

Cotton Yield and Fiber Quality from Irrigated Tillage Systems in the Tennessee Valley

Kipling S. Balkcom,* D. Wayne Reeves, Joey N. Shaw, Charles H. Burmester, and Larry M. Curtis

ABSTRACT

Cotton (*Gossypium hirsutum* L.) yield and quality responses to irrigation have not been described for conservation management systems that growers are rapidly adopting. We conducted a field experiment from 2001–2003 in the Tennessee Valley near Belle Mina, AL on a Decatur silt loam (fine, kaolinitic, thermic Rhodic Paleudults) to examine how irrigation regimes and tillage systems affect ginning percentage, lint yield, and fiber quality (length, micronaire, strength, and fiber length uniformity). Treatments were arranged with a split-plot structure in a randomized complete block design with three replications. Main plots were a factorial combination of conventional tillage (CT) with and without a fall paratill operation and no surface tillage (NST) following a rye (*Secale cereale* L.) cover crop with and without a fall paratill operation. Subplots were irrigation regimes (0, 2.7, 5.4, and 8.1 mm d⁻¹). Ginning percentage increased 2% following CT in 1 of 3 yr (2002) while irrigation improved ginning percentage in 2 of 3 yr (2002 and 2003). The NST systems increased lint yields 13% in 2003 compared with CT systems while irrigation increased yields 46 and 32% over nonirrigated yields in 2002 and 2003, respectively. Fiber properties were affected by tillage systems, primarily in 2002. Irrigation regimes affected length, micronaire, and fiber length uniformity in 2002 and 2003. Fall paratilling had no effect on any measured variable, except for an inconsistent difference between tillage systems for fiber length uniformity. An irrigated conservation system, utilizing a cover crop, can improve cotton yields and positively influence fiber characteristics in the Tennessee Valley.

WATER CAN BE A MAJOR limiting factor for cotton producers during the growing season due to sporadic summer rainfall patterns. Intermittent rainfall has prompted growers to utilize irrigation, if available, to supplement cotton water requirements during periods of short-term drought. Previous research has documented increased cotton yields and net returns with LEPA (low-energy precision application) and sprinkler-irrigated cotton compared with nonirrigated cotton in the Texas High Plains and the Delta region of Mississippi (Bronson et al., 2001; Pringle and Martin, 2003).

In the southeastern USA, annual rainfall normally exceeds evapotranspiration but is frequently distributed poorly, especially during the cotton growing season (Camp et al., 1999). Producers of agronomic crops, such as cotton, produced in coarse-textured soils of the southeastern Coastal Plain utilize overhead sprinkler

systems for their irrigation requirements. Other irrigation alternatives, such as subsurface drip irrigation have been investigated to reduce water usage and deep tillage requirements of compacted soils (Camp et al., 1997, 1999). The researchers theorized that by keeping the soil moist, soil strength would be reduced, enabling roots to penetrate the compacted layer. That would diminish the need for a deep tillage operation, which is complicated by the presence of subsurface drip tape. Other concerns related to efficient water use have prompted some regulatory agencies to offer growers monetary alternatives to restrict irrigation in an effort to maintain water resources (Balkcom et al., 2004).

A conservation system that utilizes a high-residue cover crop with noninversion deep tillage, to alleviate soil compaction, can also increase infiltration of rainfall and/or overhead irrigation, which may reduce water requirements, thereby protecting water resources. The elimination of compacted layers with noninversion tillage enables roots to explore a larger soil volume to obtain nutrients and moisture while surface soil disturbance is minimized to maintain crop residue on the soil surface (Busscher et al., 1988; Schwab et al., 2002). Previous studies conducted on coarse-textured Coastal Plain soils, prone to soil compaction, have documented yield responses for various crops to some form of deep tillage (Reeves and Touchton, 1986; Reeves and Mullins, 1995; Touchton et al., 1986).

