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Assessing of Plant Traits for Predicting Earliness in Upland Cotton (*Gossypium hirsutum* L.)

Abdul Wahab Soomro, Abdul Razzaque Channa, Muhammad Zahir Ahsan, Muhammad Saffar Majidano and Faiz Hussain Panhwar

Plant Breeding Section, Central Cotton Research Institute Sakrand, Sindh, Pakistan

Abstract: The present study was conducted to determine the early maturing genotypes by evaluating plant traits in ten advance strains of upland cotton varieties developed by Central Cotton Research Institute Sakrand for exploitation more effectively and efficiently in future breeding programs. The analysis of variance of varieties was highly significant for all the traits studied. Among the genotypes CRIS-613 proved early maturing as characters studied viz. node number of 1st sympodial branch (5.07), days taken to 1st flower (42.03), set maximum number of bolls at 90 and 150 days after planting and opened highest bolls at 120 and 150 days after planting. Whilst CRIS-342, CRIS-611, CRIS-617 and CRIS-618 produced lowest followed by node number of 1st sympodial branch, days taken to 1st flower, number of bolls setting and opening respectively. Therefore, it is suggested that CRIS-613, CRIS-611, CRIS-617, CRIS-618 and CRIS-342 are considered as early maturing genotypes. Whereas CRIS-610, CRIS-619, CRIS-620 and CRIS-621 produced more number of nodes for 1st sympodial, more days taken to 1st flower, setting minimum numbers of bolls and open less numbers of bolls, it indicated that these are the late maturing genotypes. It is further concluded that traits viz. node number of 1st sympodial branch, days taken 1st flower, setting of bolls at 90, 120 and 150 days after planting and bolls opening at 120 and 150 days after planting are more effective and efficient indicators for selecting early maturing genotypes in upland cotton.

Key words: Earliness · (*Gossypium hirsutum* L.) · Maturity · Boll formation and opening

INTRODUCTION

Early maturity is an important character for cotton varieties which are being recommended for cotton growers as mature earlier and harvest sooner in Sindh as well as overall Pakistan by recent past breeders. Earliness is decidedly character that cotton breeders want to have in commercial varieties. What generally inferred from earliness is the extent to which square initiation, flower occurrence, boll formation and complete boll opening occurs in relation to time of planting under a certain set of environments.

Brown [1] has stated that earliness usually helps in reducing damage caused by insect pests and in some areas by frost. Khan and Malik [2] have also reported the case for breeding early varieties as early varieties need less number of irrigation, escape bollworm attack and leave enough time for double cropping. Genetic components of earliness reported by various authors, such as Ray and Richmond [3] have shown that a morphological traits, the number of nodes to the first fruiting branches, a yield related trait and mean maturity date are good estimates of earliness. Godoy [4] 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 mature genotypes.

Kairon and Singh [5], Baloch and Baloch [6] carried out an extensive study on morphological trait so as to predicted earliness in cotton genotypes. They observed them as having sympodial branches at lower nodes, short sympodial branches, short internodes, medium or smaller leaves, moderate boll size, higher percent of boll opening at earlier stages of crop growth were the most important plant attributes for short season/early maturing cotton varieties. Therefore, various plant characters have been

Corresponding Author: Abdul Wahab Soomro, Plant Breeding Section, Central Cotton Research Institute Sakrand, Sindh, Pakistan. E-mail: soomro.wahab@outlook.com.

observed to differentiate for study of early maturing cottons in order to facilitate cotton breeders more effectively and efficiently in utilization of breeding material in future breeding programs.

MATERIALS AND METHODS

The experiment was conducted at the field of Central Cotton Research Institute Sakrand during 2014 cotton season. A randomize complete block design with four replications was used to assure maximum expression of earliness parameters by all varieties. The row to row distance was maintained at 75 cm; whereas, plants within rows were thinned out to maintain a distance of 30 cm between plant to plant. All the inputs and plant protection measures were applied when needed. The data was recorded through randomly selection of five plants from each genotype per replication individually for characters viz. node number of 1st sympodial branch, days to open first flower, bolls formed at 90, 120 & 150 days after planting, bolls opened at 120 & 150 days after planting. Trial included ten advance strains all developed by Central Cotton Research Institute Sakrand, including one commercial variety CRIS-342.

