

## EVALUATION OF AGRO-QUALITATIVE CHARACTERS OF FIVE COTTON CULTIVARS (*Gossypium hirsutum* L.) GROWN UNDER TOBA TEK SINGH CONDITIONS

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A field experiment was carried out to evaluate the growth, yield, and quality performance of five cotton (*Gossypium hirsutum* L.) cultivars viz. CIM-446, NIAB-999, NIAB-111, and CIM-473 & RH-511 at the farmer's field under Toba Tek Singh, Pakistan conditions. The experiment was laid out in randomized complete block design (RCBD) and was replicated four times. The net plot size was 7.0 m x 4.5 m. The data on various crop growth, yield and quality attributes was recorded using standard procedures. Significant differences in respect of plant height at maturity (cm), monopodial branches plant<sup>-1</sup>, sympodial branches plant<sup>-1</sup>, number of bolls plant<sup>-1</sup>, mature boll weight (g), total seed cotton yield (kg ha<sup>-1</sup>), fiber strength (g tex<sup>-1</sup>), fiber fineness (mic.), staple length (mm) and ginning out turn (%) were observed among all the cultivars except plant population which showed non significant results. Statistically the maximum seed cotton yield (2917 kg ha<sup>-1</sup>) was produced by cultivar NIAB-111 while the minimum seed cotton yield of 1315 kg ha<sup>-1</sup> was produced by cultivar RH-511. It was revealed from the results that variety NIAB-111 proved to be best among all the five varieties particularly in respect of almost all the agro-qualitative characters under Toba Tek Singh conditions.

**Key words:** Cotton cultivars, yield components, quality attributes, etc.

### INTRODUCTION

In Pakistan cotton (*Gossypium hirsutum* L.) crop is grown on an area of 3096 thousand hectares (3.09 million hectares) with total annual production of 12417 thousand bales (12.42 million bales), with an average seed cotton yield of 685 Kg ha<sup>-1</sup> (Economic Survey, 2006). Unfortunately, yield of cotton in Pakistan is far behind the other developed countries of the world like Australia (3075 kg ha<sup>-1</sup>), China (3064 kg ha<sup>-1</sup>), Turkey (2864 kg ha<sup>-1</sup>), Egypt (2376 kg ha<sup>-1</sup>) and USA (1757 kg ha<sup>-1</sup>) (FAO, 2002). The selection of crop variety according to the prevailing climatic conditions is of primary importance. Cultivars differ significantly in seed cotton yield mainly due to differences in fruiting branches, productive bolls and seed cotton weight boll<sup>-1</sup> (Qayyum, 1992). The cotton plant possesses a narrow range of ecological adaptability and is very much influenced by the climatic conditions. Therefore emphasis should be given on the evolution of high yielding cotton varieties keeping in view the different ecological conditions. Factors favoring high yields of cotton include the production of more number of sympodial branches which produce more number of bolls, production of sufficient flowers, favorable conditions during flowering and boll growth and maintaining boll production during growth period. Important factors for high production of cotton include the use of good quality seeds, use of improved

cultivars, proper plant population, insect, pests, weeds and disease control and conducive growing conditions to crop plants (Liang, 1998). Similarly better performance of hybrids over parents has been advocated by many researchers in the literature (Hassan and Khan, 1986 and Kalwar *et al.* 1992). Therefore owing to immense importance of cotton crop in the buildup of country's economy; researchers have made tremendous efforts in the past in order to improve yield potential of the cotton crop under local agro-ecological conditions. The present study was therefore executed with the following objectives.

1. To compare the productivity of five cotton cultivars in order to evaluate the differences in growth, yield and quality by using the recommended production technology, under prevailing climatic conditions.
2. To provide information to cotton growers that would assist them in updating and improving management practices to get better cotton yield.

### MATERIAL AND METHODS

The experiment was conducted at the farmer's field in District Toba during 2006 which comprised of five cotton varieties viz. CIM-446, NIAB-999, NIAB-111, CIM-473 and RH-511. The cotton varieties were sown on May 28, 2006, using seed rate of 20 kg ha<sup>-1</sup> for each variety. A 75 cm apart row-to-row distance was maintained at the time of sowing with drill, and thinning

was done to keep a 30 cm uniform distance between the plants. Experiment was laid out in randomized complete block design (RCBD) and was replicated four times using net plot size of 7 m x 4.5 m. Six irrigations were applied to the crop. Fertilizer was applied at the rate of 150, 75 and 50 kg ha<sup>-1</sup>, NPK, respectively. Whole of P and K with ½ of N dose was applied at the time of sowing and remaining half nitrogen was applied in two splits i.e. one split was applied at first irrigation and other with second irrigation at flowering stage.

