Upland Cotton Variety Response to Row Spacing

S. H. Husman, J. C. Silvertooth, L. E. Jech,
and R. Wegener

Abstract

An Upland cotton row spacing study evaluation 30 in. vs. 38 in. rows was conducted in the Gila Valley of western Maricopa County in 1993. In addition, six Upland varieties were also evaluated on both the 30 and 38 in. row configurations. There were no row spacing differences in yield among five of the six varieties. Sure Grow 1001 had significantly lower lint yields when produced on 30 In. rows. DPL 5415 had significantly higher lint yields that the other five tested varieties on 38 in. rows. There were no variety differences in the 30 in. rows.

Introduction

Central Arizona has historically enjoyed the reputation of high cotton lint production and excellent fiber quality. High lint yields have been attainable due to favorable climatic conditions and the long season production potential. Production strategies have relied on the use of full season indeterminate variety selection capable of producing both a primary fruit set and a secondary fruit set commonly referred to as a "top crop".

However, production strategies are rapidly changing in the low deserts of Arizona due to a variety of factors. Increasing input costs and late season insect pressures coupled with flat commodity returns are forcing growers to consider a maximum economic yield versus a maximum agronomic yield strategy. As a result, producers are shifting to a reduced season cotton production format using medium maturity, determinate cotton varieties with objectives of maximizing primary fruit cycle production, minimizing late season insect pressures, and eliminating late season input costs.

With the shift in production trends towards season reduction, optimizing system efficiency becomes critical due to the lack of late season compensation time. A great deal of research has been conducted across the cotton belt investigating the lint yield effects of narrow (30 in.) versus conventional row spacing (38-40 in.). The rationale is to maximize incoming radiation and photosynthetic efficiency for carbohydrate production and resultant yield increase. An objective of narrow row spacing is to close the canopy as rapidly as possible and maximize the photosynthetic efficiency. In some areas of the cotton belt where solar radiation and season length can be limiting, the narrower row spacing has proved advantageous and many producers have converted to narrow row production. In addition, producers who have converted to 30 in. production also cite a decrease in time to maturity or an increase in earliness. This would be another advantage of narrow row spacing when attempting to reduce season length in the low desert.

Due to trends across the U.S. cotton belt and the fact that a reduced season production format is gaining acceptance in the low deserts, conversion to narrow row has received considerable interest by Arizona producers. Generally, incoming solar radiation is not a limiting factor on the Arizona cotton production season. As a result, canopy closure occurs rapidly and is rarely a limiting factor with conventional 38-40 in. row spacing. Several previous row spacing studies conducted on the University of Arizona Maricopa Agricultural Center (Silvertooth, et. al. 1990-93) have shown no significant yield increase nor decrease due to row spacing. However, there remains considerable interest in the cotton industry relevant to the use and conversion to narrow row. Significant acreage has converted to narrow

row, generally where soils are lighter and with steeper slopes than those found on the Maricopa Agricultural Center.

The major objective of this study was to characterize conditions which may favor narrow row cotton production over conventional row spacing if a positive response was found due to 30 in. row spacing. A site was chosen on a commercial farm in the Gila Valley of western Maricopa County where soils are lighter in texture with steeper slopes. In addition, an evaluation of several Upland varieties were also included in the experiment in an attempt to identify varieties which may be suitable for narrow row production.

Materials and Methods

A field experiment was conducted on a commercial farm in the Gila Valley of western Maricopa County to investigate the effects of variety and row spacing on Upland cotton lint yields. The test consisted of six varieties replicated four times in both a 30 in. and a 38 in. row configuration. The 30 in. row plots were 20 rows wide running the entire field length of approximately 1400 feet. The conventional row plots were 12 rows wide running the entire field length. The test was planted on April 14, 1993 using standard 10 (30 in.) and 6 (38 in.) row planters. The cotton was dry planted and irrigated up (Table 1).

In season management was conducted on a standard farm practice basis. Irrigation, nutrition, and pest control were all managed identically. In season plant growth and development measurements including plant height, number of mainstem nodes, fruit retention, nodes above top white bloom (NAWB) and canopy closure % were taken about every two weeks. All plots received the final irrigation on August 23, 1993.

The experiment was harvested on September 28, 1993. The center 10 rows of the narrow row half were harvested for yield evaluations while the center eight rows were harvested in the conventional row spacing plots. Seed cotton yield was measured with portable electronic field scales. Seed cotton subsamples were taken from each plot and ginned for lint % determinations. Results were statistically analyzed and reported herein.

Results and Discussion

There was a significant difference among varieties in the 38 in. row configuration but no differences among varieties in the 30 in. row spacing. DPL 5415 resulted in significantly higher lint yields than the other five tested varieties on a 38 in. row spacing. All varieties performed equally on the 30 in. row spacing (Table 2).

There were no significant differences in lint yields by row spacing with five of the six tested varieties. However, there was a significant lint yield reduction with Sure Grow 1001 between the conventional and narrow row format. Lint yields were reduced by 242 lbs./acre when SG 1001 was produced on a narrow row configuration. Of the six tested varieties, SG 1001 responded most negatively when produced under narrow row conditions. However, the conventional row spacing resulted in an average increase of 98 and 239 lbs./acre (Table 3).

Extensive plant development data was collected across all varieties and both row spacing configurations which resulted in several interesting observations (Table 4). Plants produced on 30 in. rows were generally taller with one additional mainstem node produced particularly after June 30th. As a result, height:node ratios increased in the 30 in. spacing versus the 38 in. spacing approaching with what may be considered a slight vegetative tendency although within reasonable guidelines. This is likely due to earlier canopy closure in 30 in. rows with the same plant population resulting in an increase in inner canopy plant population for sunlight. There were no differences in fruit retention in either 30 or 38 in. rows.