Finer-textured soils located in the Tennessee Valley, degraded from erosion attributed to long-term conventional farming practices and cotton monocropping, also responded to some form of fall in-row deep tillage (Raper et al., 2000a, 2000b; Schwab et al., 2002). However, a cover crop with no deep tillage produced yields similar to deep tillage on these fine-textured soils (Raper et al., 2000a, 2000b). Touchton et al. (1986) reported reduced cotton yields and no response to spring in-row subsoiling compared with CT and no-tillage across 2 yr. These studies all utilized a cover crop combined with deep tillage to accentuate the benefits of conservation tillage. Integrating irrigation and a conservation system that utilizes a cover crop has not been examined on a finer-textured soil of the Tennessee Valley. Therefore, our objective was to compare ginning percentages, lint yields, and fiber quality (length, micronaire, strength, and fiber length uniformity) across different irrigation levels in conventional and conservation tillage systems, with and without fall paratilling.

MATERIALS AND METHODS

The experimental site was established on a Decatur silt loam at the Tennessee Valley Research and Extension Center

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Abbreviations: CT, conventional tillage; HVI, high-volume instrumentation; NST, no surface tillage.

in Belle Mina, AL (34°41'9" N lat, 86°53'29" W long) from 2001–2003. Tillage systems consisted of factorial combinations of CT (fall chisel/disk, spring disk/level) with and without a fall paratill (Bigham Brothers Inc., Lubbock, TX)¹ operation and NST with a rye cover crop with and without a fall paratill operation. Irrigation regimes were 0, 2.7, 5.4, and 8.1 mm d⁻¹. Cotton irrigation regimes were applied using Moiscot, a computer-based scheduling program that utilizes historic cotton water use curves to predict irrigation requirements (Tyson et al., 1996). Irrigation applications were based on 2.54-cm depletion of available water in the upper 61 cm of the soil profile by monitoring soil moisture sensors (Irrrometer, Riverside, CA)¹ 5 d each week, beginning at first bloom (mid-June) and terminating 1 mo before anticipated harvest date. Two soil moisture sensors were installed in each subplot to a depth of 22.9 and 45.7 cm. Available soil water was adjusted each day (5 d each week), based on precipitation and evapotranspiration, triggering the corresponding irrigation regime for specified plots when a 2.54-cm deficit was observed. Once irrigation was initiated, it continued unless there was a rainfall event to delay irrigation. Irrigation regimes were applied with four sprinkler nozzles located in each subplot corner aligned to uniformly irrigate only the specific plot. Treatments remained in the same location each year. Subplot dimensions were 11.2 m wide and 11.9 m long separated by 7.9-m alleys.

Recommended P, K, and lime for cotton were applied before planting the rye cover crop based on Auburn University soil test recommendations (Adams et al., 1994). In all NST plots, rye was drilled at 100 kg ha⁻¹ during the first 2 wk of October each year. The fall paratill operations were administered to appropriate plots immediately following cover crop planting. The rye cover crop was chemically terminated with glyphosate [*N*-(phosphonomethyl)glycine] at least 2 wk before planting. Nitrogen, as 32% UAN (urea ammonium nitrate), was injected in two applications totaling 118 kg N ha⁻¹. The first application was approximately 1 wk before cotton planting, and the second application occurred approximately 6 wk after planting.

'PayMaster 1218 BG/RR' was planted 20 Apr. 2001, and 'Suregrow 215 B/R' was planted on 24 Apr. 2002 and 1 May 2003. The cotton in each plot was chemically defoliated with thidiazuron (*N*-phenyl-*N'*-1,2,3-thiadiazol-5-ylurea), and the bolls were opened with a mixture of ethephon [(2-chloroethyl)-phosphonic acid] and cyclanilide {1-[[[(2,4-dichlorophenyl)amino]carbonyl]cyclopropanecarboxylic acid}. Defoliation and boll openers were applied to the experiment when cotton in the latest-maturing treatments was 60 to 70% open. Earlier-maturing treatments were 80 to 90% open at defoliation. Cotton was harvested on 1 Oct. 2001, 24 Sept. 2002, and 8 Oct. 2003 with a mechanical spindle picker equipped with a bag attachment system. A subsample of seed cotton collected from each plot was ginned in a 20-saw tabletop microgin to determine ginning percentage. Lint yields were determined by weighing lint and seed collected from each plot and multiplying by the ginning percentage of each plot. An additional subsample of ginned cotton was sent to the USDA Agricultural Marketing Service (AMS) Cotton Division cotton classing office (USDA-AMS, Pelham, AL) for high-volume instrumentation (HVI) analysis of fiber properties (length, micronaire, strength, and fiber length uniformity) from each plot. Discount levels were based on the 2003 USDA government loan program.

