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EVALUATION OF NEW COTTON (*GOSSYPIUM HIRSUTUM* L) LINES FOR SEED COTTON YIELD AND LEAF CURL VIRUS INFECTION

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ABSTRACT

New candidate varieties/strains of cotton (*Gossypium hirsutum*) different research stations/institutes were tested for their yield performance. NIAB-111, NIAB-98 and NIAB-999 were significantly higher fruit bearing varieties at 90 days by completing 59.5, 48.3 and 46.0% fruiting, respectively. Seed cotton yield of VH-142 was the highest with 5312 $kgha^{-1}$ having 52.05 bolls per plant with maximum value as compared to other lines. DNH-57 and NIAB-999 remained second and third with 51.28 and 4989 kg ha^{-1} seed cotton yield, respectively. BH-160 and CRIS-467 were found to be second and third highest boll bearing varieties with an average of 51.0 and 40.2 bolls $plant^{-1}$, respectively. NIAB-98 gave the highest yield among short stature varieties. In case of cotton leaf curl virus (ClCuV), highest infection was recorded in two lines CRIS-168 and CRIS-467 with 9.77 and 6.03% damage respectively.

Key words: *Gossypium hirsutum* L, leaf Curl virus, seed cotton yield.

INTRODUCTION

Cotton is mainstay of Pakistan's economy contributing 2.9 percent of GDP and 11.7% of value added in agriculture, with a total area of this crop 2796 ha and production of 9.7 million bales averaging 621 kg seed cotton per hectare. In 1999-2000 the cotton production was recorded 11.2 million bales which declined to 10.7 million bales in 2000-01, it further dipped to 10.61 million bales during 2001-02 and the downslide continued till 2002-03 reaching 9.7 million bales against the projected production of 10.2 million bales (Arion, 2004). Leaf curl virus (ClCuV) and heavy insect/pest infestation were the main causes of this decline but the third most important cause was the lack of such varieties which could be wider adaptive, disease resistant and high yielding under variable agro climatic conditions. Although many new cotton varieties have been evolved and recommended for general cultivation in the past few years but the performance of most of them under field conditions is not up to the mark.. Muhammad (2001) reported that some varieties are well adapted to all types of environments, some to less favorable and others to highly favorable environments in terms of yield, lint percentage and fiber quality. Moser et *al*. (2000) reported variation in lint percentage, boll weight and maturity in different gossypium strains. Keim *et al.* (2000) recorded 0.2 to 0.8 % per year increase in yield by early season new varieties and an increase of 0.2 to 1.1 % per year by full season *Gossypium hiursutum* varieties. Ji *et al.* (2000) characterized the high yielding varieties as strong boll setting capability (over 40% boll setting rate), medium boll weight (4-4.5 g) and high lint percentage (over 40 %). Badr (1999) studied Egyptian cotton cultivars (Giza-87 and Giza-88) and four commercial cultivars and recorded a highly significant difference between cultivars, environment, and cultivar x environment. Giza-88 produced the highest overall yield, seed index and boll weight. Giza-88 produced superior fiber than all other cultivars.

Vieira *et al.* (1999) evaluated 10 commercial cotton (*Gossypium hirsutum*) cultivars for productivity and fiber characteristics. There was non significant difference observed between the cultivars in relation to yield of seed cotton, but there was significant variation in boll weight, percentage fiber and technological characteristics of fiber (varying 42.7 to 38.5 %). Baloch. (1997) evaluated ten Pakistani upland cotton varieties (*Gossypium hirsutum*) for seed cotton yield, lint percentaqge and fiber length and reported that varieties Sarmast and NIAB-78 were high yielder, CRIS-9 and NIAB-78 had high lint percentage and Qalandri, Shaheen, CIM-70 and CIM-109 had more fiber length. Kalsy and Grag (1989) observed that yield has direct correlation with boll number and so the hybrids that showed high hetrosis for yield also exhibited high hetrotic effect for boll number indicating a great scope for increase in yield. Mirza and Chaudhry (1985) obtained all the hybrids statisti-By superior to both the standards i.e. MNH-93 and B-557. Average yield per plant is the product of average boll weight and number of bolls per plant in hybrid and standard variety Qalandri. They also recorded significantly longer staple length in hybrid compared to variety Qalandri.

