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Measurement of Earliness in Upland Cotton

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Abstract: Earliness studies were carried out on four strains (CRIS-19, CRIS-52, CRIS-133, CRIS-134) and one commercial variety CRIS-9 developed by CCRI Sakrand, during 1997 cotton season by evaluating five characters viz., plant height, main stem node number bearing 1st sympodial branch, number of days to bloom first flower / boll and number of days to attain 5-NAWF (Nodes Above White Flower) stage for their effectiveness in measuring earliness. The results demonstrated that the advance strains tested were 2 to 3 days earlier than CRIS-9 in opening their first flower, 2 to 6 days in attaining the stage of 5 – NAWF stage and 7 to 10 days in opening their first boll. It was also found that the characters attaining date of 5-NAWF stage and date of opening first boll were more reliable indicators of earliness as compared to others.

Key words: Earliness, 5-NAWF stage, sympodial branch, cotton

Introduction

Earliness of the crop maturity is important in the avoidance of frost damage, insect and disease buildup, soil moisture depletion and weathering of the open cotton. Earliness also has other advantages, like allowing rotation with a winter crop or extending the season for harvesting and ginning operations. Therefore, greater emphasis on earliness has been advocated by cotton breeders in order to increase production efficiencies by decreasing input of fertilizer, water, crop protection and in part, by pest management consideration.

Earliness in cotton cannot be measured easily because of the fact that the cotton plant, flowers and sets bolls over a long period of time. Earliness is influenced by how early the cotton plant begins to flower, rate at which the flowers open and the length of time required for the boll to mature. Bourland, *et al.* (1991) observed that the plant is the best indicator of actual growth and development at conditions within any production field. The nodes above white flower (NAWF) measurement is an indicator of fruit load, relative to vegetative growth and can be used to monitor maturation of plants after flowering. An established "cutout" benchmark will provide a focal point for all management decisions from cultivar selection to fertility and pest control programs.

Godoy (1994) worked on several early lines and one full season cultivar to gain information on 15 earliness estimators. The results indicated that number of nodes to the first fruiting branch, plant height, date of first square, date of first flower and date of first open boll can be used for efficient selection of early genotypes.

Ray and Richmond (1966) suggested that the node number of the first fruiting branch is a morphological measure of earliness of good heritability and is highly correlated with earliness as estimated through picking data of seedcotton.

Solis *et al.* (1989) conducted field trials during 1988-89 on 18 cotton cultivars known to exhibit substantial variation in phenological and yield parameters. The cultivars were classified as early, intermediate and late maturing. They further concluded that days to first flower from sowing provided a reliable estimation of earliness of maturity and the mean maturity date gave the best yield estimate. Richmond and Radwan (1962) made a comparative study of seven methods of measuring earliness. Three of the measurements were based on the number of days from planting to the date of a specific phenological event (i.e. date of first square, first bloom, and first open boll). The other four measurements were based on the ratio of various fractions of the crop yield to the total crop yield. They concluded that out of seven methods used, the most practical was the combined weights of the first and second pickings expressed as a percentage of the total seedcotton harvest.

The objective of this study was to ascertain the suitability of phenotypic characteristic for the measurement of earliness in newly advanced strains of upland cotton.

Materials and Methods

A field experiment was conducted at the experimental area of the Department of Plant Breeding and Genetics, Sindh Agriculture University, Tandojam, during 1997 cotton season. The trial comprised of four advanced strains (CRIS-19, CRIS-52, CRIS-133 and CRIS-134) and a standard cultivar CRIS-9 evolved by the CCRI, Sakrand. The experiment was conducted in a randomized complete block design with four replications. The row-to-row distance was maintained at 2.5 feet whereas plants within rows were thinned out to maintain a distance of 8 - 9" in between. Each treatment plot contained three rows, 17.5 feet long. All the agronomical, nutritional and plant protection requirements of the experiment were completed when needed. Five plants from the central row of each cultivar per replication were monitored randomly.

Phenotypic characters viz., plant height, main stem node number bearing first sympodial branch, days taken to open first flower and boll and days taken to attain five nodes above white flower (NAWF) stage were studied.

The data were statistically analyzed for analysis of variance (ANOVA), adopting Snedecor and Cochran (1967) procedure, also Duncan's Multiple Range Test (DMRT) was carried out for comparison of means.