We used a split-plot treatment structure in a randomized complete block design with three replications. Main plots were the factorial combination of tillage systems, and subplots were four irrigation regimes. All response variables were analyzed using the MIXED procedure (Littell et al., 1996), and the LSMEANS PDIFF option was used to distinguish between tillage means. Data were analyzed with year as a fixed effect in the model, and there were significant year × treatment interactions for all response variables. Therefore, data were analyzed within year, with data and discussion presented by year. Tillage system and irrigation regimes were also considered as fixed effects while rep and rep × irrigation regime were considered random. No interactions between tillage systems and irrigation levels were observed for any response variables; therefore, only main effects of tillage system and irrigation levels are presented. Orthogonal contrast statements were used to further distinguish between tillage systems, and single degree-of-freedom contrasts were used to evaluate linear and quadratic effects of irrigation levels on each response variable. If a single degree-of-freedom contrast indicated a significant linear or quadratic response, the specified regression model was fit with the PROC REG procedure (SAS Inst., 2001). Treatment differences were considered significant if $P \leq 0.10$, unless otherwise stated.

RESULTS AND DISCUSSION

Rainfall, heat units, and irrigation applied during each month and totals for the 2001, 2002, and 2003 growing seasons are shown in Table 1. Rainfall received during the 2001 and 2003 growing season averaged 74% higher than rainfall during the 2002 growing season while accumulated heat units averaged 17% higher during the 2002 growing season compared with the 2001 and 2003 growing seasons. In addition, irrigation amounts were higher and, subsequently, applied over a longer period of time during the 2002 growing season. Rainfall totals, heat units, and irrigation applied for each month were also variable between the 2001 and 2003 growing seasons, but totals were similar (Table 1). This data illustrates that the 2002 growing season was drier and hotter than the 2001 and 2003 growing seasons. However, within years, no interactions existed between tillage systems and irrigation levels for any response variable examined; therefore, only main effects are presented.

Ginning Percentage

Means and significance levels for ginning percentages are shown for each tillage system in Table 2. No differences were observed between ginning percentage for the two similar growing seasons (2001 and 2003), but in the drier and warmer 2002 growing season, the NST systems had 2% lower ginning percentages than CT systems, regardless of fall paratill (Table 2). Higher soil moisture contents in NST systems, attributed to cover crop residue, could delay maturity, decreasing ginning percentages. Previous research showed that ginning percentage decreased as soil moisture increased (Grimes et al., 1969). It is usually accepted that higher soil moisture contents are observed in conservation tillage production systems compared with CT production systems, especially before canopy closure (Phillips et al., 1980).

¹ Mention of a trade name, proprietary product, or specific equipment does not constitute a guarantee or warranty by the USDA or Auburn University and does not imply approval of a product to the exclusion of others that may be suitable.

Table 1. Measured rainfall, heat units, and irrigation water applied during the 2001, 2002, and 2003 growing season at the Tennessee Valley Research and Extension Center in Belle Mina, AL.

Month	2001			2002			2003								
	Heat units†	Rainfall	Irrigation regime (mm d ⁻¹)			Heat units	Rainfall	Irrigation regime (mm d ⁻¹)			Heat units	Rainfall	Irrigation regime (mm d ⁻¹)		
			2.7	5.4	8.1			2.7	5.4	8.1			2.7	5.4	8.1
		mm	— mm applied —				mm	— mm applied —				mm	— mm applied —		
April	42	86				28	31				94				
May	299	143				240	218				294	211			
June	439	185				525	19	53	58	104	430	106			
July	602	43	55	111	109	647	100	62	87	84	573	103			
August	560	88	45	62	57	626	6	61	92	87	615	66	109	136	136
September	321	125				524	72				384	196			
October	42	89				114	2				13	23			
Total	2305	759	100	173	166	2704	448	176	237	275	2309	799	109	136	136

† Heat units were calculated with the following formula $[(T_{max} + T_{min}/2) - 15.5^{\circ}\text{C}]$, where T_{max} = daily maximum temperature and T_{min} = daily minimum temperature. Calculations began on the day of planting and ended on the day of harvest.