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The objectives of the present investigation were the agronomic evaluation of high yielding, wider adaptive, disease resistant and superior quality varieties

MATERIALS AND METHODS

The present study was conducted in 2002-03 at the Nuclear Institute for Agriculture and Biology, Faisalabad on a sandy clay loam soil, medium alkaline (pH 8.0), non-saline (EC: 0.30 ds/m), low organic matter (0.92%), nitrogen (0.06%), low available phosphorus (8.0 ppm) and very high available K (224.0 ppm) soil. Twenty six candidate varieties/strains of cotton from different research stations/institutes of Pakistan were tested for their performance related to yield, quality and disease resistance under the agro-climatic conditions of Faisalabad. The experimental design was randomized complete block with four replications. The plot size was 3.8x4.8 m while 2.5 ft. row to row and 1 ft. plant to plant spacing. All inputs such as water, fertilizer, weeds and pest control were managed in an optimal fashion. Nitrogen was applied in three splits i.e. 50 kg N ha^{-1} at sowing, 50 kg N ha^{-1} at flowering stage and 50 kg N ha^{-1} at boll formation. Phosphorus was uniformaly applied to all the treatmental plots @ 70 kg P_2O_5 ha^{-1} at sowing.

The following crop growth and development measurements were made in each plot throughout the season with an interval of approximately 14 days: germination percentage, plant population, plant morphological characteristics, fruit bearing at different intervals, CLCuV infestation at different growth stages, plant height and seed cotton yield.

Fifty boll samples were taken at random from each treatment to compute boll weight. Seed cotton of five guarded plants was picked and Ginning of each sample was made and GOT percentage of each variety was calculated. Lint samples were analyzed for fiber quality studies. To estimate total seed cotton production, all plots were harvested manually and weighed. Data was analyzed statistically.

RESULTS AND DISCUSSION

Seed cotton yield

Out of twenty-six advance lines/varieties sixteen varieties produced significantly higher cotton yield while nine varieties produced significantly lower seed cotton yield than cotton variety CIM-473. VH-142, DNH-57and NIAB-999 produced significantly higher seed cotton yield i.e. 5312.41, 234.40 and 4989.63 kg ha^{-1} with plant population 39675, 51510 and 51107 plants per ha while boll bearing per plant was 52.05,40.20 and 40.08, and GOT 42.42%, 37.54% and 36.64% , respectively. The increase in yield of seed cotton was associated with hetrosis in average number of bolls per plant and average boll weight these results are in conformity wth the findings of Moser *et al*. (2000) and Kalsy and Grag (1989). CIM-506 and NIAB-111 was ranked as third high yielding varieties with 4734.10 and 4707.70 kg ha^{-1} having per plant average bolls 39.90 and 52.05 with plant population 50165 plants per ha, and GOT% 40.03 and 38.33 respectively but yield of these varieties was statistically at par with the seed cotton yield of NIAB-999. SLH-224 and NIAB-98 were ranked third high yielding varieties with 4475.88 and 4465.12 kg ha^{-1} seed cotton yield, having 50569 and 47610 per hectare plant population, 31.20 and 28.30 per plant boll bearing, average boll weight 3.55 and 3.61 g and GOT% 37.85 and 39.95, respectively but seed cotton yield of these varieties was statistically at par with NIAB-111/S and CIM-506. The yield variation is due to heterosis in agronomic characteristics of different strains. These findings are supported by results of Marani (1967).

Plant height at maturity

The plant height at harvest was maximum in CRIS-467 (161 cm), MNH-642 (160.7 cm) and SLH-224 (159.4 cm) in comparision to other varieties but in terms of seed cotton yield and fruit bearing at different intervals during growth period, these varieties are ranked at much lower position. It indicates that in these strains maximum plant height do not contribute towards yield. NIAB-98, CIM-499 and CIM-506 were found short stature varieties in comparision with other but out of these, NIAB-98 and CIM-506were in high yielding position and CIM-499 was found medium yielding variety. These results indicate that short stature strains can be high yielder. BH-142, DNH-57 and NIAB-999 are medium stature varieties with plant height 132.4, 136.4 & 147.0 cm, respectively but these are top yielding varieties. It indicates that medium stature varieties can be high yielding.

The divergence in plant height of different candidate lines might be due to their varied genetic constitution in accordance with the findings of Marani (1967); Hawkins *et al.* (1965), Young and Murray (1966) and Rafique (1972). In some cases, the plant height variation in field experiments is due to soil variability but analysis of soil from various locations of the field indicated that there was no significant variation in the field. But in some treatments, plant population was recorded to be lower due to poor germination and it provided an opportunity for vigorous growth with least competition for nutrition, moisture and aeration as is the case in CRIS-467, it is ranking at lower position in terms of plant population with 37120 plants per ha but it is on the top position with regard to plant height.