Results and Discussions

Mean squares obtained from analysis of variance (Table 1) showed, non-significant difference among the cultivars for their plant height at maturity and number of main stem nodes on which first sympodial branch was developed. However, Table 2 showed that average plant height varied from 74.1 cm (CRIS-133) to 91.2 cm (CRIS-9) and first sympodial branch was produced on main stem at node number 6.4 to 7.4 in all of the cultivars under study.

Table 1: Mean squares obtained from the ANOVA of five quantitative traits of five upland cotton cultivars

Source of variation	Replications	Cultivars	Error
Degrees of freedom	3	4	12
Plant height (cm).	125.45	202.41 [NS]	81.23
Main stem node number bearing first sympodial branch.	0.23	0.65 [NS]	0.23
Days taken to open first flower	6.00	5.62*	1.12
Days taken to attain five nodes above white flower.	3.78	21.57*	5.07
Days taken to open first boll.	6.37	65.76*	13.45

* Significant at 0.05 level of probability NS Stands for non-significant

Table 2: Mean values of five quantitative traits of the five upland cotton cultivars

Character	CRIS-9	CRIS-19	CRIS-52	CRIS-133	CRIS-134
Plant height (cm).	91.2	83.66	81.02	74.1	90.6
Main stem node number bearing first sympodial branch.	7.4	7.3	6.8	6.4	6.9
Days taken to open first flower	48.50 a	45.50 c	46.25bc	47.00abc	47.75 ab
Days taken to attain five nodes above white flower.	77.25 a	74.75ab	74.75ab	71.00 c	73.00 bc
Days taken to open first boll.	92.30 a	82.30 b	83.20 b	83.50 b	85.70 b

Within rows means followed by different letters are significantly different at the 0.05 probability level based on DMRT.

Number of days taken to open first flower: The ANOVA (Table 1) showed significant difference among cultivars, for number of days taken to open first flower. However, it may be seen from Table 2 that CRIS-9 took 48.5 days to open its first flower, while CRIS-19 and CRIS-52 took significantly less number of days i.e. 45.5 and 46.25, respectively to open their first flower. However, CRIS-133 and CRIS-134 opened their first flower on 47.0 and 47.75 days respectively. So statistically there was non-significant difference among them.

Number of days taken to open first boll: There was a significant difference among cultivars for number of days taken to open first boll (Table 1). It may be seen from Table-2 that CRIS-19 was earliest in opening its first boll 82.3 days after sowing and 36.83 days after opening of first flower. CRIS-52, CRIS-133 and CRIS-134 were also significantly earlier than CRIS-9 and opened their first boll at 83.2, 83.5 and 85.7 days respectively after sowing.

Five nodes above white flower stage (days): The ANOVA (Table 1) showed significant difference among cultivars for the number of days taken to attain the stage of 5-NAWF. It is obvious from Table-2 that CRIS-133 had reached the stage of 5-NAWF after only 71 days from sowing, followed by CRIS-134, CRIS-19, CRIS-52 and all were also significantly earlier than CRIS-9 to stop the nodal development and reached 5-NAWF stage at 73, 74.5 and 74.75 days respectively after sowing, where as the CRIS-9 had reached 5-NAWF stage at 77.25 days after sowing. Bourland *et al.* (1991) suggested that using the NAWF technique, variation in maturity of cultivars could be distinguished early in the flowering stage. Late maturing cultivars have relatively more NAWF at first flower and throughout the season than early maturing cultivars.

These results clearly indicate that the four advance strains were 2 to 3 days earlier than CRIS-9 in opening their first flower and 2 to 6 days earlier in attaining the stage of 5-NAWF, and were 7-10 days earlier in opening their first boll. This was mainly because the CRIS-9 took about 6-7 days more to mature its bolls than the remaining cultivars.

It was therefore, concluded that decisions regarding selection for earliness can be made early in the season keeping in view the date of opening first boll and the date of attaining 5-NAWF stage. So in this case CRIS-9 showed tendency of late maturity by about one week.

Further crop management decisions regarding insect pest control, irrigation and fertilizer applications can be taken keeping in view the stage of 5-NAWF as a reliable indicator of 'cutout' stage. The results further suggest that the early maturity in cotton is a complex genetic trait influenced by several plant phenotypic characters which could be combined through appropriate breeding method for developing suitable early maturing high yielding cultivars without loss of seedcotton yield.

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