

Soybean Yield and Net Returns Response to Corn Crop Residue Management and Tillage Systems in a Corn/Soybean Rotation

M.P. Harrison, N.W. Buehring and A.R. Taylor, North Mississippi Research and Extension Center,
Mississippi Agricultural and Forestry Experiment Station, Mississippi State University

M.W. Ebelhar and L.L. Falconer, Delta Research and Extension Center, Mississippi State University Extension Service,
Mississippi Agricultural and Forestry Experiment Station, Mississippi State University

W.L. Kingery and S.G. Shanmugam, Department of Plant and Soil Science, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University

Table 1. March ground cover (%), 2012-2014 in Verona and Stoneville, MS.

Tillage	Verona				Stoneville				
	2012	2013	2014	2012	2013	2014	2012	2013	2014
	Burn	No-burn	Burn	No-burn			Burn	No-burn	
NT	63 a ¹ B ²	86 aA	40 aB	93 aA	86 a	66 a	68 a	83 aA	91 aA
BR	63 aA	59 cA	33 aA	43 cA	59 bc	30 c	50 b	31 bA	31 dA
TT	68 aA	75 bA	29 aB	68 bA	66 b	46 b	50 b	73 aA	85 bA
D + TT	41 bA	50 dA	31 aA	31 dA	57 c	34 c	33 c	42 bB	72 cA

¹Numbers within a column with the same lower case letters are not significantly different at the 5% probability level.

²Numbers across columns with the same upper case letters are not significantly different at the 5% probability level.

Table 2. March bed-height (inches) in 2012-2014 in Verona and Stoneville, MS.

Tillage	Verona			Stoneville		
	2012	2013	2014	2012	2013	2014
NT	3.2 d ¹	2.3 c	2.5 d ³	2.9 c	1.9 b	2.5 b ³
BR	6.0 a	5.9 a	6.7 a	5.3 a	4.1 a	6.9 a
TT	4.8 b	5.3 b	4.9 b	3.7 b	1.6 bc	2.5 b
D + TT	3.9 c	2.3 c	3.4 c	2.5 c	1.0 c	0.9 c
	Burn	No-burn				
	3.5 B ²	4.4 A				

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²Numbers across columns with the same upper case letters are not significantly different at the 5% probability level.

³Bed height data was taken before the beds were reshaped.

Table 3. Soybean Yield (Bu/A) in 2012-2014, Verona and Stoneville, MS.

Tillage	Verona			2013 Verona		Stoneville		
	2012	2013	2014	Burn	No burn	2012	2013	2014
NT	71 b ¹	66 b	78 a	70 B ²	76 A	63 a	53 ab	62 a
BR	72 b	72 a	79 a			61 a	50 b	64 a
TT	75 a	77 a	81 a			59 a	55 ab	62 a
D + TT	78 a	75 a	80 a			63 a	57 a	63 a

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Table 4. Net returns (\$/A) above total specified cost in 2012-2014, Verona and Stoneville, MS.

Tillage	Verona			Stoneville		
	2012 ¹	2013 ²	2014 ³	2012 ¹	2013 ²	2014 ³
NT	727 b ⁴	590 b	411 a	702 a	350 a	262 a
BR	733 b	666 a	425 a	664 ab	285 a	271 a
TT	787 a	716 a	436 a	620 b	359 a	229 b
D + TT	803 a	669 a	403 a	664 ab	365 a	221 b
	Burn	No-burn				
	621 B ⁵	699 A				

¹\$16.43/bu market price 2012.

²\$12.73/bu market price 2013.

³\$9.16/bu market price 2014.

⁴Numbers within a column with the same lower case letters are not significantly different at the 5% probability level.

⁵Numbers across columns with the same upper case letters are not significantly different at the 5% probability level.



Acknowledgement

Funded in part by Mississippi Soybean Promotion Board.
Equipment Supported by Bigham Ag., Lubbock, TX.

Objective

Determine long term (2012-2016) corn residue management and tillage affect on:

- Spring ground cover (old crop residue and vegetation)
- Spring bed height
- Soybean yield
- Net returns above total specified costs

Locations

- Verona (non-irrigated) Marietta loam
- Stoneville (irrigated) Bosket/Dubbs silt loam

Soil type

- Marietta loam
- Bosket/Dubbs silt loam

Experimental Design: Split Plot

Main Plot: Corn Crop Residue Management

- Burn
- No-burn

Sub-plot: Tillage Systems (all plots were flail-mowed prior to burning and fall tillage applications)

- No-tillage (old beds) (NT)
- Annual fall bed-roller (BR)
- Annual fall disk (2X) Fb TerraTill® (D + TT) (a one-pass operation, in-row-subsoil-bed-roller, Bigham Ag, Lubbock, TX.)
- Annual fall TerraTill (TT)

Summary

Crop Residue Management: Crop residue management influenced ground cover, yield and net returns.