RESULT AND DISCUSSIONS

The ten advance strains genotypes were studied for earliness parameters at Central Cotton Research Institute Sakrand. The analysis of variance presented in Table-1, which revealed that highly significant result among varieties for all the traits viz. node number of 1st sympodial branch, days open 1st flower, bolls formed at 90, 120 and 150 days after planting respectively. Bolls opened at 120 and 150 days after planting. The mean performance result presented trait wise.

Node Number of 1st Sympodial Branch: The result of node number of 1st sympodial branch presented in Table-2, it revealed that CRIS-613 has lowest node number of first

Table 1: Analysis of variance (ANOVA) mean square values of ten genotypes

Source of Variation	Replication	Genotypes	Error
D.F	2	9	18
Node number of 1st sympodial branch	0.53	1.86**	0.61
Days open 1st flower	3.83	23.68**	3.31
Bolls formation at 90 DAP	3.66	16.87**	5.83
Bolls formation at 120 DAP	11.21	102.12**	58.82
Bolls formation at 150 DAP	5.07	181.91**	46.89
Bolls opening at 120 DAP	41.84	65.18**	21.1
Bolls opening at 150 DAP	28.62	103.29**	17.49

* = significant, ** = highly significant, ns = non significant

Please redesign table 1 as follows:

SOV	d.f	Node number of 1st sympodial branch
Replications	2	
Genotypes	9	
Error	18	

Table 2: Mean performance of ten genotypes regarding earliness indicators

Genotypes	NNOFS**	Days open 1st flower	Boll Formation at 90 DAP*	Boll Formation at 120 DAP	Boll Formation at 150 DAP	Boll opening at 120 DAP	Boll opening at 150 DAP
CRIS-610	8.47a	49.33ab	10.93bcd	26.53c	42.13bc	14.20c	28.10e
CRIS-611	7.07ab	43.49de	12.67abc	33.93abc	52.60ab	18.87bc	38.87bc
CRIS-612	6.37abc	44.67cde	8.80cd	35.27abc	49.67ab	17.60bc	35.60cd
CRIS-613	5.07d	42.03e	15.20a	43.19ab	63.80a	27.53a	47.72a
CRIS-617	5.90bcd	45.19bcd	11.27abcd	37.87abc	48.13abc	25.27ab	38.57bc
CRIS-618	5.33cd	43.51de	13.20ab	36.17c	49.80ab	21.47bc	41.43bc
CRIS-619	6.40abc	44.27cde	9.07bcd	31.12bc	43.93bc	17.07c	32.07cd
CRIS-620	7.83ab	51.13a	7.87d	32.53abc	39.33c	17.07c	32.07cd
CRIS-621	8.80a	48.63bc	8.67cd	30.93bc	41.47c	15.53c	29.03de
CRIS-342	6.03abc	43.10de	13.50ab	44.47a	62.70a	25.33ab	43.97ab
LSD @0.05%							
Genotypes	1.33	3.12	4.14	13.15	11.74	7.87	7.17

**NNOFS: node number of first sympodial, *DAP: day after planting,

sympodial branch 5.07. Meanwhile the varieties CRIS-618, CRIS-617 and CRIS-342 followed the lowest node number of first sympodial branch 5.33, 5.90 and 6.03, respectively. While, the variety CRIS-621 (8.80) and CRIS-610 (8.47) set maximum node number of 1st sympodial branch. The result suggested that the variety set lower node number of 1st sympodial branch assumed early in maturity. Whereas late maturing variety have more number of nodes at 1st sympodial. Baloch and Baloch [6] used data on first sympodial node number on maim stem, sympodial branch length, inter node length and percent first pick to measure earliness and suggested that there is strong relationship between early maturity and lower sympodial branch node number. Lakho *et al*. [7] reported that variety producing sympodial branch at lower node number are early mature, whereas late maturing variety set more number of node at 1st sympodial. Ahmed and Malik [8] estimated that one node decrease in sympodial branch matures the cotton crop by approximately 4 to 7 days earlier. Jatoi *et al*. [9] reported that lower node number to form 1st sympodial branch will be highly correlated with earliness and heat tolerance.

