Mechanized Picking of Cotton Cultivated in Narrow Rows in Greece

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ABSTRACT

The early cotton picker, adjusted to pick at 1 metre spacing, imposed this spacing on the traditional cotton cultivation system. Subsequent experimental results proved the superiority of narrower row spacing in many cases. Accordingly, in the 1980's, many farm machinery companies in the USA started to convert existing cotton pickers to pick cotton sown in 0.75m rows. However, the superiority of this is expected to become more evident with modern low-input agriculture with smaller crop growth and late canopy closure under the imposed reduced inputs in the near future. This mechanized system started being evaluated for the first time in Greece, in a field experiment (split-split plot experiment with five blocks) carried out in two different locations in Thessaly in 1997. In particular, the growth and development of two important Greek cotton cultivars (i.e. Corina and Zeta-2) was studied for three plant populations (e.g. 10, 20 and 30 plants/m^2) and two sowing row-spacings, the modern 0.75 m versus the classical row spacing of 1.0 m. It was found that the crop cultivated in narrow rows was generally earlier than that cultivated in conventional rows. The plants growing in narrow rows were smaller and more compact. They attained a greater leaf area index and were characterized by more flowers and bolls, giving a clear (though not statistically significant) evidence of an increased final yield. The superiority of dense rows was more apparent in the more compact cultivar "Corina". No significant difference was found for cotton-quality characteristics among the various treatments. This is an ongoing investigation.

Introduction

The main objective of modern agriculture is the optimization of crop productivity through low input farming. Mechanized cotton cultivation in narrow rows is a promising approach. Dense populations and narrow row cultivation of cotton are two subjects that have received a great deal of attention (Galanopoulou, 1977; Lefkopoulou *et al.*, 1980; Williford, 1992; Heithold *et al.*, 1993). In the last decade, researchers in the USA demonstrated an increase in cotton production by 12-14% when cultivating at rows of 0.75 m rows rather than 1 m (Williford, 1992). Additional research data from Mississippi Delta have shown an increased cotton yield by 6.5-9% with narrower rows (Williford, 1992). This yield increase was attributed to the more uniform distribution of the crop stand and thus the better exploitation of solar radiation (Wilhelm *et al.*., 1985; Robinson, 1991), and earlier crop development (Mauney, 1992). These results demonstrate earlier crop maturation, greater water conservation, reduced inputs of pesticides and energy, and better use of solar radiation (Weir, 1996).

Harvesting in narrow rows has been the main restriction of this cultivation system. In 1982, some cotton pickers were converted to pick cotton at rows The usual cultural practices were applied in the study area. A basal dressing of 65 kg N and 100 kg P per of 0.75 m instead of 1 m. This was expanded in subsequent years. In 1989 John Deere company released its new 0.75 m row spindle pickers followed by the IH Case company. Currently, adjustaqble pickers have the ability to pick at both row spacings.

The objective of this study is to evaluate growth and development of cotton grown on 0.75 m rows and mechanically harvested for first time in Greece. The experimentation will last at least three years. In this paper, the results of the first year are presented.

Material and methods

A field experiment was conducted at two locations in central Greece in 1997. The sites that represent major cotton production areas in the country are: a) Stefanovikio, Magnesia (farmer's field), and b) Palamas, Karditsa (National Agricultural Research Foundation). The experiment was 2x2x3 factorial, arranged in a split-split-split plot design with five blocks at site (a) and 4 blocks at site (b). Main plots were two row spacings, 1 m and 0.75 m, subplots were two cultivars: Zeta2 and Corina, and sub-subplots were three plant populations: 10, 20 and 30 plants/m². However, only the results of row-spacings and varieties are presented in this paper.

hectare was applied. Sowing took place April 23-25 with a machine of high accuracy.

At site (a) three hand pickings (dates: 22/9, 1/10, and 20/10) were realized, and one mechanical picking (October 2nd) using a cotton harvesting machine of picker type (IH Case 2055) capable of picking narrow rows. At site (b), two hand pickings (dates: 24/9 and 14/10) were realized, and a mechanical harvesting (October 15th) with a conventional cotton harvester (John Deere 9920) that is not suitable for narrow rows, so special care had to be taken.