CLCuV Response

Cotton leaf curl virus (CLCuV) infestation under field conditions was also observed on all the varieties. CRIS-168, CRIS-468 and CRIS-467 were found to be 9.77, 6.03 and 1.81% viral susceptible, respectively. In initial growth stage of the crop in the month of June to July only 1-5 % viral infection was recorded but in later August the damage increased due to the abundance of whiteflies in the field. Significantly lower seed cotton yield was produced by these varieties due to virus problem. A minute viral infestation (less than 0.5%) was also recorded on DNH-57 and BH-160 but this damage was much lower to cause any drastic impact on yield.

Ginning out turn percentage (GOT %)

A significant difference in GOT % and fibre qualitaty traits were recorded in different stains. That was significantly higher in some varieties as compared to other ones. In case of MNH-642 it was 45.00% and in MNH-635 44.59% respectively followed by MNH-636 and VH-142 with 43.33 and 42.42 GOT%, respectively. Out of above mentioned four strains with higher GOT% three strains i.e. MNH-642, MNH-635 and MNH-636 remained at much lower position in terms of seed cotton yield while VH-142 gave good performance in terms of seed cotton yield and GOT%. NIBGE-1, CRIS-168 and CRIS-467 got lowest position by attaining 35.73, 35.89 and 36.62%, respectively. The variation in GOT% among different strains can be due to environmental or genetic factors.

Table 1. Comparative growth and yield performance of various candidate lines/ varieties of cotton.

REFERENCES

Variety	Germination %	Plant population per hectare	Mature bolls at 90 days	Bolls at maturity	Seed cotton yield (Kgha^{-1})	Plant height at maturity (cm)	GOT%
FH-945	97.54 a	50300 abc	9.77ij	24.63 k	4021.30fghi	136.05abcdef	41.15bc
CRIS-168	94.53 bcd	48148 bcde	3.66k	29.05hij	3496.78 jkl	135.95abcdef	35.89f
CIM-497	96.56ab	50165 abc	18.20b	29.98ghi	4088.54 fg	128.85ef	39.34d
FH-1000	91.17 fg	50569 abc	8.41j	26.55ijk	3846.46ghij	132.75cdef	40.60d
SLH-257	88.72 gh	37120 g	12.42fg	36.80cde	3281.59 l	155.60abcd	37.95de
NIAB-98	97.54 a	47610 cde	13.67b	28.30hijk	4465.12cd	119.20f	39.95cd
MNH-636	86.76 hi	4397 f	13.65ef	26.30ijk	2528.44 m	148.85abcde	43.33ab
CRIS-468	53.43 m	26764 h	14.22de	43.63b	3362.29kl	142.15abcdef	38.50d
NIBGE-1	92.15 ef	47475 cde	15.65cd	33.40efg	3685.07 ijk	133.20bcdef	35.73f
NIAB-999	96.50 ab	51107 ab	18.44 b	40.08bc	4989.63 ab	147.00abcde	36.64de
SLH-224	96.07 abc	50569 abc	12.41fg	31.20fgh	4478.57 cd	159.35ab	37.85de
FH-925	93.62 cdef	47475 cde	10.33hi	29.30hi	3416.08 kl	153.45abcde	38.85d
CIM-506	95.58 abcd	50165 abc	12.22fg	28.40hijk	4734.10 bc	127.65ef	40.03c
NIAB-111	93.13 def	4908 abcde	23.77a	39.90bc	4707.20 bc	131.26def	38.33d
VH-142	73.52 k	39675 g	16.77c	52.05a	5312.41 a	132.45def	42.42b
CRIS-467	63.72 l	37120 g	9.33 ij	40.20bc	3335.39 kl	161.00a	36.62def
MNH-635	92.64 ef	49896 abcd	10.07 i	33.73def	4223.03 def	146.65abcde	44.59a
DNH-57	92.64 ef	51510 a	8.30 j	24.88jk	5128.43 a	136.35abcdef	37.54de
CIM-707	85.29 ij	48013 bcde	8.86 ij	28.28hijk	4142.34 defg	152.30abcde	39.63cd
BH-160	84.31 ij	46803 def	13.30ef	50.90a	4451.67 cde	129.10def	38.12d
CIM-499	83.86 j	44113 f	16.54 c	27.30hijk	4048.19 fgh	126.70ef	40.22c
BH-147	92.64 ef	49224 abcde	14.73de	34.23def	4088.54 efg	145.40abcdef	37.61de
MNH-642	92.15 ef	45996 ef	11.55gh	34.23def	3685.07 hijk	160.70a	45.00a
N- EXP.	94.60 bcde	45996 ef	14.43de	35.75de	4126.20 defg	149.55abcde	38.26d
CIM-473	93.62 cdef	46534 ef	22.77 a	37.58cd	3792.66 ghij	127.65ef	39.93cd
CIM-511	91.79 ef	48148bcde	12.23fg	24.73k	2797.42 m	158.95abc	40.15c

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