2006 Beltwide Cotton Conferences, San Antonio, Texas - January 3 - 6, 2006

MANAGEMENT AND LINT QUALITY CHARACTERISTICS FOR VARIETY CHOICE IN NEW MEXICO

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Abstract

Closer examination of lint quality characteristics early in variety testing as well as yield is essential in determining the best varieties to plant for sustainable cotton production. General high volume instrument (HVI) measurements for fiber quality do examine micronaire, length, strength, length uniformity index and color grade but cannot focus as succinctly on short fiber content, neps and seed coat fragments, fabric barre or reduced maintenance as is needed to confirm a high quality cotton fiber for mills. Further examination of cotton varieties through the use of the advanced fiber information system (AFIS) is essential in early variety testing through breeder as well as farmer trials in order to confirm cotton quality and its potential at being sold as premium cotton (Estur, 2004). AFIS and HVI testing along with yield confirm how well the cotton performed within the environment and management of the field as well as the latitude or adaptation of each particular variety to the region. Further use of AFIS will help in narrowing top variety choices to growth regions by providing fiber length by weight and number, length coefficient of variation by weight and number, upper quartile length, short fiber content by weight and number, net count and size, trash and dust count and size, visible foreign matter, fineness and maturity which will all provide a snapshot of variety consistency, performance and quality during the season.

Introduction

Much of the evaluation of cotton is run based on high volume instrument (HVI) testing for measuring fiber quality. This determination of cotton fiber quality sets the USDA classing, cotton purchasing, bale management and mix selection of much of the cotton in the United States (Thibodeaux, 2004). It is a fast and efficient process that can be run by a single operator processing 700 to 800 samples per eight hour day to record micronaire, length, strength, length uniformity index and color grade. This HVI process does provide in depth information on cotton quality; however, a new method of testing cotton called AFIS can provide more detailed information, especially when paired with the testing currently used. The AFIS system can further refine the information on reduced short fiber content, reduced neps and seed coat fragments, reduced or eliminated fabric barre as well as reduced maintenance on the cotton tested. AFIS provides this information through measurements of staple length by weight and number; length coefficient of variance percentage by weight and number; upper quartile length; short fiber content by weight and number; nep count and size (including seed coat neps); trash and dust count and size; visible foreign matter; fineness; and, maturity. This additional information provides more detailed an analysis on the quality characteristics that are currently sought by foreign cotton buyers—namely staple strength; length and length uniformity; and, less bale contamination (Bell, 2004). It further provides a way to evaluate the cotton quality for textile use by providing information toward number and size of neps, seed coat fragments, maturity and possible stickiness. Where the cotton market is reaching for an enhanced, quality-based buyer outlet, the AFIS testing provides a means for sellers to show reliability as a supplier including consistency of quality supplies (shipment to shipment) as well as consistency of fiber quality, particularly staple strength. In order to determine if additional information could be supplied on two popular Upland cotton varieties, AFIS testing was performed on Delta and Pineland (DP) 555 and Stoneville (ST) 5599 grown in 2004 around the Mesilla Valley near Las Cruces, New Mexico. This testing was run across two locations under two different cooperators on each of the two varieties revealing some differences in quality factors of length and strength—factors often influenced by variety, quality of seed, weather and/or farming practices in these two similar in maturity cotton varieties.

Materials and Methods

Two trials were run in 2004 on various cotton varieties in order to ascertain differences in Upland cotton for differences in quantity and quality. Both trials contained both DP 555 and ST 5599 as two of the varieties within the lineup. Each trial had each variety replicated in strips four times in a randomized,

replicated plan. Both dates of planting were within two days of each other. One was planted on April 30, 2004 and the other on May 1, 2004 at a seeding rate of six seed per foot at a depth of 1 to 1.5 inches. Each strip of each variety was four rows in one trial and 6 rows in the second trial, in 40-inch rows, replicated four times through each trial. Eight-row and twelve-row John Deere equipment was used to plant the trials with half the boxes containing one variety and the other half containing another variety that then was flagged to each randomized, replicated strip for the varieties with the only constraint a preset randomization based on the two-variety planting manner. The soil type for both fields was a clay loam with one of the fields with drip irrigation just established in the field new for this season at seven inches in depth, a replacement of a previous drip system that was established closer to the soil surface and the other field furrow irrigated. The fields for the trials were located just west of La Union, New Mexico, near the farmer's residence for the drip irrigated field and just north of La Mesa, New Mexico, near the other farmer's residence for the furrow irrigated cotton and within a few miles of each other. Soil temperatures the previous week were up above 65F at the three inch depth and although consistent for another week, did dip back down to below 55F during the two weeks following initial seed germination. Readings were taken on emergence and vigor twice within the first two months and yield was taken based on boll buggy weights obtained from picking each strip of each variety separately. These weights were then converted to pounds per acre. Samples were taken of each variety strip and replication and run for lint quality and turnout. This information was then used to determine actual bales per acre obtained for each variety strip and then averaged across each variety in each trial to determine yield. These results were then analyzed statistically to determine differences in varieties across the trials. Samples were hand-ginned and used for the HVI testing and then were collected back and identified by variety, location and replication and sent for AFIS testing through Cotton Incorporated to determine if differences existed to further define cotton quality and variety selection for these varieties grown in the south-central area of New Mexico.

