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Measuring Earliness in Cotton Through Bartlett's Earliness Index

M. A. Chang[1], Rehana Anjum[2] and A. R. Soomro[3]
[1]Department of Plant Breeding & Genetics, Sindh Agriculture University, Tandojam, Pakistan
[2,3]Central Cotton Research Institute, Sakrand Sindh, Pakistan

Abstract: An experiment was conducted to evaluate the earliness of four advance strains (CRIS-19, CRIS-52, CRIS-133 and CRIS-134) against one commercial variety CRIS-9 by using Bartlett's Earliness Index.
According to Bartlett "The higher the value of the index the earlier would be the variety". The results of this study demonstrated that CRIS-133 was recorded as earlier variety with 0.745 earliness index followed by CRIS-134 (0.719). CRIS-9 was observed as late variety with earliness index of 0.658 as compared to all other advance strains included in the test.

Key words: Bartlett's earliness index, picking dates, weathering of open cotton, earliness

Introduction

The attainment of earliness of crop maturity and high lint yield has been a primary research objective of cotton breeders and agronomists. Earliness of the crop maturity is important in the avoidance of frost damage, insect and disease buildups, soil moisture depletion and weathering of the open cotton. Early varieties need less number of irrigations, fertilizer, insecticide applications, reduced costs, escape pink bollworm and whitefly attack and leave sufficient time for following wheat sowing preparations.

Proper maturity period of a crop is very useful to cut down the production cost, to reduce the unnecessary vegetative growth and to take the maximum yield in a given growing condition. In an early maturing material, the time available for a damaging buildup of insect populations is reduced.

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 ratios of various fractions of the crop yield to the total crop yield. They concluded that of the 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.

Richmond and Ray (1966) compared three product quantity measurements of earliness: amount of crop harvested (ACH); percentage of crop harvest (PCH); and mean maturity date (MMD). They pointed out that the ACH or PCH measurements were more effective than MMD when the major consideration was maximum yield in minimum time; and of the two, ACH appeared to be the most desirable. They also noted the importance of the date or period upon which the calculation was based. On the other hand, MMD was considered to be the most discriminating and reliable of the three measurements when earliness, without regard to yield was the prime objective.

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.

Munro (1987) opined that earliness could be explained as potential of cotton plants to attain an acceptable level of yield in shortest possible time from planting, the seedcotton yield is a product of number of open bolls per unit area and the weight of seedcotton per boll. Oosterhuis, (1990) reported that a large percentage of the total yield is derived from the central portion of the canopy, approximately between main stem nodes 6 and 13, which coincides with the distribution of leaf area within the canopy. Heitholt (1993) has reported that the number of bolls produced per unit area is the product of the number of open flowers produced and percentage of flowers that develop into open bolls. Therefore, whole plant boll retention (total bolls/flowers) is an important process affecting seedcotton yield.

Godoy, (1994) worked on seven earliness 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. Although total number of flowers, flower index and maturity index appeared unsuitable as selection criteria, they could be used as indicators of differences between genotypes that are evaluated for yield.

In cotton Bartlett's earliness index is the method by which cotton breeder can measure the earliness of his material easily and accurately. Therefore, the studies were conducted to measure the earliness of CRIS varieties developed by CCRI Sakrand through Bartlett's earliness index.

Materials and Methods

A field experiment was conducted at the experimental area of the Department of Plant Breeding and Genetics, Sindh Agriculture University, Tando Jam, 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 Central Cotton Research Institute, 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" between plants. 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. A random number of five plants from the central row of each cultivar per replication were monitored individually. Earliness was measured by adopting Bartlett's (1973) index given as under:

$$\frac{P1 + (P1 + P2) + (P1 + P2 + P3) + \ldots\ldots\ldots\ldots (+ Pn)}{n\,(P1 + P2 + P3 + \ldots\ldots\ldots\ldots + Pn)}$$

Where (P1, P2, Pn) being the weight of seedcotton picked during first, second and n^{th} picking and n is the total number of pickings. The higher the value of the index the earlier would be the variety. The data were statistically analyzed for analysis of variance (ANOVA) adopting Snedecor and Cochran (1971) procedure.

Results and Discussions

The plants of all cultivars were ready for the first pick at 97 days after planting (DAP). The remaining four pickings were done after regular intervals of about ten days. Analysis of

Table 1: Mean squares (ANOVA) for pick-wise seedcotton yield (g) per plant for five cultivars

Source of variation	Replication	Cultivar	Error
Degree of freedom	3	4	12
First picking (97 DAP)	15.79	31.34*	8.38
Second picking (107 DAP)	5.33	10.36 NS	9.85
Third picking (126 DAP)	57.59	52.27 NS	34.89
Fourth picking (134 DAP)	2.01	1.90 NS	2.89
Fifth picking (148 DAP)	7.59	1.26 NS	5.05

* Significant at 0.05% level of probability NS stands for non-significant DAP stands for days after planting

Table 2: Picking-wise mean performance for seedcotton yield (g) and seedcotton contribution percentage in five American upland cotton cultivars

