COMPARING NEWER VS OLDER TECHNOLOGIES – MANAGEMENT SYSTEMS IN A 3-YEAR STUDY

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Abstract

This study compared results of some of the new production technologies to some of the older production technologies. In-row subsoiling was compared to 45 degree subsoiling to the row. The newer planting pattern of 32-inch rows in a 2x1 skip-row was compared to solid planted 40-inch rows. A modified no-till production system was compared to a conventional tillage system with hipping and cultivation. It also compared new Roundup-Ready® varieties and a BXN variety to standard cotton varieties. Subsoiling at a 45 degree angle to the row increased lint yields in both row spacings in 1998 and in the 32-inch rows in a 2x1 skip-row planting pattern over the 3-year study as compared to a modified no-till production system with in-row subsoiling but without cultivation. The solid planted 40-inch rows increased lint yields in 1997, 1998, and the 3-year average over 32-inch rows in a 2x1 skip-row planting pattern. Roundup Ready varieties did poorly except in 1999 as compared to conventional variety checks. Stv BXN 47 performed as well as its parent variety Stv 474 during the study. This study seemed to suggest that the skipped row in a 2x1 skip-row pattern on 32-inch rows should be subsoiled at a 45 degree angle to the row to allow for additional exploration of roots for nutrients and moisture.

Introduction

Typically, soils are sampled and amended in the top 6 inches of the soil profile. Roots explore this volume, but also explore deeper depths. Sampling soils at deeper depths has shown that there are a lot of soils with potassium deficiencies in the subsoil (Hamil et al., 1987). A dry material deep-banding applicator was developed in 1985 (Tupper and Pringle, 1986). The most consistent yield increases came from deep banding potassium in the drill from 6 to 15 inches deep (Tupper et al., 1998). The most consistent rate for deep banding was 120 lb K_2O/A. The surface broadcast method was the least consistent method for increasing lint yields. The no potassium (check) treatment produced the lowest lint yield in 15 of 16 possibilities. The Stoneville deep banding dry materials applicator was very effective in deep banding potassium fertilizer and was used to amend low potassium subsoils and increase lint yield.

A 5-year study showed no yield advantage by moving from 40-inch to 30-inch rows in solid planted cotton (Tupper et al., 1995). The 30-inch 2x1 skip-row pattern produced more lint than 40-inch row 2x1 skip-row pattern. When skip-row planting patterns were used, the 30-inch row 2x1 planting pattern produced more lint and higher returns above production costs than 40-inch 2x1 skip-row planting pattern. The low-till parabolic subsoiler, do-all treatment with deep band 150 lb K_2O/A may be a good alternative system to no-till in the Mississippi Delta on relatively flat sandy loam soil types (Tupper et al., 1998). The deep band 150 lb K_2O/A treatment produced the highest returns in both the low-till and conventional tillage systems.

This study compared some of the older technologies such as 45-degree angle to the row subsoiling to the newer method of in-row subsoiling. It compared the older method of solid planted 40-inch rows with the newer form of 2x1 skip-row 32-inch rows. It compared the older method of cultivated cotton, using band chemicals, to the newer method where broadcast chemicals are used for weed control without cultivation. This study also compared old standard varieties of SureGrow 125 ('SG 125') and Stoneville 474 ('Stv 474') to newer genetically modified cotton varieties. Stoneville BXN 47 ('Stv BXN47'), and the Roundup varieties (1997) Hartz 1215RR ('HZ 1215RR'), Hartz 1244RR ('HZ 1244RR'), (1998) Deltapine 436 RR ('DP 436RR'), Paymaster 1244RR ('PM 1244RR'), and (1999) Deltapine 456 RR ('DP 456RR'), and Paymaster 1220RR ('PM 1220RR'). The objective of this study was to see if new technologies were comparable in yield to the older standard production technologies.

