-irrigated corn, and it is likely that a farm in a soybean-corn or soybean-cotton rotation would need to maintain both a narrow row planter for soybean and a more conventional wide-row planter for corn and/or cotton.

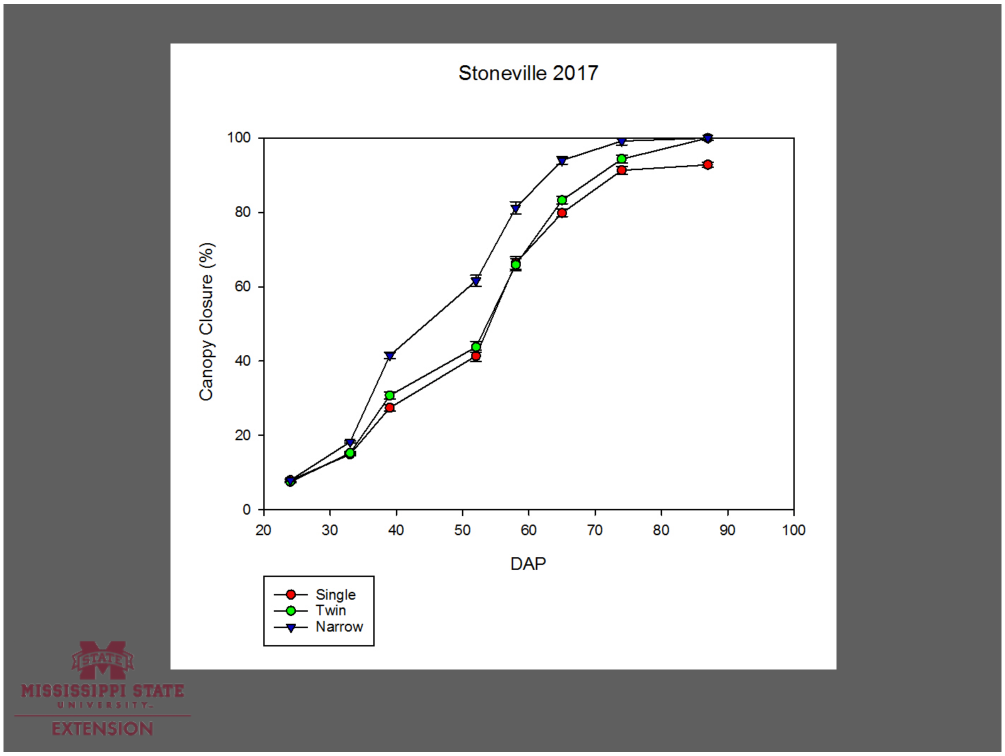
END PRODUCTS COMPLETED AND FORTHCOMING

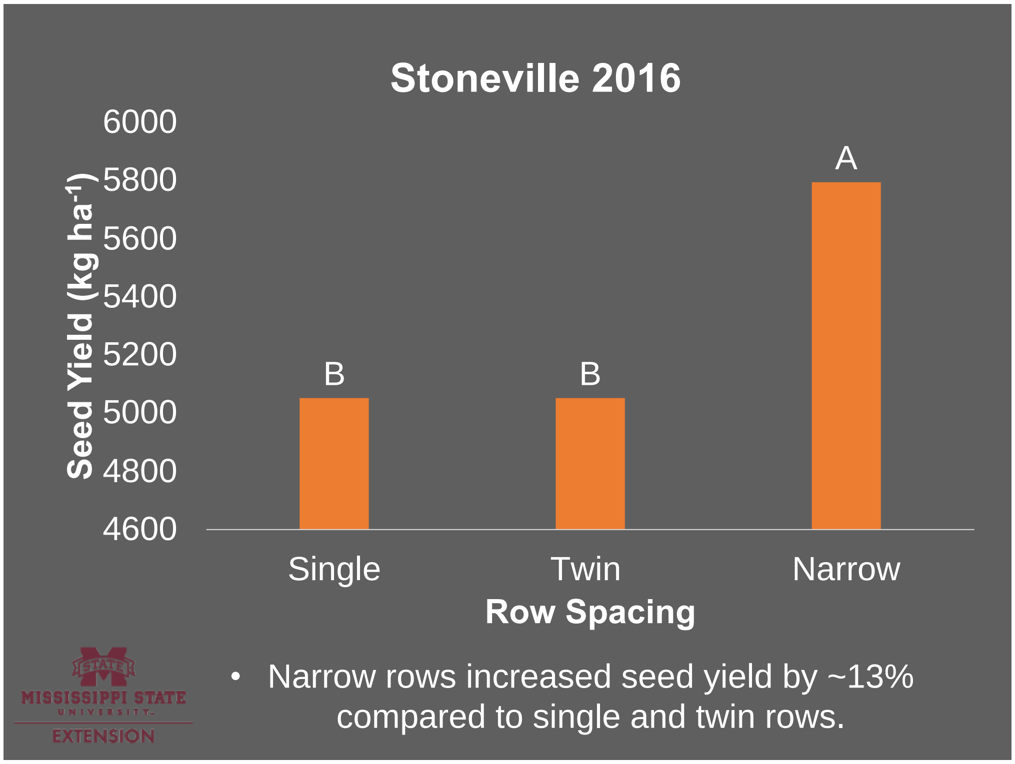
These results are being prepared in a report intended for publication in Agronomy Journal. The research from this project has been presented by Richard at multiple professional meetings. Richard has won multiple awards for conduct of the project.