All the other cultural practices such as thinning, hoeing, spraying etc were kept constant for all the treatments. The data on various growth and quality traits viz, number of plants m<sup>-2</sup> at harvest, plant height at maturity (cm), number of monopodial branches plant<sup>-1</sup>, number of sympodial branches plant<sup>-1</sup>, number of bolls plant<sup>-1</sup>, mature boll weight (g), total seed cotton yield (kg ha<sup>-1</sup>), staple length (mm), fiber strength (g tex<sup>-1</sup>), fiber fineness (micronaire), ginning outturn (%) were recorded by using standard procedure. The data collected were analyzed statistically using analysis of variance (ANOVA) test. Least significant difference (LSD) test was employed to sort out significant differences among the treatment means (Steel *et al.* 1997).

## RESULTS AND DISCUSSION

### 1. Number of plants m<sup>-2</sup> at harvest

An optimum plant density is one of the important yield components responsible for high yield of the cotton crop. The results regarding the number of plants m<sup>-2</sup> recorded at harvest as affected by different varieties presented in Table-1 showed non significant effect on plant population m<sup>-2</sup> at harvest. The non significant differences among plant population m<sup>-2</sup> at harvest among different varieties were probably due to the reason of maintaining plant population during early growing period. These results are in complete agreement with those of Chitarra *et al.* (1997) and Reiter *et al.* (1999) who reported non significant differences among the plant population of different varieties.

### 2. Plant height at maturity (cm)

The data regarding the final plant height at harvest presented in Table-1 revealed that the effect of different varieties on plant height was highly significant. The data revealed that statistically the maximum plant height (157.1 cm) was recorded in variety RH-511 which was followed by CIM-446 with a plant height of 148.10 cm. The minimum plant height (128.7 cm) was

recorded in variety NIAB-999 which was followed by CIM-473 (133.70 cm). The difference in plant height might be due to the difference in genetic makeup, soil characteristics and environmental factors used by different genotypes in the experiment. These results are in line with those of Wankhade *et al.* (2002), who reported that plant height is affected by genetic makeup of cultivars and environmental conditions. These results are also supported by Saeed *et al.* (1996) and Bolonhezi *et al.* (1999), who reported that plant height varies significantly because of varieties.

### 3. Monopodial branches plant<sup>-1</sup>

The data pertaining to number of monopodial branches plant<sup>-1</sup> presented in Table-1 exhibited significant effect of varieties on the number of monopodial branches plant<sup>-1</sup>. Statistically maximum number of monopodial branches plant<sup>-1</sup> (2.20) were recorded in variety RH-511 which was statistically at par with NIAB-111 with 2.00 monopodial branches plant<sup>-1</sup>, followed by CIM-446 which had 1.85 monopodial branches plant<sup>-1</sup>. The minimum (1.25) number of monopodial branches plant<sup>-1</sup> was recorded in variety CIM-473. The difference in number of monopodial branches plant<sup>-1</sup> was due to the reason that different cultivars were used in the experiment. These results are in confirmation with Jenkins *et al.* (1990) and Bolonhezi *et al.* (1999) who reported that the monopodial branches differ significantly because of different varieties.

### 4. Sympodial branches plant<sup>-1</sup>

A greater number of sympodial branches plant<sup>-1</sup> is an indication of high potential of cotton crop for high production of seed cotton because these are considered the boll bearing branches. Data regarding the number of sympodial branches plant<sup>-1</sup> is given in Table 1 showed highly significant differences in number of sympodial branches plant<sup>-1</sup>. The data revealed that statistically the maximum (26.20) number of sympodial branches plant<sup>-1</sup> was recorded in NIAB-111 which was closely followed by RH-511 having 23.00 number of sympodial branches plant<sup>-1</sup>. Similarly the minimum (12.85) number of sympodial branches plant<sup>-1</sup> were recorded in variety CIM-473. The variation in number of sympodial branches plant<sup>-1</sup> was attributed to the use of different types of genetic material. These results are in complete agreement with those of Bolonhezi *et al.* (1999) who reported significant differences in number of sympodial branches plant<sup>-1</sup> due to different varieties.