Growth analysis was carried out, based on five samplings during the growing period at each site. Experimental results were statistically processed using broadly known computer software (Microsoft Excel and MSTAT).

Results and discussion

Row spacing did not affect total yield significantly, estimated by hand and mechanical picking. However, both varieties gave numerically higher yield at the 0.75 m spacing at Palamas while at Stefanovikio only Corina that is characterized by a compact plant type, gave numerically higher yield in narrow rows. At this location, Zeta2 with a bigger plant type, behaved slightly better in 1m rows (Table 1).

At the location of Palamas, both varieties exhibited early maturity, expressed by the yield at the first picking as percentage of total yield, when grown on narrow rows. This trend was not supported at Stefanovikio (Table 1).

Boll weight was not substantially affected by row spacing. Only Corina gave slightly smaller bolls at Palamas probably due to its higher boll loading (Table 1).

Growth analysis showed that plants are smaller on 0.75m rows than on 1m rows (Table 1). Cotton plants in narrow rows had higher dry weight per square meter in July but this difference disappeared in subsequent stages. This indicates that vegetative growth was retarded in conventional rows.

Cotton plants of both cultivars grown on conventional rows, at both locations, showed a delayed development of leaf area compared to cotton plants grown on narrow rows until the end of July. Subsequently these differences generally disappeared (Fig. 1).

Lint percentage was not substantially affected by row spacing.

Conclusions

Preliminary results indicate that yield and earliness advantages reported for narrow row cotton may be realized. The experiments will be continued in the next two years.

Currently, there are some problems regarding the availability of narrow row pickers in Greece. In the near future, new adjustable picker models suitable for different row spacing are expected to be introduced. Some of such models have already entered the Greek market and a number of the conventional pickers will be converted.

References

Galanopoulou-Sendouca, S. (1977): Growth and Development of Cotton (*Gossypium hirsutum L.)* Under Different Plant Density and Sowing Period. PhD Thesis, University of Thessaloniki, Dept. of Agriculture: 83.

Heitholt, J.J., W.T. Pettigrew and W.R. Meredith, Jr. (1993): Growth, boll opening rate, and fiber properties of narrow-row cotton . Agron. J. 85:590-594.

Lefkopoulou, S., S. Galanopoulou and A. Chlichlias. (1980): Cotton in twin sowing lines. Agricultural Research IV: 257-276.

Mauney, J. (1992): What is the best plant population for narrow-row cotton? Cotton Grower April: 32G.

Robinson, E. (1991): The development of the first narrow-row cotton picker involved more than just row spacing, Cotton Grower, July 1991, Pp. 12-13.

Weir, B. (1996): Narrow row cotton distribution and rationale. In: Beltwide Cotton Conf. P Dugger and D. Richter (Ed). Natl. Cotton Council Memphis TN. Pp. 65-66.

Wilhelm, S., J.E. Sagen and H. Tietz. (1985): Phenotype modification in Cotton for control of *Verticillium* with through dense plant population culture. Plant Disease. Vol. 69 No. 4: 283-288.

Williford, J. (1992): Production of cotton on narrow-row spacing. Transaction of the ASAE: 35(4):1109-1111.

Table 1. Effect of row spacing on yield, earliness, boll weight and plant height of two cotton cultivars grown at two Central Greek locations, in 1997.

Variety .	Row spacing	Seed Cotton Yi eld		Boll weight	Lint	Final plant
		Total	First harvest	First pick	Outturn	height
	(cm)	(g/m²)	(%)	(g)	(%)	(cm)
Stefanovikio						
Zeta2	100	415	81	7,5	40,1	85
Zeta2	75	403	80	7,6	40,4	78
Corina	100	409	88	5,9	42,3	84
Corina	75	438	88	5,9	42,6	78
LSD (0,05)		ns	6.7	ns	ns	5.8
Palamas						
Zeta2	100	385	65	7,7	39,3	103
Zeta2	75	409	76	7,6	39,8	96
Corina	100	399	85	6,2	40,4	108
Corina	75	413	91	5,7	40,3	94
LSD (0,05)		ns	ns	ns	ns	ns

(ns not significant at p=0.05)

Figure 1. Leaf Area Index (LAI) of two cultivars grown at 1 m and 0.75 m row-spacing, at two Greek locations in 1997.