Irrigation regime affected ginning percentage differently between the 2002 and 2003 growing seasons (Fig. 1A) while no differences were observed in 2001 (data not shown). In 2002, ginning percentage decreased quadratically as irrigation regime increased to 5.4 mm d⁻¹ while ginning percentage increased linearly with irrigation level during the 2003 growing season. Also, in 2002, quadratic response curves for ginning percentage and lint yields suggest a negative relationship between lint yield and ginning percentage. Similar to the effect of NST systems, irrigation could have delayed crop maturity compared with nonirrigated plots, which may have influenced the 2002 ginning percentages. Pettigrew (2004) showed that irrigation delayed cutout an average of 6 d in a fine sandy loam soil of Mississippi.

Lint Yields

Lint yields were affected by tillage treatments only in 2003 (Table 2). The NST systems yielded 13% higher than CT systems. The hot, dry growing season of 2002 is evident when lint yields are compared with the other growing seasons. The lack of lint yield response observed during a hot, dry growing season contradicts the

moisture conservation benefit of a NST system. These data do suggest that the lint yield increase in 2003 could be attributed to the cover crop because the fall paratill operation had no effect on lint yields. Defoliation did not occur until all cotton was 60 to 70% open; therefore, some plots were 90 to 100% open, indicating differences in maturity levels across the experiment. The lack of lint yield response for the NST system in 2002 could be related to differences in maturity between the tillage systems, similar to differences observed for ginning percentage. Increased soil moisture, through irrigation or NST maximizing residue retention, could delay maturity, diminishing potential benefits of a NST system with a cover crop, if harvest was premature. In addition to cotton maturity differences between tillage systems, Rhoton (2000) reported that the beneficial changes in soil properties for no-tillage systems may not be immediate but can occur within 4 yr. This finding supports our study, which showed increased lint yields for NST systems the final year (2003).

Lint yields were positively influenced by irrigation levels in 2002 and 2003 (Fig. 1B). An irrigation regime of 5.4 mm d⁻¹ maximized lint yields in 2002 and 2003, but lint yields declined somewhat with the highest regime

Table 2. Ginning percentage and lint yield means for conventional tillage (CT) and no surface tillage (NST) treatments with and without fall paratilling measured during the 2001, 2002, and 2003 growing seasons at the Tennessee Valley Research and Extension Center in Belle Mina, AL.

Tillage system	Ginning percentage			Lint yields		
	2001	2002	2003	2001	2002	2003
	%			kg ha ⁻¹		
CT - P†	39.1	39.0	40.0	1291	1053	1489
CT + P	40.8	39.2	39.7	1342	1042	1507
NST - P	41.8	36.9	40.1	1275	1018	1694
NST + P	40.3	37.4	40.3	1343	986	1685
	Analysis of variance (P > F)					
Tillage system	0.3277	<0.0001	0.7431	0.5795	0.5253	<0.0001
CT vs. NST		<0.0001				<0.0001
+ P vs. - P		0.2385				0.8923
Interaction		0.5151				0.6974
Tillage × irrigation	0.5398	0.6596	0.4334	0.6252	0.2113	0.8146

† CT - P, conventional tillage without fall paratill; CT + P, conventional tillage with fall paratill; NST - P, no surface tillage without fall paratill; NST + P, no surface tillage with fall paratill.