Results and Discussion

Differences between the two varieties within the drip irrigated trial were reported at the 2005 Cotton Beltwide with emergence and vigor differences shown between DP 555 and ST 5599 (McWilliams, 2005). Differences in yield were also noted at both locations. The results from this initial testing, including HVI, are shown in the two tables shown below. Table 1 has the results from the drip irrigated location and includes all varieties planted in the trial, including DP 555 and ST 5599. Table 2 are the results from the furrow irrigated trial, including both DP 555 and ST 5599.

Table 1. Agronomic information as well as the final results from cotton quality and quantity testing on DP 555 and ST 5599 as well as other varieties within the trial under drip irrigation.

New Mexico 2004Cotton Variety Trial Results - Dona Ana County, Joel Tellez and Robert Sondergroth

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Trial Description

Year of Harvest (yyyy)	2004	Country	United States	State/Province	NM	Study Design (number of replications):	
Special Test (Describe)	Stacked gene cotton trial--Upland trial drip irrigation			County/Area	Dona Ana	Replicated Within Site	4
Soil Name & Texture	sandy clay loam	Soil Depth (inches)		Longitude		Replicated Across Sites	
				Latitude			
Planting (mm/dd/yy)	4/30/2004	Harvest Date(s) (mm/dd/yy)	11/30/2004				
Herbicides/Insecticides							

Fertilizer Applied (lb/a):	Nitrogen	(P2O5)	(K2O)	Other (specify)	type	lb/a	type	lb/a

	January	February	March	April	May	June	July	August	September	October	November	December
Temperature (deg F)				62.0	71.6	78.0	75.7	75.4	69.6	62.6	48.5	
Rain (Inches)				0.00	0.10	0.40	1.30	2.90	0.90	0.0	0.0	
Irrigation (Inches)												

Plant Population (number or pounds per acre)	52324	Row Spacing (inches - enter '0' for broadcast)	40.0	Total Rain	5.60
Unusual Conditions (or 'none')	Soil crusting right at emergence but was lightly tilled to break soil sealing; this is a drip irrigation tria			Total Irrigation	

Results

	Brand/Company Name	Hybrid/Variety Name	Yield lbs/a	Lint % %	Micronair	Length Inches	Uniformit	Strength HVI	Elongation %	Yield lint lbs/a	Yield bales/a
		Trial Mean	4076.9	43.0	3.8	1.1	79.1	19.5	7.2		
		LSD	346.64	1.75	0.29	0.06	4.63	1.02	0.63		
		LSD P >	0.0767 ns	0.0463*	0.0032*	0.0527 ns	0.0057*	0.0102*	0.8455 ns		
		CV	5.32	2.55	4.72	3.26	3.66	3.26	5.49		
Averages Estimated		F Test	3.2	3.99	10.01	3.78	8.37	6.95	0.27		
2.78	D&PL	555	3898.4	43.8	3.60	1.13	77.50	19.43	7.05	1706.82	3.56 b
2.89	D&PL	488	4045.2	41.6	3.79	1.18	76.26	20.56	7.13	1684.44	3.51 ab
3.12	Stoneville	5599	4351.7	42.5	3.67	1.13	77.23	19.51	7.26	1851.52	3.86 a
2.87	Stoneville	5242	4012.2	44.0	4.24	1.10	85.31	18.52	7.25	1763.95	3.67 ab

Table 2. Agronomic information as well as the final results from cotton quality and quantity testing on DP 555 and ST 5599 as well as other varieties within the trial under furrow irrigation near La Mesa, New Mexico.