Number of pickings	CRIS-9	CRIS-19	CRIS-52	CRIS-133	CRIS-134
Picking-wise seedcotton yield (g)					
First picking (97 DAP)	4.74	11.05	9.79	11.98	9.72
Second picking (107 DAP)	11.14	11.61	12.81	8.41	11.13
Third picking (126 DAP)	26.23	20.36	20.96	16.27	19.31
Fourth picking (134 DAP)	2.67	2.19	1.86	0.90	1.39
Fifth picking (148 DAP)	2.11	2.93	2.34	1.53	1.67
Total	46.89	48.14	47.76	39.09	43.22
Picking-wise seedcotton contribution (%)					
First picking (97 DAP)	9.83	23.21	19.89	31.12	22.87
Second picking (107 DAP)	24.63	23.82	27.28	21.33	25.76
Third picking (126 DAP)	55.85	41.7	43.81	41.01	44.28
Fourth picking (134 DAP)	5.31	4.18	3.72	2.60	3.28
Fifth picking (148 DAP)	4.38	7.09	5.29	3.94	3.81
Total	100	100	100	100	100

DAP stands for days after planting

Table 3: Bartlett's earliness index calculated for five American upland cotton cultivars

Characters studied	CRIS-9	CRIS-19	CRIS-52	CRIS-133	CRIS-134
Bartlett's Earliness Index	0.658	0.707	0.708	0.745	0.719

variance (Table 1) showed significant differences among cultivars only for first picking which was done at 97 days after planting, but non-significant differences were observed for remaining four pickings done at 107, 126, 134 and 148 days after planting respectively. However, Table 2 indicated that highest seedcotton yield (48.14 g) per plant was harvested from CRIS-19 followed by CRIS-52 that yielded 47.76 g per plant. Numerically lowest seedcotton yield (39.09 g) per plant was picked from CRIS-133.

It was revealed from Table 1 that significant differences among five cultivars for their seedcotton yield (g) per plant were observed during the first pick, whereas the cultivars did not show any significant differences in their seedcotton yield harvested from the second, third, fourth and fifth pickings. However, it may be seen from the Table 2 that CRIS-9 contributed significantly lowest seedcotton yield (4.74 g per plant) than all the other cultivars under study during the first pick, while CRIS-133 produced highest seedcotton yield (12.0 g per plant). The next best was CRIS-19 that produced 11.1 g per plant seedcotton yield during the first pick.

Table 2 demonstrated that CRIS-133 contributed significantly highest (31%) of its total yield, while cultivars CRIS-19 and CRIS-134 contributed 23% and 22%, respectively of the total seedcotton yield per plant during their first pick. Whereas, CRIS-9 contributed only 9.8% of the total seedcotton yield per plant during first pick. The cumulative contribution percentage of seedcotton weight showed that after second pick the gap among the cultivars narrowed down and by the end of third pick which was carried out 126 DAP, the percent contribution of seedcotton yield per plant was almost same, as 90.3, 88.7, 91.0, 93.5 and 92.9% respectively of the total seedcotton yield was produced by the cultivars CRIS-9, CRIS-19, CRIS-52, CRIS-133 and CRIS-134, respectively by the end of third pick (126 DAP). These results clearly indicate that CRIS-9 was late only in the initial stage but after about two weeks it reached to the maturity level of other cultivars/strains. Thus once again from the picking data earliness of advanced strains by about one week was established. The results also confirm the opinion of Richmond and Radwan (1962) who opined that the most practical method of measuring earliness is the combined weights of the first and second pickings expressed as percentages of the total seed cotton harvested.

The Bartlett's earliness index (the higher the value of the index the earlier would be the variety) of each cultivar as defined in material and methods was also calculated to establish the earliness of the varieties. The data presented in Table 3 indicated that CRIS-133 had the highest earliness index of 0.745; accordingly this variety was rated as the early variety followed by CRIS-134 with 0.719 earliness index. The CRIS-9 was observed as late variety having lowest earliness index of 0.658.

References

Bartlett, M. S., 1973. Some examples of statistical methods of research in Agriculture and applied Botany. In J. Roy Statist. Soc. B., 4: 37-70

Godoy, S., 1994. Comparative study of earliness estimators in cotton (*Gossypium hirsutum* L.) Red de Fibras-Algodon, CIFAP-Laguna-INIFAP, Apdo, Postal 247, Torreon, Mexico. ITEA-Production-Vegetal, 90:3, 175-186

Heitholt, James. J., 1993. Cotton boll retention and its relationship to lint yield. Crop Sci., 33: 485-490

Munro, J. M., 1987. Cotton. (Tropical Agriculture Series). Longman Group, U. K. Limited

Oosterhuis, D. M., 1990. Growth and development of a cotton plant. In W. N. Miley and D. M. Oosterhuis, (ed.) Nitrogen nutrition in cotton. Practcal issues. Proceedings of the First Annual Workshop for practicing Agronomists. American Society of Agronomy, pp: 1-24

Ray, L. L. and T. R. Richmond, 1966. Morphological measures of earliness of cotton. Crop Sci., 6: 527-631

Richmond, T. R., and L. L., Ray, 1966. Product quantity measure of earliness of crop maturity in cotton. Crop Sci., 235-239

Richmond, T. R., and Sami, R. H. Radwan, 1962. A comparative study of seven methods of measuring earliness of crop maturity in cotton. Crop Sci., 2: 394-400

Snedecor, G. W. and W. G. Cochran, 1971. Statistical Methods. The Iowa State University Press, Ames. IOWA, U S A.