Online Available at: https://www.sciplatform.com/index.php/ijcrt/article/view/1114

ISSN (Online) = 2707-5218

International Journal of Cotton Research and Technology

Research Manuscript https://www.sciplatform.com/index.php/ijcrt

Evaluation of Bt. cotton varieties for yield and related traits under agro-ecological environment of Dera Ismail Khan

Sohail Akbar Khan [a], Kalim Ullah [b], Rashid Khan [c], Fazal Yazdan Saleem[d] and Aslam Noor[c]

[a] Department of Agronomy, Gomal University D.I.Khan, Paksitan,
[b] The PCCC, Cotton Research Station, D.I.Khan, Pakistan
[c] Agricultural Research Institute, Rata Kulachi, D.I.Khan, Pakistan
[d] Oilseed section, Pakistan Agricultural Research Center, Pakistan.

*Corresponding Author's Email Address: kalimpbgian@gmail.com

Review Proccess: Peer review

ABSTRACT

An investigation to find out performance of various cotton cultivars under local agro-ecological environment of Dera Ismail Khan was carried out at Cotton Research Station, D.I.Khan during the crop season 2020. Trial was laid out in RCB fashion having 3 repetitions. Data were collected on various yield and related attributes like plant height (cm), plant population (ha^{-1}), No. of bolls plant^{-1}, boll weight (g), seed cotton yield (kg ha^{-1}) and ginning out turn (%). Statistical analysis revealed that different varieties depicted significant differences regarding yield and related attributes. Cotton cultivars differed significantly for lint production due to differences in number of bolls per plant, boll weight and height of plant. Based on these results it is concluded that FH-Lalazar was the most promising genotype producing yield (3444 kg ha^{-1}), bolls plant^{-1} (35.33) and boll weight (2.58 g). The cultivar CIM-622 also depicted reasonable yield and its related parameters. It is thus recommended that cotton cultivars FH-Lalazar and CIM-622 should be cultivated to harvest good yield under the agro-ecological environment of Dera Ismail Khan.

Keywords: Cotton, varieties, seed cotton yield, agro-climatic conditions.

INTRODUCTION: Cotton belongs to family Malvaceae and is considered very important on account of its significance as cash as well as industrial crop. Although cotton is grown in almost 70 countries, only four countries such as China, USA, India and Pakistan produce two-third of the cotton produced worldwide, however, China produces maximum with 25% share, followed by USA, India and Pakistan with 19%, 14% and 9%, respectively Sabir *et al.* (2011). Its produce during the crop season 2014-2015 was 13,983 thousand bales as compared to 12,769 in preceding year exhibiting an enhancement of approximately 9%. American cotton contributes approximately 90% of the world fiber production (Ullah *et al.*, 2015). In Pakistan cotton is considered as multipurpose agricultural product and used in manufacturing of many products. It earns 45-60% foreign exchange. Along with fiber, it also provides 65-70% edible oil to the industry Khan *et al.* (2010). Pakistan ranks at 4th position in cotton production and its contribution in GDP is 1.6% while value addition is 8% (Khan *et al.*, 2009). Economy of Pakistan is largely reliant on production of upland cotton, with 1815 textile and ginning units supported by millions of laborers, farmers and traders, earning livelihoods directly or indirectly from this crop (Khan and Hassan, 2011; Khan, 2013). Bt. cotton is a significant source of foreign exchange (60%). Unfortunately current cotton yield of the country is low in comparison to other advanced countries. Lack of advanced production technology, uncertain rainfalls during the crop season, various biotic and abiotic factors and limited availability of advanced and developed cotton varieties might be the reasons of low cotton yield in Pakistan as compared to the advanced countries. The potential of Bt cultivars are comparatively better than non Bt cultivars. Non Bt cultivars are less productive having less resistance to insect pests. A better seed consists of resistance to insect pest, drought tolerance and maximum production ability. Different cultivars may differ regarding number of bolls and fiber percentage (Wang *et al.*, 2004). Different cultivars may even differ regarding bollworms resistance and yield (Lisheng, 2005; Sezener *et al.*, 2006). Bt cultivars also have bollworm resistance which may also decrease pesticides charges for pest management. Maximum producing cultivars are preferred always for cultivation whereas in cotton, it is more specific on account of maximum biotic stresses and due to the reason that Bt. cultivars are considered vital for ensuring more production.

