Phenotypic response of cotton genotypes for yield and fiber quality traits

Abdul Wahab Soomro
Central Cotton Research Institute Sakrand (Pakistan Central Cotton Committee)

ABSTRACT

Twenty five cotton genotypes were tested with two standard check varieties in National Coordinated Varietal Trial (NCVT). The significant difference was observed among all the genotypes of yield, its contributing traits and fiber quality traits, which indicated sufficient genetic diversity, were present in the material. Among the genotypes, ICI-2121, GH-Hadi and NIAB-898 are high yielding cotton genotypes; these are suggested for commercial cultivation at the environmental condition of central zone of Sindh to boost up cotton production and at the same time utilization in hybridization and breeding program to evolve high yielding variety. For the fiber quality traits NIBA-898 and NS-191 are suitable genotypes to meet the criteria of textile sector.

Key word: Cotton genotypes, phenotypic performance, seed cotton yield and fiber traits.

INTRODUCTION: Cotton is an important cash and fiber crop of Pakistan, whereas the yield of this crop is reliant upon the environment in which it is grown and management practices of the cropping system. Cotton contribute raw material to textile sector, that's why countries economy depend on this crop. It provides seeds with potential of various products viz. lint, oil, hulls and food for animals (Ozyigit 2008). Globally Pakistan is 5th largest cotton producing country, 3rd major consumer as compared with other cotton growing countries. The area under cotton cultivation in Pakistan during year 2019-20 was 2.895 million hectares and production was 12.72 million bales, as regards the provincial status, Punjab contributed 2.145 million hectares with production 7.90 million bales and Sindh was on 0.640 million hectares and 4.60 million bales production (Cotton Review, 2020). The cotton has been challenging crop for Pakistani growers due to various factors, ultimately causes decline in seed cotton yield (Choudhary et al. 2017 and Nachimuthu et al. 2017). Significant difference of various characters in cotton is due to sowing of different cotton genotypes/varieties (Afzal et al. 2002). Major difference of cotton traits is due to performance of varieties (Hanif et al. 2001). Sezener et al. (2006) also reported that significant variation in seed cotton yield is due to varieties. Therefore, keeping in view the cotton crop importance and different response of cotton varieties, the present research was carried out to evaluate 27 cotton genotypes and identify most promising variety for commercial cultivation to boost-up cotton production and utilization in hybridization and breeding program to transfer the traits and improve the characters.

OBJECTIVES: The main objective of this study was to assess the cotton genotypes at the environmental condition of Sakrand, Sindh and best genotypes which produce high yield with better fiber traits that could be used commercial to boost up cotton production and good stuff also utilized for breeding program to evolve high yield variety with desirable fiber traits. The significant variation was recorded in mean performance of genotypes for all the characters which suggested that varieties are statistically differ from each other.

MATERIALS AND METHODS: The trial was conducted at experimental farm of Central Cotton Research Institute Sakrand, 27 advance cotton genotypes were tested in National Coordinated Varietal Trial (NCVT) during the 2018-19 for yield and fiber traits at the environmental condition of Sakrand. The experiment was conducted with randomized complete block design with three replications. The plot size was maintained 30’x10. The seed was planted on ridges with plant to plant and row to row distance was maintained at 30 cm and 75 cm respectively. The agronomic practices viz. weedicide, irrigation, thinning and inter-culturing were done uniform accordingly in all the replications. The fertilizer and plant protection measures were applied as per need whenever required. The 5 plants were tagged from each replication to record the data. The traits were studied viz. plant height, sympodial branches plant-1, bolls plant-1, boll weight, seed cotton yield (kg ha-1), ginning outturn, staple length, micronaire value and fiber strength. The significance difference of genotypes were tested through using method suggested by Steel and Torrie (1980) and the comparison of means were tested by Duncan Multiple Range Test (DMRT) at 5% and 1% probability by using statistical computer software application Statistix8.1.

RESULTS AND DISCUSSION

The significant difference was observed among all the genotypes of yield, its contributing traits and fiber quality traits at 1% and 5% probability, which indicated sufficient genetic diversity, were present in the material (table 1). The significant variation was recorded in mean performance of genotypes for all the characters. Regarding the plant height (figure 1), the tallest varieties was observed NS-191 given (107.2 cm), while lowest was given by NIAB-898 (85.2 cm). The variation in plant height among various cotton genotypes were due to significant difference in genetic makeup of strains. Similar findings were reported by Anwar et al. (2002), Corpur (2006) and Ashokkumar and Ravikesavan (2011). Cotton breeders and farmers prefer medium height varieties due to lodging. Therefore, selection of varieties should be based on medium plant height. The per se performance of sympodial...
Table 1: Analysis of variance means performance and statistical analysis of yield and fiber traits of cotton.