Table 1. Comparison of growth, yield and quality characters of different cotton (*Gossypium hirsutum* L.) varieties

Varieties	Plants m <sup>-2</sup>	Plant height (cm)	Monopodial branches	Sympodial branches	No. of bolls	Mature boll weight (g)	Seed cotton yield (kg ha <sup>-1</sup> )	Fiber strength (g tex <sup>-1</sup> )	Fiber Fineness (mic.)	Staple Length (mm)	% GOT
V1 = CIM-446	4.25	148.1 b	1.85 bc	19.33 c	40.03 b	1.61 d	1710 d	24.58 b	3.97 c	26.27 d	37.24 cd
V2 = NIAB-999	4.18	128.7 e	1.65 c	15.70 d	37.00 c	1.80 c	2479 b	24.08 c	4.48 b	29.10 a	42.20 b
V3 = NIAB-111	4.25	142.1 c	2.00 ab	26.20 a	43.38 a	2.47 a	2917 a	25.48 a	4.88 a	28.13 b	44.59 a
V4 = CIM-473	4.21	133.7 d	1.25 d	12.85 e	32.20 e	2.08 b	2113 c	24.42 bc	4.10 bc	27.15 c	38.41 c
V5 = RH-511	4.18	157.1 a	2.20 a	23.00 b	34.63 d	1.45 e	1315 e	23.50 d	3.52 d	25.55 e	35.98 d
LSD VALUE	NS	1.76	0.27	1.32	0.92	0.07	133.40	0.36	0.39	0.53	1.42

NS = Non Significant

## 5. Number of bolls plant<sup>-1</sup>

Number of bolls plant<sup>-1</sup> is an important yield contributing parameter to estimate the yield of seed cotton. Data regarding the number of bolls plant<sup>-1</sup> presented in the Table-1 revealed that the effect of varieties on the boll formation was highly significant. The Table exhibited statistically higher (43.38) number of bolls plant<sup>-1</sup> in variety NIAB-111 which was followed by variety CIM-446 having 40.03 bolls plant<sup>-1</sup> but had significantly more number of bolls plant<sup>-1</sup> than varieties NIAB-999, RH-511 and CIM-473. While the minimum number of bolls plant<sup>-1</sup> were found in variety CIM-473 which produced 32.20 number of bolls plant<sup>-1</sup>. The difference in number of bolls plant<sup>-1</sup> among varieties was a direct consequence of difference in number of sympodial branches plant<sup>-1</sup> and number of flowers formed. These results are in consonance with Saeed *et al.* (1996) and Shakeel *et al.* (2001) who reported that the number of bolls plant<sup>-1</sup> differ significantly among different varieties.

## 6. Mature boll weight (g)

Boll size and weight of seed cotton boll<sup>-1</sup> are directly related to the final yield of seed cotton. The data regarding the average mature boll weight given in the Table-1 showed that highly significant differences were found in average mature boll weight among various cultivars of cotton used in experiment. The data revealed that statistically the maximum (2.47g) average mature boll weight was observed in variety NIAB-111 followed by the variety CIM-473 having 2.08 g average mature boll weight but was statistically superior in respect of average mature boll weight than rest of the varieties used. However the minimum (1.45 gm) average mature boll weight was found in variety RH-511. The variation in average mature boll weight was probably due to the use of different cultivars and the ability of different genotypes in utilizing and assimilating the available resources for the increase in average mature boll weight. These results are in confirmation with Elayan *et al.* (1992) and Shakeel *et al.* (2001) who reported that the average mature boll weight was affected significantly due to different varieties.

## 7. Total seed cotton yield (kg ha<sup>-1</sup>)

The total seed cotton yield is the function of combined effect of entire yield components exposed under particular set of environmental conditions. The data pertaining to the total seed cotton yield as influenced by different cultivars of cotton presented in Table-1 showed highly significant effect of varieties on the total seed cotton yield. The data revealed that significantly

the maximum seed cotton yield (2917 kg ha<sup>-1</sup>) was recorded in variety NIAB-111 followed by variety NIAB-999 having 2479 kg ha<sup>-1</sup> total seed cotton yield. The minimum (1315 kg ha<sup>-1</sup>) seed cotton yield was observed in variety RH-511 which was statistically lower than variety V1 (CIM-446). The increase in seed cotton yield kg ha<sup>-1</sup> of variety NIAB-111 was attributed to more number of sympodial branches plant<sup>-1</sup>, more number of bolls plant<sup>-1</sup>, Number of seeds boll<sup>-1</sup>, 100-seed weight and seed cotton weight plant<sup>-1</sup>. It means that variety NIAB-111 had the ability to utilize the soil and environmental resources in such a manner that resulted in more seed cotton yield kg ha<sup>-1</sup>. These results are in consonance with those of Oakley *et al.* (1998), Nunes *et al.* (1998) Ramna *et al.* (1998), and Presley *et al.* (1999), who reported the significant differences in total seed cotton yield due to difference in genetic makeup existing among varieties.