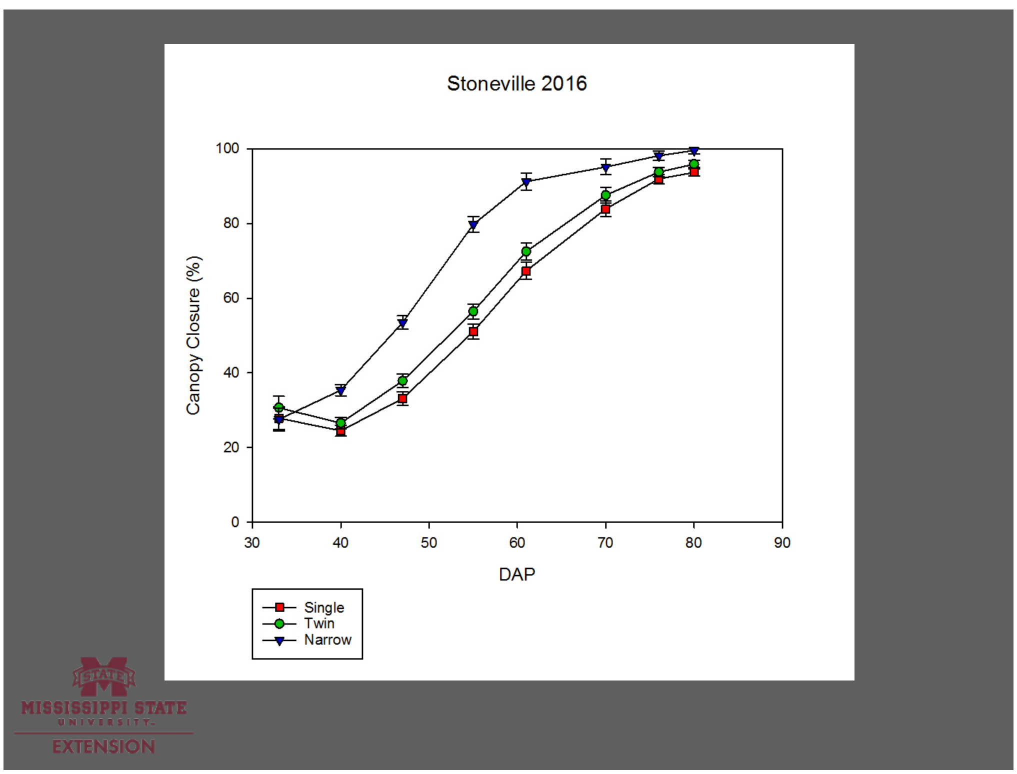

Hollandale, MS
Seed Yield (kg/ha)
4800
4700
4600
4500
4400
4300
4200
4100
4000
3900
A
B
B
Single
Twin
Narrow
Row Spacing
MISSISSIPPI STATE UNIVERSITY EXTENSION
• Both twin and narrow rows increased seed yield by ~11% compared to the single rows.


Hollandale, MS
Light Interception (%)
100
80
60
40
20
0
25
30
35
40
45
50
55
60
65
Days after Planting
Single
Twin
Narrow
MISSISSIPPI STATE UNIVERSITY EXTENSION


Stoneville 2017
Seed Yield (kg ha-1)
5000
4900
4800
4700
4600
4500
4400
4300
4200
B
A
A
Single
Twin
Narrow
Row Spacing
Narrow and twin rows increased seed yield by ~9% compared to single rows.
MISSISSIPPI STATE UNIVERSITY EXTENSION


Stoneville 2017
Canopy Closure (%)
0
20
40
60
80
100
20
30
40
50
60
70
80
90
100
DAP
Single
Twin
Narrow
MISSISSIPPI STATE UNIVERSITY EXTENSION


Stoneville 2016
Seed Yield (kg ha-1)
6000
5800
5600
5400
5200
5000
4800
4600
B
B
A
Single
Twin
Narrow
Row Spacing
• Narrow rows increased seed yield by ~13% compared to single and twin rows.
MISSISSIPPI STATE UNIVERSITY EXTENSION


Stoneville 2016
Canopy Closure (%)
100
80
60
40
20
0
30
40
50
60
70
80
90
DAP
Single
Twin
Narrow
MISSISSIPPI STATE UNIVERSITY EXTENSION

Advantages compared to Single Row

Assume Soybean Price: $0.35/kg

	Hollandale 2016	Stoneville 2016	Stoneville 2017
Twin	$151.82	-	$137.49
Narrow	$174.15	$244.85	$156.65

MISSISSIPPI STATE UNIVERSITY EXTENSION