Materials and Methods

This study was initiated on a Bosket very fine sandy loam soil type in 1997. The study was designed in a split-split plot study with varieties randomized. Main plots were row-spacing pattern, and sub-plots were tillage treatments. Varieties were randomized and maintained in the same location (unless a substitution was made) each year. Plots were 4 rows wide in 40-inch rows and 6 rows wide in 32-inch rows. Plots were 90 ft long with 6 replications. Main-plots treatments were as follows: (1) 40-inch rows planted in a solid planting pattern, and (2) 32-inch rows planted in a 2x1 skip-row pattern. Sub-plots treatments were as follows: (1) modified no-till without cultivation but with in-row deep banded 120 lb K_2O/A (Tupper et al., 1998), and (2) 45 degree angle subsoiling to the row plus in-row deep banded 120 lb K_2O/A with hipping and cultivation. Five varieties were planted each year. In 1997, the varieties were (1) SG 125, (2) Stv 474, (3) Stv BXN47, (4) HZ 1215RR, and (5) HZ 1244RR. Then in 1998, the varieties were (1) SG 125, (2) Stv 474, (3) Stv BXN 47, (4) DP 436RR, and (5) PM 1244RR. In 1999, the varieties planted were (1) SG 125, (2) Stv 474, (3) Stv BXN 47, (4) DP 456RR, and (5) PM 1220RR.

Each year 120 lb N/cotton acre was applied to both row patterns. The modified no-till treatments were chemically treated broadcast, whereas, the tillage treatments were chemically treated on a 20-inch band centered on 40-inch rows and a 16-inch band centered on 32-inch rows. The modified no-till treatments were not cultivated, whereas, the tilled treatments were cultivated each year. Insecticides were applied as recommended and cotton was grown dry-land each year. The Roundup Ready varieties had some changes each year. In 1998, Hartz was sold to Paymaster. HZ 1215RR was dropped and was no longer an available variety. It was replaced with DP 436RR in 1998. In 1999, DP 436RR was replaced with DP 456RR. In 1999, PM 1244RR was replaced with PM 1220RR because of very poor yields of PM 1244RR.

After defoliation, the two center rows of each plot were harvested twice each year with a spindle picker for yield determinations. Representative samples of seed cotton were taken from each plot of the 20 treatments at first and second harvest. Replications of each treatment were combined and ginned to determine lint percent and lint yield of each plot was calculated. A small scale ginning system (20 saw gin stand) was provided by the USDA Ginning Laboratory at Stoneville. A standard recommended gin equipment sequence was used to gin these samples. Data were subjected to analysis of variance and means were separated by Fisher Protected Least Significant Difference procedure at the 5% level of significance.

Results and Discussion

A conventional production system of 40-inch rows, planted in a solid planting pattern with subsoiling at a 45 degree angle to the row, hipping and conventional cultivation and banded herbicides, was compared to a modified no-till narrow-row production system. The modified no-till production system was planted to 32-inch rows in a 2x1 skip-row pattern subsoiled in the row direction (including the skip) with broadcast chemicals and no cultivation.

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Subsoiling at a 45 degree angle to the row direction with conventional tillage practices significantly increased lint yield in both row-spacing-patterns in 1998 (Table 2) and in the 32-inch 2x1 planting pattern over the 3 years (1997-99) (Table 4), as compared to a modified no-till system without cultivation. The solid planted 40-inch rows significantly increased lint yield in 1997, 1998, and the 3 year average over the 32-inch 2x1 planting pattern (Tables 1, 2 and 4, respectively).

The standard varieties of SG 125 and Stv 474 with the genetically modified variety Stv BXN47 were planted all three years and are included in the 3-year average. The Roundup Ready varieties performed poorly in this study. Both HZ 1215RR and HZ 1244RR were significantly lower in lint yield than the three other varieties in 1997 (Table 1). With HZ 1215RR no longer being sold as a variety in 1998, DP 436RR was substituted in 1998 (Table 2). In 1998, after Paymaster bought Hartz, PM 1244RR performed so poorly it was dropped in 1999 (Table 3) and PM 1220RR was substituted in its place. Also, in 1998, DP 436RR was significantly lower in yield than Stv 474 and Stv BXN 47, DP 456RR was substituted for DP 436RR in 1999. In 1999, PM 1220RR was the leading variety and significantly higher in yield than the two conventional varieties SG 125 and Stv 474. DP 456RR was significantly lower in lint yield than PM 1220RR in all row-spacing-patterns and tillage combinations of treatments in 1999 (Table 3).

In Table 4, a 3-year average for the three varieties which were planted all three years is shown. No significant difference was shown between the three varieties. Stv BXN 47 performed equal to Stv 474. In the 40-inch row plots, the 45 degree subsoiled and conventionally cultivated plots were not significantly higher in lint yield than the in-row subsoiled plots which were not cultivated. However, in the 32-inch 2x1 skip-row plots, 45 degree angle subsoiling with conventional cultivation significantly increased lint yield in both Stoneville varieties and the 3-year average (Table 4). Also, 45 degree angle subsoiling with conventional cultivation increased lint yield across both row spacings (Table 4). The solid planted 40-inch rows yielded significantly more lint per land acre than the 32-inch 2x1 skip-row planting pattern (Table 4).