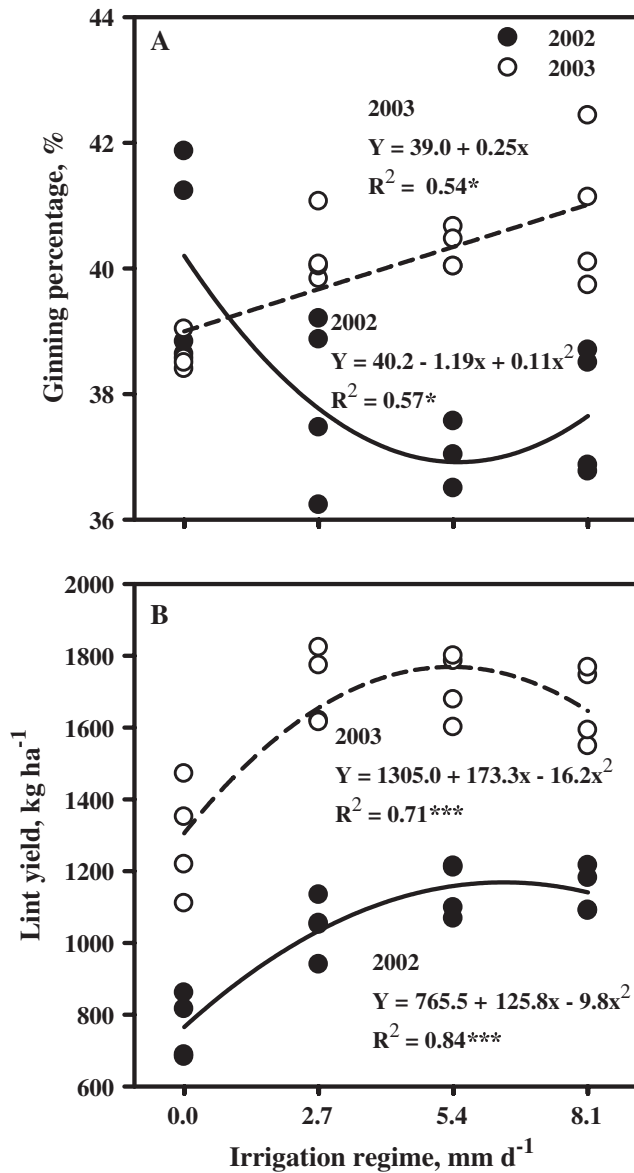


Fig. 1. Regression equations relating (A) ginning percentage and (B) lint yield means measured during the 2002 and 2003 growing seasons to irrigation levels at the Tennessee Valley Research and Extension Center at Belle Mina, AL. * and *** indicate significance at $P \leq 0.05$ and 0.001 , respectively.

of irrigation. Warmer temperatures and limited rainfall during the 2002 growing season depressed lint yields across all irrigation regimes compared with 2003 irrigation regimes. Nonirrigated lint yields measured in 2003 were superior to lint yields measured in 2002 across all irrigation regimes. The lower lint yields observed in 2002 again highlight the drastic differences in climate between years.

Fiber Quality

Tillage system influenced fiber length only during the dry 2002 growing season (Table 3). Length was increased in NST systems compared with CT systems, but the fall paratill operation had no effect. These dif-

Table 3. Fiber length and micronaire means for conventional tillage (CT) and no surface tillage (NST) treatments with and without fall paratilling measured during the 2001, 2002, and 2003 growing seasons at the Tennessee Valley Research and Extension Center in Belle Mina, AL.

Tillage system	Length			Micronaire		
	2001	2002	2003	2001	2002	2003
	mm					
CT - P†	27.3	26.9	27.8	4.6	3.9	3.9
CT + P	27.2	26.9	27.9	4.6	3.9	3.9
NST - P	27.2	27.4	27.8	4.5	3.5	4.0
NST + P	27.3	27.2	27.9	4.5	3.5	3.9
	Analysis of variance ($P > F$)					
Tillage system	0.7848	0.0038	0.8268	0.3621	0.0002	0.9760
CT vs. NST		0.0007			<0.0001	
+ P vs. - P		0.3228			0.7908	
Interaction		0.2441			0.8735	
Tillage × irrigation	0.5344	0.2108	0.2347	0.3812	0.6818	0.9834

† CT - P, conventional tillage without fall paratill; CT + P, conventional tillage with fall paratill; NST - P, no surface tillage without fall paratill; NST + P, no surface tillage with fall paratill.

ferences will not influence a grower's net return because the values were above minimum standards for discounts. In addition to differences in cotton maturity, the longer fiber lengths observed for the NST systems may also be attributed to soil moisture conservation associated with maintaining surface residue during the dry growing season. Lascano and Hicks (1999) reported that as irrigation increased, which implies higher soil moisture contents, fiber length increased. Bauer and Frederick (2005) found longer fibers from cotton grown in conservation tillage compared with disk tillage for two loamy sand soil types during a dry year in South Carolina. The observed discrepancy between lint yields and fiber length seems plausible because Bednarz et al. (2002) reported optimum fiber quality is established earlier during boll opening than lint yield.