March Ground Cover (Table 1):

- Most often no-tillage at both locations had more ground cover than the other tillage systems. TerraTill most often had more ground cover than bed-roller and disk (2X) + TerraTill.
- In 2012 and 2013 at Verona and 2014 at Stoneville there was a crop residue management by tillage interaction.

Verona (2012 & 2013): No-tillage in 2012 and TerraTill and no-tillage in 2013 had more ground cover with the no-burn than with the burn crop residue. With the no-burn TerraTill both years had more ground cover than bed-roller and disk (2X) + TerraTill. Both years bed-roller and disk (2X) + TerraTill indicated no ground cover differences between burn and no-burn.

Stoneville (2014): Tillage systems indicated no ground cover differences between burn and no-burn crop residue management systems. However, TerraTill and no-tillage had more ground cover than bed-roller and disk (2X) + TerraTill with the no-burn and burn crop residue management systems.

March Bed Heights (Table 2):

- At both locations no-tillage and disk (2X) + TerraTill bed heights most often were lower than the bed-roller and TerraTill. Bed-roller beds were taller than the other tillage treatments.
- At both locations after two years (2012 and 2013) of no-tillage production on old beds (bed-roller), bed heights were very low (<2.5 inch height) and were reshaped with a bed-roller.
- In 2013 the no-burn (corn residue) bed heights at Verona were higher than the burn bed height.

Verona (non-irrigated) Yield (Table 3):

- TerraTill and disk (2X) + TerraTill indicated no yield differences but were higher than no-tillage (old beds) 2 of 3 years and higher than the bed-roller 1 of 3 years.
- In 2013, not burning corn residue (Fall 2012) resulted in 6 bu/A higher yield than burning corn crop residue.
- Compared to TerraTill without disking, the disk (2X) operation did not increase yield.

Stoneville (irrigated) Yield (Table 3):

- With above normal rainfall during the 2014 growing season no irrigations were necessary.
- There were no yield differences between tillage systems in 2012 and 2014. In 2013 the bed-roller had lower yields than the disk (2X) + TerraTill. No-tillage, TerraTill and the disk (2X) + TerraTill yields were not different.
- Compared to the TerraTill without disking, the disk (2X) operation did not increase yield all 3 years of the study.
- Burning corn crop residue had no effect on yield all 3 years of the study.

Economics (Net Returns) (Table 4): The economic analysis was based on enterprise budgeting of net returns above total specified expenses. Returns above total specified expenses are used as a proxy for the economic concept of net returns above variable plus fixed costs. The net returns per acre are based on the average reported price the week of the plot harvest date (USDA Market News-JK_GR110). The soybean prices for 2012, 2013 and 2014 were \$16.43, \$12.73 and \$9.16/bu, respectively. Prices direct and fixed expenses were taken from the Mississippi State University Budgets (MSU Department of Agricultural Economics Budget Report 20123-05). **Note: no allowance was made for burning in the total specified costs.** Some items were intentionally left out of these cost calculations, i.e., costs for land or land rent, taxes, insurance premiums, general farm overhead, and expected incomes from government payments or insurance payments as they vary widely between operations.

Verona (non-irrigated): Two of 3 years the TerraTill and disk + TerraTill had higher net returns than no-tillage and higher than bed-roller 1 of 3 years. With above normal rainfall and cooler temperatures during the 2014 growing season, there were no yield and net return differences between tillage systems. In 2013, burning corn stubble resulted in a \$78/A lower net return than not burning corn residue (\$621/A vs. \$699/A).

Stoneville (irrigated): No-tillage net returns were equal or higher than bed-roller, TerraTill and disk (2X) + TerraTill all 3 years (2012-2014).

Conclusion

- The economic data indicated that in an irrigated environment the in-row-subsoil-bed-roller (TerraTill) may not increase net returns. However, in a non-irrigated environment TerraTill increased net returns.
- Not-burning corn crop residue has the potential for a positive yield response in a non-irrigated environment.
- No-till production on old beds can be achieved successfully on loam/fine sandy loam soils for about 2 years.

Future Research

- Evaluate the TerraTill in an irrigated environment using soil moisture sensor technology to determine whether in-row-subsoiling would extend the intervals between irrigations.