<table>
<thead>
<tr>
<th>Traits</th>
<th>Replication DF-2</th>
<th>Replication DF-26</th>
<th>Genotypes</th>
<th>Error DF-52</th>
<th>CD 5%</th>
<th>CD 1%</th>
<th>CV %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Height</td>
<td>51.308</td>
<td>99.664**</td>
<td></td>
<td>42.591</td>
<td>10.53</td>
<td>14.03</td>
<td>6.75</td>
</tr>
<tr>
<td>Sympodial Branches</td>
<td>13.823</td>
<td>14.531**</td>
<td></td>
<td>6.753</td>
<td>4.20</td>
<td>5.59</td>
<td>9.86</td>
</tr>
<tr>
<td>Bolls Plant-1</td>
<td>66.952</td>
<td>112.107**</td>
<td></td>
<td>44.066</td>
<td>10.87</td>
<td>14.49</td>
<td>8.51</td>
</tr>
<tr>
<td>Boll Weight</td>
<td>0.0267</td>
<td>0.4587**</td>
<td></td>
<td>0.082</td>
<td>0.47</td>
<td>0.62</td>
<td>7.84</td>
</tr>
<tr>
<td>Seed cotton Yield</td>
<td>38971</td>
<td>657178**</td>
<td></td>
<td>10775</td>
<td>170.07</td>
<td>218.5</td>
<td>4.36</td>
</tr>
<tr>
<td>Ginning Outturn</td>
<td>0.111</td>
<td>21.515**</td>
<td></td>
<td>0.327</td>
<td>1.39</td>
<td>1.85</td>
<td>4.50</td>
</tr>
<tr>
<td>Staple Length</td>
<td>0.583</td>
<td>3.332**</td>
<td></td>
<td>0.245</td>
<td>0.81</td>
<td>1.08</td>
<td>2.87</td>
</tr>
<tr>
<td>Micronaire Value</td>
<td>0.007</td>
<td>0.3418**</td>
<td></td>
<td>0.0103</td>
<td>0.17</td>
<td>0.23</td>
<td>2.58</td>
</tr>
<tr>
<td>Fiber Strength</td>
<td>0.0414</td>
<td>6.205**</td>
<td></td>
<td>0.709</td>
<td>1.37</td>
<td>1.83</td>
<td>3.05</td>
</tr>
</tbody>
</table>

Figure 1: Plant height.

Figure 2: Sympodial Branches

branches (figure 2) revealed significant variation among cultivars, FH-444 given maximum sympodial branches (22.7). It was statistically at par with variety NIA-85 (22.2). While, minimum was noted in strain BS-18 (14.0). The results are in accordance with Corpor (2006), Ehsan et al. (2008) and Ashokkumar and Ravikesavan (2011).

Bolls plant-1 considered as important character that has direct effect on seed cotton yield. Among the varietal performance GH-Mubarak formed maximum (46.0) number of bolls plant-1, followed 45.4 and 43.2 given by varieties AA-993 and NIAB-898 (figure 3) as compared with standard check varieties, CIM-602 and IUB-13. While, minimum number of bolls plant-1 produced by BS-18 (22.8), which indicated that variety could not perform well in Sakrand environment that could be due to stability and changing environmental condition. Boll weight is also an important trait which contributed in seed cotton yield. Out of 27 genotypes FH-444 given bigger boll and stood top as compared with other advance cotton genotypes and standard check varieties. The smaller boll weight was weighted in variety NIA-85 (figure 4). The character seed cotton yield place a unique position as compared to other traits. It is a joint contribution of other traits and their direct effect on increasing and decreasing yield. All the cotton genotypes were statistically differ from each other. The utmost seed cotton yield was produced by genotypes ICI-2121 (3279 kg ha-1), followed by GH-Hadi (3135 kg ha-1) and NIAB-898 (3087 kg ha-1) which were highest among all other genotypes as well as comparison with standard check varieties CIM-602 and IUB-13 (figure 5). Whereas, the lowest seed cotton yield was given by BZU-05 and IUB-69 which were below from standard check varieties. The results indicated that every genotype performed in different way at the environmental condition of Sakrand on the basis of varietal genetic makeup, characters, stability, environmental condition and might be soil factors. Therefore, it is suggested that varieties which possess higher boll plant-1, boll weight and seed cotton yield could be preferred for commercial cultivation.
as well as utilization in breeding program to improve the characters. Corpur (2006), Ehsan et al. (2008) and Ashokkumar and Ravikesavan (2011) also reported significant difference among varieties for bolls plant, boll weight and seed cotton yield. Hofs et al. (2006) documented variation in boll weight due to varieties. Khalid and Mueen-u-Din (2018) found variation in mean performance of genotypes for bolls plant, boll weight and seed cotton yield.

Hofs et al. (2006) documented variation in boll weight due to varieties. Khalid and Mueen-u-Din (2018) found variation in mean performance of genotypes for bolls plant, boll weight and seed cotton yield.

Figure 3: Bolls Plant

Figure 4: Boll Weight


Figure 5: Seed cotton yield.

Figure 6: Ginning outturn


Data pertaining to ginning outrun per se performance (figure 6) indicated that ICI-2121 ginned higher ginning outturn (42.7%) followed by Bahar-07, BS-18 and GH-Mubarak compared with
standard check varieties CIM-602 and IUB-13. While, nine advance strains lowest ginning outturn which was below than standard. The results of varieties for ginning outturn was found statistically differ from each other. The results are supported with Wang et al. (2004), Ehsan et al. (2008) and Ashokkumar and Ravikesavan (2011). The comparison of treatment means indicated that varieties had significant effect on staple length. The longest staple length was measured in genotype NIAB-898 (28.2 mm) and NS-191 (28.1 mm) as compared with standard check varieties CIM-602 and IUB-13. However, out of twenty five advance genotype only two genotypes given staple length more than set standard (figure 7). As regards the trait fiber strength (figure 8), the strongest fiber strength was noted in genotype NS-191 and FH-Afnan as compared with other genotypes and standard check variety.

Fiber fineness/micronaire value is an important trait in fiber quality parameters and is very valuable for textile industry. The significant difference in mean performance was observed for micronaire value (figure 9).

CONCLUSION: It was concluded that ICI-2121, GH-Hadi and NIAB-898 are high yielding cotton genotypes, these are suggested for commercial cultivation at the environmental condition of central zone of Sindh to boost up cotton production and at the same time utilization in hybridization and breeding program to evolve high yielding variety. For the fiber quality traits NIBA-898 and NS-191 are suitable genotypes to meet the criteria of textile sector.


Hofs, J.L., B. Hau and D. Marais. 2006. Boll distribution pattern in Bt and non-Bt cotton cultivars: I. Study on commercial...