In our study, irrigation increased length during the 2002 and 2003 growing seasons, but a more pronounced effect was observed during the dry 2002 growing season (Fig. 2A). In 2002, length was below the established minimum value when no irrigation was applied; however, irrigation resulted in fiber lengths above the minimum standards for discounts with only 2.7 mm d⁻¹ and lengths were maximized at 5.4 mm d⁻¹ (Fig. 2A). All fiber lengths were above the minimum with no deductions, regardless of irrigation regime in 2003. An irrigation regime to supply between 2.7 and 5.4 mm d⁻¹ appeared to maximize fiber lengths.

Similar to fiber lengths, tillage system influenced micronaire only in 2002, but higher micronaire values were observed for the CT systems compared with the NST systems (Table 3). These differences are important because micronaire values from NST systems are at the value where growers would receive a low micronaire deduction. The dry 2002 growing season also possibly influenced micronaire from the standpoint of soil moisture and its effect on plant maturity. Triplett et al. (1996) reported delayed maturity for no-tillage cotton compared with CT cotton during the first year of their experiment on a silt loam soil, previously in sod. De-

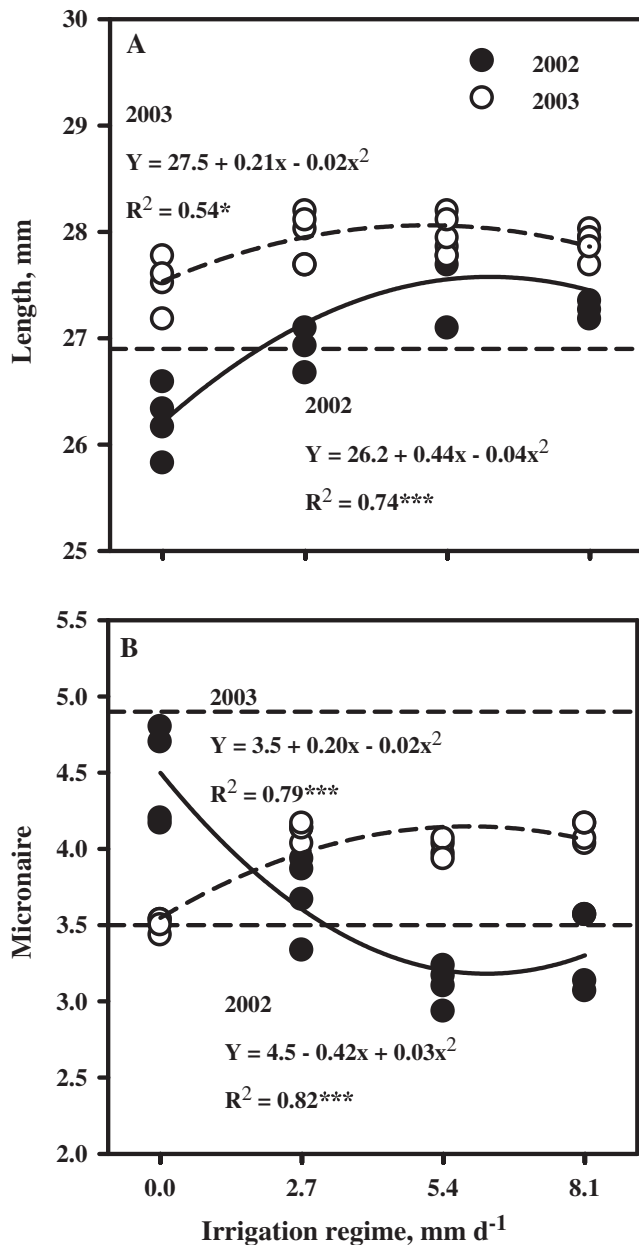


Fig. 2. Regression equations relating length (A) and micronaire (B) means measured during the 2002 and 2003 growing seasons to irrigation levels at the Tennessee Valley Research and Extension Center at Belle Mina, AL. * and *** indicate significance at $P \leq 0.05$ and 0.001 , respectively. Dashed lines indicate minimum values or ranges of values for discounts.

layed cotton maturity in the NST systems would correspond to immature bolls if the harvest date was early, resulting in low micronaire cotton. In fact, one proposed method to control micronaire is with early crop termination (Lewis, 1993). The low ginning percentages measured in NST systems during the dry growing season also support delayed cotton maturity compared with CT systems. The fall paratill operation had no effect on micronaire.