New Mexico 2004Cotton Variety Trial Results - Dona Ana County, Bobby Sloan

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Trial Description

Year of Harvest (yyyy)	2004	Country	United States	State/Province	NM	Study Design (number of replications):	
Special Test (Describe)	Stacked gene cotton trial.			County/Area	Dona Ana	Replicated Within Site	4
Soil Name & Texture	sandy clay loam	Soil Depth (inches)		Longitude		Replicated Across Sites	
				Latitude			
Planting (mm/dd/yy)	5/1/2004	Harvest Date(s) (mm/dd/yy)	11/5/2004				
Herbicides/Insecticides							

Fertilizer Applied (lb/a):	Nitrogen	(P2O5)	(K2O)	Other (specify)	type	lb/a	type	lb/a

	January	February	March	April	May	June	July	August	September	October	November	December
Temperature (deg F)					71.6	78.0	75.7	75.4	69.6	62.6	48.5	
Rain (inches)					0.10	0.40	1.30	2.90	0.90	0.0	0.0	
Irrigation (inches)												

Plant Population (number or pounds per acre)	55017	Row Spacing (inches - enter '0' for broadcast)	38.0
Unusual Conditions (or 'none')	Soil crusting right at emergence but was lightly tilled to break soil sealing; this is a drip irrigation		

		Results										
		Brand/Company Name	Hybrid/Variety Name	Yield lbs/a	Lint %	Micronair	Length inches	Uniformit	Strength HVI	Elongation %	Yield lint lbs/a	Yield bales/a
			Trial Mean	3937.6	42.4	3.7	1.1	81.5	20.5	6.7		
			LSD	294.72	8.71	0.5	0.02	5.24	1.54	1.01		
			LSD P >	0.4404 ns	0.7364 ns	0.0567 ns	0.0000 ns	0.0037*	0.0041*	0.1926 ns		
			CV	4.68	12.84	8.56	1.11	4.02	4.68	9.41		
Averages	Estimated	Bales/A	F Test	0.99	0.43	3.66	62.77	9.55	9.29	1.95		
	2.78	D&PL	555	3898.6	40.8	3.6	1.2	78.7	19.8	6.4	1589.56	3.31 a
	2.88	D&PL	488	4034.7	42.1	3.4	1.2	81.4	22.0	7.1	1696.74	3.53 a
	2.74	Stoneville	5599	3829.4	44.9	3.7	1.1	77.4	21.6	6.3	1720.91	3.59 a
	2.85	Stoneville	5242	3988.0	41.8	4.1	1.1	88.7	18.9	7.0	1667.29	3.47 a

Differences noted in yield at on the drip irrigated field between DP 555 and ST 5599 but very small differences in strength testing as well as the other parameters tested on the cotton staple required further testing to distinguish any quality differences between the two varieties. During 2005, the collected cotton samples for the two varieties from both trials were mailed to Cotton Incorporated for AFIS testing. Some differences were noted in nep size and number as well as in other quality characteristics shown below in Table 3. While several quality differences were noted between the varieties at each location, when the data was run for differences across both locations and all replications, these quality characteristics showed no significant differences.

Figure 3. AFIS reporting information across the two varieties grown in two locations with four replications at each location where DP represents the DP 555 variety and ST represents the ST 5599 variety at either the drip irrigated location (TEL) or at the furrow-irrigated location (SLO).

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COTTON INCORPORATED

Report: AFIS

Project: 26635 Submit: CANTRELLR Work By: DAVIS, L.
Track No: D. MCWILLIAMS Dept: AGR Assist: -
Reference: Customer: COTTON INCORPORATED
Received: 06/08/05 Material:
Complete: 06/08/05 Process:

AFIS
Advanced Fibre Information System

Sample	Nep Size [um]	Neps/g	L(w) [in]	L(w) CV [%]	UQL (w) [in]	SFC (w) [%]	L(n) [in]	L(n) CV [%]	SFC (n) [%]	L5% (n) [in]	L2.5% (n) [in]	Trash Total (Cnt/g)	Trash Size [um]	Dust (Cnt/g)	Trash (Cnt/g)	VFM [%]	SCN Size (um)	SCN (Cnt/g)	Fine [mTex]	IFC [%]	Mat Ratio
SLO-DP1-1	670	202	0.97	37.40	1.19	10.2	0.72	59.30	33.1	1.36	-	1508	358	1192	316	6.11	956	16	152	5.60	0.88
SLO-DP2-1	693	369	0.89	44.50	1.17	17.9	0.57	74.90	49.4	1.30	-	2520	348	1994	525	9.87	975	22	141	7.60	0.84
SLO-DP3-1	675	260	0.93	38.70	1.18	12.5	0.68	61.70	37.1	1.34	-	875	385	660	214	3.97	1080	15	153	6.70	0.86
SLO-DP4-1	687	196	0.95	38.90	1.21	12.1	0.69	61.80	36.4	1.37	-	1389	354	1104	285	5.27	972	26	155	6.10	0.88
SLO-ST1-3	701	150	0.98	35.60	1.21	9.9	0.73	59.20	33.0	1.34	-	1825	341	1456	369	6.44	1133	17	177	4.20	0.92
SLO-ST2-3	702	227	0.98	35.00	1.20	9.5	0.73	57.40	31.6	1.35	-	1564	392	1181	383	7.08	1089	28	161	5.50	0.89
SLO-ST3-3	703	243	0.96	37.70	1.21	11.1	0.70	61.30	35.2	1.35	-	1697	361	1331	366	6.68	1056	35	165	5.50	0.89
SLO-ST4-3	661	248	0.92	37.50	1.15	12.2	0.68	59.90	36.1	1.30	-	2117	349	1696	421	7.62	855	17	155	6.60	0.87
TEL-DPX1-1	713	242	0.97	37.50	1.21	10.9	0.72	59.70	34.1	1.37	-	1812	381	1400	412	7.56	1013	30	160	5.90	0.88
TEL-DPX1-2	786	253	0.99	37.20	1.25	10.8	0.72	61.50	34.9	1.41	-	4608	286	3910	698	12.58	1138	54	162	5.90	0.88
TEL-DPX1-4	679	191	0.99	32.10	1.18	7.4	0.77	52.70	26.9	1.32	-	2200	328	1800	400	7.08	1085	20	174	5.30	0.89
TEL-STX3-1	698	175	0.96	36.30	1.18	10.0	0.72	58.30	32.6	1.33	-	2782	339	2208	574	9.57	908	36	164	5.20	0.90
TEL-STX3-2	744	276	1.00	36.40	1.24	9.7	0.73	59.80	32.9	1.40	-	4320	287	3632	687	11.72	1137	54	159	6.20	0.87
TEL-STX3-3	703	226	0.94	37.60	1.18	11.8	0.68	62.30	37.0	1.33	-	4384	303	3621	763	12.98	966	31	167	5.50	0.90
TEL-STX3-4	653	155	0.90	33.70	1.07	9.7	0.69	55.20	31.3	1.21	-	1790	307	1467	323	5.29	1063	13	181	4.70	0.91
Avg:	698	228	0.96	37.07	1.19	11.0	0.70	60.33	34.8	1.34	0.00	2359	341	1910	449	7.99	1028	28	162	5.77	0.88
Std:	33	54	0.03	2.75	0.04	2.3	0.04	4.80	4.8	0.04	0.00	1169	33	1010	163	2.75	87	12	10	0.83	0.02
CV%:	4.74	24.05	3.45	7.42	3.53	20.90	6.26	7.96	13.91	3.51	0.00	49.55	9.85	52.91	36.51	34.51	8.46	47.03	6.40	14.39	2.26

Although both varieties were very close in yield as well as quality characteristics, the use of regular HVI testing combined with AFIS testing can indeed show some differences in quality. The testing also reveals that variability does exist across replications and locations when the same cotton variety is tested using AFIS. In particular, the number of neps, the short fiber content, the dust content, the trash content, and the seed coat neps can be quite variable even within one variety at one location. However, within some of the other parameters such as nep size, length by weight and number, upper quartile length, short fiber content, and fineness, differences were more apparent between the two varieties, showing ST 5599 at a slight advantage over DP 555 in length by weight and number as well as in less short fiber content.

Conclusions

Use of AFIS testing with new varieties in combination with farm trial testing on emergence, vigor, yield and quality can provide additional information on cotton varieties if disease package information and confirmation on each variety is also reviewed. Used over multiple years, more information on variety stability in both yield and quality can be provided on individual varieties. This will provide farmers an added edge on variety selection that will help determine best picks under specific management, irrigation, and quality markets. Even more importantly, this testing in combination specifically with AFIS testing will show stability of specific varieties across locations and years. AFIS testing will also provide insight into possible management and variety changes that may enhance staple length and strength while managing to reduce short fiber content, reduce neps and seed coat fragments, reduce or eliminate fabric barre as well as reduce maintenance needs at textile factories. Providing the best quality cotton possible from the United States will place our cotton on par and in better competition with the needs and desires of the world-wide market.

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