## 8. Fiber Strength (g tax<sup>-1</sup>)

Fiber strength is an important quality parameter of cotton fiber. The data pertaining to fiber strength presented in Table-1 showed that the varieties have highly significant effect over fiber strength. The data indicated that the maximum fiber strength (25.48 g tax<sup>-1</sup>) was observed in variety NIAB-111 followed by variety CIM-446 with 24.58 g tax<sup>-1</sup> fiber strength which was also statistically at par with variety CIM-473 having fiber strength of 24.42 g tax<sup>-1</sup>. The minimum (23.50 g tax<sup>-1</sup>) fiber strength was found in variety RH-511 which was statistically inferior to CIM-473 having 24.42 g tax<sup>-1</sup> fiber strength but was statistically at par with variety NIAB-999 having 24.08 g tax<sup>-1</sup> fiber strength. These results are in complete agreement with those of Gilbert *et al.* (1998), Oakley *et al.* (1998) and Presley *et al.* (1999) who reported that the fiber strength differs significantly due to differences among varieties.

## 9. Fiber Fineness (Micronair)

Fiber fineness is another important attribute showing the quality of cotton fiber. The data pertaining to fiber fineness presented in Table-1 exhibited that the effect of varieties over fiber fineness was highly significant. The data showed that the maximum degree of fiber fineness (4.88 mic) was observed in variety NIAB-111 which was followed by variety NIAB-999 having a fiber fineness value of 4.48 mic. but was statistically at par with variety CIM-473 with a fiber fineness value of 4.10 mic. The minimum (3.52 mic.) value of fiber fineness was observed in variety RH-511 which was significantly lower than the varieties CIM-473 and CIM-446 having a micronair value of 4.10 and 3.97 respectively. These results are in contrast with those of

Nunes *et al.* (1998), and Presley *et al.* (1999) who reported non significant effect of fiber fineness due to variations among different varieties but are in complete agreement with those of Oakley *et al.* (1998) and Gilbert *et al.* (1998) who reported that the fiber fineness show significant differences due to variation among different varieties.

### 10. Staple Length (mm)

Staple length is important quality parameter of cotton fiber. The data regarding the staple length presented in Table-1 indicated that the effect of varieties over the staple length was highly significant. The data showed that the maximum value of staple length (29.10 mm) was observed in variety NIAB-999 followed by NIAB-111 having a staple length of 28.13 mm but was significantly higher than CIM-473 and CIM-446 having a staple length of 27.15 and 26.27 mm respectively. Statistically the minimum value of staple length (25.55 mm) was observed in variety RH-511. These results are in contrast with those of Nunes *et al.* (1998), and Presley *et al.* (1999) who reported that staple length has non-significant differences among different varieties. While the above findings are well supported by Khan *et al.* (1989), Oakley *et al.* (1998) and Gilbert *et al.* (1998) who reported that the staple length showed significant differences due to variation among different varieties.

### 11. Ginning out turn (%)

Ginning out turn was calculated to observe the effect of different cultivars on the ratio of lint to the seed cotton. The data regarding the ginning out turn presented in Table-1 showed highly significant effect of different varieties on ginning out turn percentage. The data revealed that the minimum ginning out turn (35.98 %) was observed in variety RH-511 which was statistically at par with variety CIM-446 having a ginning out turn of 37.24% and was followed by variety CIM-473 with a GOT of 38.41%. Statistically the maximum ginning out turn of 44.59% was observed in variety NIAB-111 which was statistically higher GOT than variety NIAB-999 having 42.20 % GOT. These results are in line with those of Khan *et al.* (1989), Saeed *et al.* (1996) and Oakley *et al.* (1998) who reported significant differences in the ginning Outturn percentage (% GOT) due to differences among varieties.

### CONCLUSION

From above mentioned results, it was concluded that variety NIAB-111 had more number of monopodial and sympodial branches plant<sup>-1</sup>, higher number of bolls

plant<sup>-1</sup>, maximum mature boll weight, maximum total seed cotton yield (kg ha<sup>-1</sup>), higher ginning out turn percentage and better quality in respect of fiber strength, fiber fineness and fiber length than rest of the four cultivars used in the experiment. On the bases of these results it is recommended that the variety NIAB-111 should be grown under soil and climatic conditions of District Toba Tek Singh.

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