Days Open First Flower: The varieties which open its first flower ultimately possess boll formation and opening earlier, which help in selection of early maturing genotypes. The trait days open to first flower presented in Table 2, it shown the range 42.03 to 51.13 days. The variety CRIS-613 taken minimum days to open its first flower after 42.03 days, whereas CRIS-342, CRIS-611 and CRIS-618 also taken minimum days to open its first flower on 43.10, 43.49 and 43.51 days respectively. The variety CRIS-620 and CRIS-610 were taken maximum days to open its first flower after 51.13 and 49.33, respectively. The results concluded that the variety which taken minimum days to open its flower is early, whilst the variety taken more days to open its first flower which assumed late. As regards the same trait findings the some other workers, Godoy [4] emphasized that the variety which take less days to open its first flower assessed early and this can be used for efficient selection of early maturing genotypes. Ahmed *et al*. [8] conducted research and predicted that earliness indicated as variety took minimum days to its first flower. Baloch and Veesar [10] reported that days to first flower is not directly considered as yield component but days taken to first flower after planting of the crop would ultimately influence the opening of bolls, thus helps in determining the earliness in maturity. Baloch *et al* [10] conducted study that manifestation of first flower is easily identifiable and can be used for early maturing varieties.

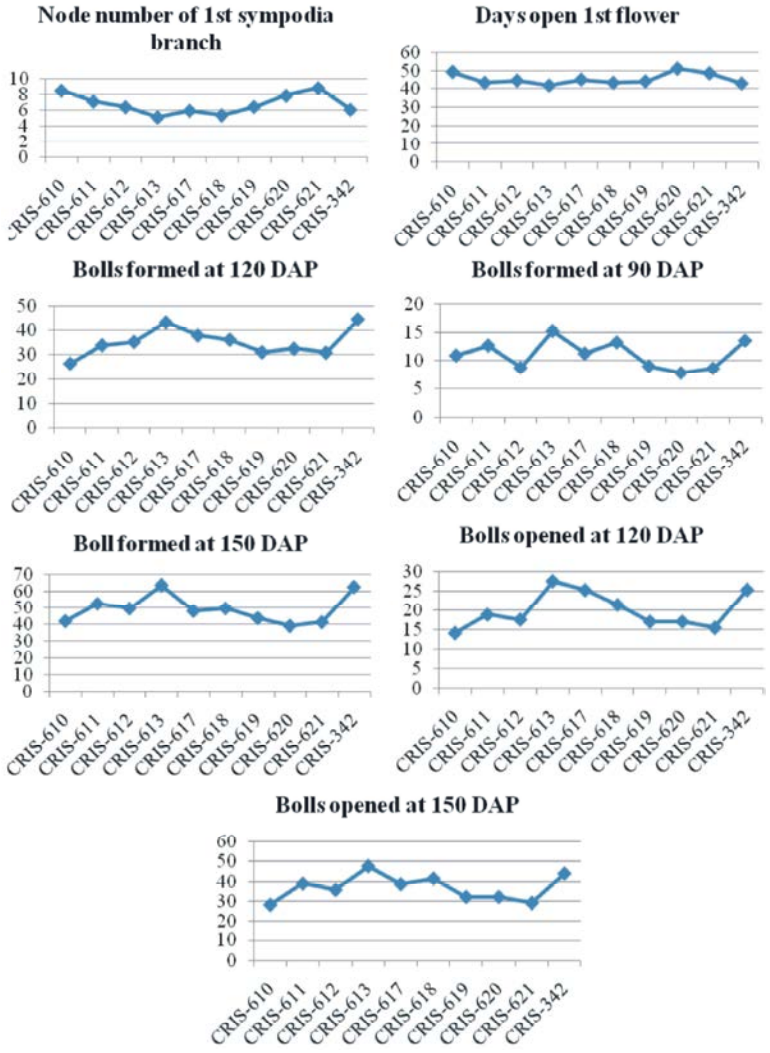
Boll Formation: Boll formation is an important and yield attributing character; because producing maximum number of bolls at earlier growth period will be consider as early maturing variety, which will be picked early. The data recorded at 90, 120 and 150 days after planting presented in Table 2, it indicated that CRIS-613 (15.20) formed maximum bolls at 90 DAP, while CRIS-342, CRIS-618 and CRIS-611 produced minimum bolls followed by 13.50, 13.20 and 12.67 respectively. Whereas, CRIS-620 and CRIS-621 formed very lowest boll.