Irrigation regime also affected micronaire during the 2002 and 2003 growing seasons (Fig. 2B). Micronaire

was highest, but within the no-discount range, with no irrigation applied during the 2002 growing season. Micronaire decreased with all regimes of irrigation and was in the discount range for low micronaire at an irrigation regime of 5.4 and 8.1 mm d⁻¹. Additional water supplied by irrigation may have delayed maturity, resulting in immature bolls that lowered micronaire. Lascano and Hicks (1999) reported a similar finding that as irrigation increased micronaire decreased. An irrigation regime of 2.7 mm d⁻¹ maximized micronaire, during the 2003 growing season, while all regimes of irrigation produced micronaire values within the accepted range with no deductions.

Tillage system influenced fiber strength during the 2002 growing season. Fiber strength was greater for CT systems compared with NST systems (Table 4); however, these differences are insignificant because all fiber strength values are above established minimum values that would result in a price reduction. Although this difference only occurred 1 yr out of 3, this finding contradicts results of a 2-yr study conducted by Bauer and Busscher (1996), who found no difference in fiber strength among various cover crops preceding a CT and a conservation tillage system. Neither fall paratill or irrigation level had any effect on fiber strength in our study.

Fiber length uniformity was influenced by tillage systems during the 2001 and 2002 growing seasons; however, the results were not consistent across years (Table 4). In 2001, there was an interaction between surface tillage and the fall paratill operation (data not shown). The fiber length uniformity was greatest for the CT systems without the fall paratill operation, but in the NST systems, fiber length uniformity was greatest for plots that received the fall paratill operation. During the 2002 growing season, fall paratill had no effect on fiber length uniformity, but fiber length uniformity was greatest for NST systems compared with CT systems. Higher fiber length uniformity values for NST systems was related to higher observed fiber lengths during the dry 2002 growing season, attributed to soil moisture conservation from surface residue. Irrigation only influenced fiber length uniformity during the 2003 growing season. The fiber length uniformity values associated with all regimes of irrigation were above the critical value designated for deductions and were maximized near 5.4 mm d⁻¹ (Fig. 3).

Higher fiber length uniformity values were measured during the 2002 growing season from NST systems (Table 4). Although no cotton defoliates were applied before 60 to 70% opened bolls, these results suggest that cotton was harvested prematurely from the NST systems in 2002 and correspond to the findings of Bednarz et al. (2002) indicating that optimal lint yield occurs after optimum fiber quality. These findings may partially be explained by the indeterminate growth habit of cotton, which produces bolls that vary considerably by age (Bednarz et al., 2002), and by the effect of irrigation. Pettigrew (2004) reported that horizontal and vertical distribution of bolls was affected by irrigation. In Pettigrew's study, a higher percentage of bolls was set as Position 1 fruit on plants in nonirrigated plots, and irrigated plants set more bolls on the upper plant nodes.

Table 4. Strength and fiber length uniformity means for conventional tillage (CT) and no surface tillage (NST) treatments with and without fall paratilling measured during the 2001, 2002, and 2003 growing seasons at the Tennessee Valley Research and Extension Center in Belle Mina, AL.

Tillage system	Strength			Fiber length uniformity		
	2001	2002	2003	2001	2002	2003
	kN m kg ⁻¹			%		
CT - P†	257	262	284	83.9	82.1	83.6
CT + P	253	266	289	83.2	82.1	83.7
NST - P	253	260	282	83.3	82.8	83.8
NST + P	255	259	284	83.6	82.5	83.6
	Analysis of variance (P > F)					
Tillage system	0.3436	0.0536	0.1146	0.0425	0.0397	0.5807
CT vs. NST		0.0229		0.5222	0.0066	
+ P vs. -P		0.3565		0.2898	0.5071	
Interaction		0.1738		0.0096	0.5071	
Tillage × irrigation	0.8265	0.4362	0.2140	0.7935	0.6898	0.8968

† CT - P, conventional tillage without fall paratill; CT + P, conventional tillage with fall paratill; NST - P, no surface tillage without fall paratill; NST + P, no surface tillage with fall paratill.