In the 3-year average (Table 4), the 2x1 skip-row plots treated with in-row tillage produced 79.3% (794/1001) of the yield of 40-inch row plots treated with in-row tillage. However, this 2x1 skip-row plot treated with 45 degree angle subsoiling produced 88.3% (911/1032) of the yield of 40-inch row plots treated with 45 degree angle subsoiling. These data suggest that the narrow skipped row pattern should be subsoiled at a 45 degree angle to the row to allow for the exploration of additional roots for additional nutrients and moisture.

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Table 1. Effect of tillage system, row spacing-pattern, and variety on lint yield, Stoneville, MS, 1997.

	Row Spacing Pattern				
	40-inch solid		32-inch 2x1		
Variety	In-row Subsoil	45°∠ Subsoil	In-row Subsoil	45°∠ Subsoil	Mean
	lb lint/land acre				
SG 125	1367[1/]	1255[1/]	1089[1/]	1069[1/]	1195
Stv 474	1339	1353	1102	1132	1232
Stv BXN 47	1365	1361	1066	1027	1205
HZ 1215RR	1025	956	973	956	977
HZ 1244RR	932	909	1019	910	942
Mean	1206	1167	1050	1019	
LSD 5%		91			67
		Treatment Means			
40-inch solid		1186	In-row Subsoil		1128
32-inch 2X1		1034	45°∠ Subsoil		1093
LSD 5%		73			68

[1/]LSD 5% = 170 for comparing varieties within row spacing-tillage.

Table 2. Effect of tillage system, row spacing-pattern, and variety on lint yield, Stoneville, MS, 1998.

	Row Spacing Pattern				
	40-inch solid		3 2-inch 2x1		
Variety	In-row Subsoil	45°∠ Subsoil	In-row Subsoil	45°∠ Subsoil	Mean
	lb lint/lan d acre				
SG 125	874[1/]	972[1/]	574[1/]	758[1/]	794
Stv 474	867	1010	676	914	867
Stv BXN 47	916	968	643	857	846
DP 436RR	774	848	607	788	755
PM 1244RR	482	627	411	532	513
Mean	783	885	582	770	
LSD 5%		61			50
		Treatment Means			
40-inch solid		834	In-row Subsoil		683
32-inch 2X1		676	45°∠ Subsoil		827
LSD 5%		48			48

[1/]LSD 5% = 120 for comparing varieties within row spacing-tillage.

Table 3. Effect of tillage system, row spacing-pattern, and variety on lint yield, Stoneville, MS, 1999.

	Row Spacing Pattern				
	40-inch solid		32-inch 2x1		
Variety	In-row Subsoil	45°∠ Subsoil	In-row Subsoil	45°∠ Subsoil	Mean
	lb lint/land acre				
SG 125	712[1/]	808[1/]	639[1/]	750[1/]	727
Stv 474	718	744	668	868	750
Stv BXN 47	846	819	686	829	795
DP 456RR	651	621	567	618	614
PM 1220RR	935	925	801	771	858
Mean	773	783	672	767	
LSD 5%		105			74
		Treatment Means			
40-inch solid		778	In-row Subsoil		722
32-inch 2X1		720	45°∠ Subsoil		775
LSD 5%		80			80

[1/]LSD 5% = 176 for comparing varieties within row spacing-tillage.

Table 4. Effect of tillage system, row spacing-pattern, and variety on lint yield, Stoneville, MS, 1997-1999.

	Row Spacing Pattern				
	40-inch solid		32-inch 2x1		
Variety	In-row Subsoil	45°∠ Subsoil	In-row Subsoil	45°∠ Subsoil	Mean
	lb lint/land acre				
SG 125	985[1/]	1011[1/]	767[1/]	859[1/]	906
Stv 474	975	1036	815	971	949
Stv BXN 47	1043	1049	798	904	948
Mean	1001	1032	794	911	
LSD 5%		95			64
		Treatment Means			
40-inch solid		1016			897
32-inch 2X1		853	In-row Subsoil		972
LSD 5%		72	45°∠ Subsoil		72

[1/]LSD 5% = 143 for comparing varieties within row spacing-tillage.