The data presented bolls formed at 120 DAP, among the genotypes CRIS-342 produced highest number of bolls 44.47. While, CRIS-613, CRIS-617 and CRIS-618 formed minimum numbers of bolls followed by 43.19, 37.87 and 36.17, respectively. At the same time CRIS-610 and CRIS-621 formed very low numbers of bolls at 120 DAP.

The results in Table 2 indicated that about bolls formed at 150 DAP, the variety CRIS-613 formed highest (63.80) numbers of bolls per plant, meanwhile genotypes CRIS-342, CRIS-611 and CRIS-618 produced lowest numbers of bolls per plant followed by 62.70, 52.60 and 49.80, respectively. While, CRIS-620 and CRIS-621 formed very lowest numbers of bolls per plant. The similar results presented by Baloch *et al.* [10] suggested that the characters measuring as early maturing in terms of bolls formed at 90 and 120 days after planting (DAP) assumed as early mature. Lakho *et al*. [7] reported that variety set maximum bolls at 90, 120 and 150 days after planting assumed as early maturing genotypes. Azhar *et al*. [11] predicted that the formation of maximum number of bolls between 75 and 90 days after sowing was reliable indicator for earliness in cotton genotypes.

Bolls Opening: The variety open its maximum bolls ultimately picked early and can be considered early maturing. According to earliness classification, the short duration cotton crop matures in 125 to 145 days, medium duration (145 to 165 days) and long duration matures in 170 to 190 days [5]. The genotypes presented in Table 2 have highly significant difference among the genotypes at 120 and 150 days after planting. The variety CRIS-613 opened its maximum number of bolls 27.16 at 120 DAP, while CRIS-342, CRIS-617 and CRIS-618 opened minimum numbers of bolls followed by 25.33, 25.27 and 21.47 respectively. Whereas CRIS-610 and CRIS-621 opened less numbers of bolls at 120 DAP.

The data of bolls opened at 150 DAP presented in table 2; it indicated that among the genotypes CRIS-613 opened its maximum number of bolls 47.60. Meanwhile, variety CRIS-342, CRIS-618 and CRIS-611 opened minimum number of bolls at 150 DAP followed by 43.97,



41.43 and 38.87, respectively. Whilst, CRIS-610 and CRIS-621 opened minimum numbers of bolls. The results suggested that the variety which opened its maximum numbers of bolls at 120 and 150 days after planting considered as earlier and variety which opened minimum number of bolls reflect late maturing. The same results reported by Baloch *et al.* [10] suggested that the characters measuring as early maturing in terms of bolls opened at 90 and 120 days after planting (DAP) assumed as early mature. Godoy [4], Kairon & Singh [5] and Richmond & Ray [3] have also reported these traits as an important one for developing early maturing varieties in cotton. *Ahmed et al*. [8] reported that boll opening percentage at 120 days after planting have been found the main traits associated with earliness in cotton. Thus predict that selection for this trait could be helpful in evolving early maturing varieties.

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