Heitholt (1997) and Pettigrew (1995) showed that when only Position 1 bolls remained on sympodial branches, strength, micronaire, and maturity increased. Our results showed higher ginning percentages, strength, and micronaire values for CT systems compared with NST systems. Lower ginning percentages and micronaire values across irrigation regimes compared with nonirrigated plots were observed during the 2002 growing season. We did not attempt to characterize boll distribution for any growing season; however, our findings suggest that cotton grown with CT and no irrigation possibly had more Position 1 bolls than cotton grown with NST and irrigation during the 2002 growing season.

CONCLUSIONS

In at least 1 yr out of 3, tillage system influenced ginning percentages, lint yields, length, micronaire, strength, and fiber length uniformity while irrigation regime influenced all variables except strength. No interactions were observed for any variables between tillage systems and irrigation regimes. Fall paratilling had no effect on any measured variable, with the exception of fiber length uniformity, and that effect was minimal. This indicates that deep tillage is not required for irrigated cotton grown on the fine-textured soils of the Tennessee Valley. Although no tillage × irrigation interactions existed, irrigation may have adequately supplemented soil moisture, eliminating the need for deep tillage previously reported for dryland cotton. Pringle and Martin (2003) concluded that producers with the ability to perform deep tillage and irrigation should do either one or the other, but not both, due to lack of yield response and increased costs. Differences observed between tillage systems can be attributed to surface tillage intensity and the rye cover crop. Both variables affect the amounts of residue maintained on the soil surface, which influences soil moisture and ultimately crop growth. These effects were more pronounced during the dry 2002 growing season and indicate that results from 2002 may have been influenced by crop maturity. Although statistically significant differences were detected among HVI properties, these differences were not likely to influence net returns. The fiber properties are based on samples ginned with a tabletop gin, which can provide numbers for comparative purposes but may not necessarily coincide with values obtained by a farmer from a full-scale cotton gin. However, growers in the Tennessee Valley, using irrigation or NST systems, should be aware that following traditional harvest guidelines developed for nonirrigated CT systems may negatively influence lint yields and fiber quality. Increased soil moisture from irrigation and/or residue can delay cotton maturity in NST systems, with higher yield potential, negatively influencing lint yields and fiber characteristics if harvest timing coincides with nonirrigated CT systems that mature sooner.

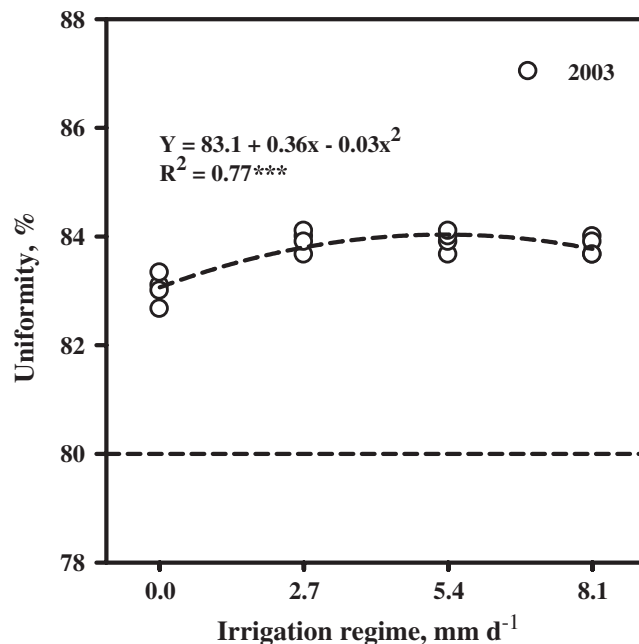


Fig. 3. Regression equation relating fiber length uniformity means measured during the 2003 growing season to irrigation levels at the Tennessee Valley Research and Extension Center at Belle Mina, AL. * indicates significance at $P \leq 0.001$. Dashed line indicates minimum value for discounts.**

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