As mentioned previously, earliness has been attributed to narrower row spacing. This data does not confirm that report. Generally, Upland cotton is considered to be rapidly approaching cutout when the nodes above the top white bloom (NAWB) are 5 or less. On June 30, there were 8 NAWB in both the 30 and 38 in. rows. On July

12 the 38 in. rows had decreased to 5 NAWB, while the 30 in. rows had 6 NAWB. On July 28, the 38 in. rows had decreased to 1 NAWB while the 30 in. rows had 5 NAWB. This would indicate that there was actually a delay of maturity in the 30 in. row spacing as opposed to the 38 in. rows. Again, this is likely due to the inner canopy competition for incoming sunlight.

Conclusions

The results of this field experiment indicate that there is no obvious advantage to utilization of narrow row spacing in the low deserts of Central Arizona. In general, all measured variables from yield to earliness all resulted in the 38 in. row spacing being superior to the 30 in. rows spacing. These results also support the results of previous field studies conducted (Silvertooth, et.al. 1990-93) where no yield differences and a maturity delay were observed in the 30 versus 38 in. rows. Incoming solar radiation is not commonly limiting in the low desert and the time necessary to close canopy to maximize photosynthetic efficiency is rarely a yield limiting factor.

Acknowledgements

Sincere thanks are extended to Ted, Greg, and Stan Pierce for serving as cooperators on this project. Their willingness to tolerate two different row configurations within the same field and deal with associated management challenges is greatly appreciated.
In addition, the support provided by the Electrical District #8 is appreciated.

References

Silvertooth, J.C., T.F. Watson, L.I. Terry, and J.E. Malcuit. 1990. Evaluation of date of planting and irrigation termination on the yield of Upland and Pima Cotton. Cotton, A College of Agricultural Report. University of Arizona. Series P-81:6-12.

Silvertooth, J.C., T.F. Watson, L.I. Terry, and J.E. Malcuit. 1991. Evaluation of date of planting and irrigation termination on the yield of Upland and Pima cotton. Cotton, A College of Agriculture Report. The University of Arizona. Series P-87:1-14.

Silvertooth, J.C., T.F. Watson, J.E. Malcuit, and P.W. Brown. 1992. Evaluation of date of planting and irrigation termination on the yield of upland and Pima cotton. Cotton, A College of Agriculture Report. The University of Arizona. Series P-91:252=-273.

Silvertooth, J.C., T.F. Watson, J.E. Malcuit, and P.W. Brown. 1993. Evaluation of date of planting and irrigation termination on the yield of Upland and Pima cotton. Cotton, A College of Agriculture Report. The University of Arizona. Series P-94:27-39.

Table 1. Crop Management Record for the Conventional and Narrow Row Test 1993

Planting Date:	April 14, 1993
Field Length	1,410 Ft
Conventional Rows	12 Row Plots 38 inches
Narrow Rows	20 Row Plots 30 inches
Harvest Date:	September 28, 1993
Harvest Center 8 Rows (Conventional)	0.809 Acre Plot Size
Harvest Center 10 Rows (Narrow)	0.818 Acre Plot Size

Table 2. Row Spacing by Variety Study, Gila Bend, Arizona

Variety	Lint 38" (lbs. / A.)	Lint 30" (lbs. / A.)	Lint % 38"	Lint % 30"	Seed Cotton 38" (lbs. / A.)	Seed Cotton 30" (lbs. / A.)
DPL 5415	1573 a*	1447 a	35.1	34.1	4481 a	4242 a
KC 311	1357 b	1285 a	32.7	32.3	4151 a	3980 a
CB 407	1335 b	1306 a	33.3	32.5	4008 a	4019 a
HS 44	1406 b	1356 a	33.8	33.2	4160 a	4083 a
SG 1001	1399 b	1157 a	32.9	32.5	4253 a	3561 a
GC 210	1398 b	1329 a	34.1	34.7	4099 a	3835 a
mean =	1411	1313			4192	3953

Planting Date: April 14, 1993
Harvest Date: September 28, 1993
*Means followed by the same letter are not significantly different (Fisher's LSD $\alpha=0.05$)

Table 3. Analysis of Variance Results For Lint Yield by Row Spacing

	ROW SPACING	
	Lint 38"	Lint 30"
DPL 5415	1573a	1447a
KC 311	1357a	1285a
CB 407	1335a	1306a
HS 44	1406a	1356a
SG 1001	1399a	1157b
GC 210	1398a	1329a

* Means followed by the same letter are not significantly different (Fisher's LSD $\alpha = 0.05$)

Table 4. Plant Growth and Development

Date	Plant Ht(in) 38"	Plant Ht(in) 30"	#Nodes 38"	#Nodes 30"	Hgt. Node 38"	Hgt. Node 30"	Fruit Ret. 38"	Fruit Ret. 30"	NAWB 38"	NAWB 30"
6-3-93	11	10	9	9	1.2	1.1	NA	NA	NA	NA
6-16-93	16	16	13	13	1.3	1.2	89	81	NA	NA
6-30-93	28	26	17	17	1.6	1.5	90	90	8	8
7-12-93	30	33	19	20	1.6	1.6	76	83	5	6
7-28-93	33	37	21	22	1.6	1.7	68	73	1	5
8-13-93	35	39	22	23	1.6	1.7	54	51	0	0
9-14-93	38	44	24	26	1.6	1.7	41	36	0	0

*NAWB = Nodes Above Top White Bloom