OBJECTIVE: Thus, present investigation was initiated in order to assess Bt. varieties for yield and yield related traits under agro-ecology of D.I. Khan.

MATERIAL AND METHODS: An investigation on the evaluation of 9 cotton varieties (Bt.type) for yield and related attributes under agro-ecological environment of Dera Ismail Khan, was conducted at Cotton Research Station, Dera Ismail Khan on 5th April 2020. Trial was carried out in RCB fashion having 3 repeats using a sub- plot of 30` × 10` (300 feet^2). The distance between rows and plants were kept as 75 and 30 cm, respectively. Nitrogen was applied @ 120 kg per hectare in three splits. 1/3 of N and 100 kg P ha^{-1} was used at sowing time, whereas other was used at squares and boll formation stages. Crop was watered as recommended. All the cultural practices were kept uniform for all treatments. Data on various parameters like plant height (cm), plant population (ha^{-1}), bolls plant^{-1}, boll weight (g), seed cotton yield (kg ha^{-1}) and ginning out turn (%) were recorded.

Statistical analysis: The data obtained was scrutinized according to ANOVA procedure as outlined by Steel et al. (1997) using MSTATC computers software. Averages were further divided by using LSD test (Steel and Torrie, 1960).

RESULTS AND DISCUSSIONS: Plant height (cm): The data concerning plant height of different cotton cultivars is shown in Table-1 and its statistical mean squares in table 2. Data analysis depicted that various cotton cultivars showed significant differences in plant height. The overall range of plant height was 133.33 to 156.33 cm. Maximum but statistically at par plant height of 156 cm, 153.67 cm, 146 cm, 143.33 cm and 147.33 cm. was recorded in cotton cultivars CEMB-66, SLH-4, SLH-8, FH-142 and CIM-622 respectively. Minimum plant height (133.33 cm) was documented in Cyto-178 that was similar with SLH-12 and FH-Lalazar. The remaining varieties were intermediate between these cultivars. All the varieties depicted medium plant height except cyto-178 and Lalazar which showed least height. Differences in plant height might be due to variation in hereditary makeup of cotton cultivars. Similar trend of variation in plant height was also previously recorded by Ahmad *et al.* (2008) who observed the adaptation and stability of *Gossypium hirsutum* varieties and recorded different standards for plant height and other yield related traits. The previous findings of Anwar *et al.* (2002) and Copur (2006) are also in close conformity with the present findings.

Plant population (ha^{-1}): Mean values of plant population of various cotton cultivars are presented in Table-1 whereas its mean squares are presented in Table-2. Statistical analysis showed significant differences in cotton cultivars for plant population. Maximum population was recorded for cultivar SLH-12 which was 41408 plant ha^{-1}. The cultivar CIM-622 and Lalazar ranked 2nd and 3rd regarding plant population showing 39927 and 39805 plants, respectively. Minimum plant population of 25354 was recorded for cultivar SLH-8. The remaining cultivars showed intermediate plant population. The variation in plant population might be attributed to the better germination percentage and excellent adoptability of certain varieties to agro ecological environment of study area in comparison to others. The significant variation regarding the plant population in cotton varieties had also been reported by Copur (2006) which confirmed the present findings.

No. of bolls (plant^{-1}) : Bolls are the most significant trait in managing variation in seed cotton produce as this is the main liberated and directly yield influencing parameter. Data pertaining to number of bolls is given in table 1 while its statistical mean squares are in Table 2. It was recorded that maximum bolls was found in cultivar FH-Lalazar (35.33 plant^{-1}) which was statistically at par with SLH-4 (33.33). Minimum number of bolls (25.66 plant^{-1}) was recorded for FH-142. Ahmad *et al.* (2008) also recorded the same findings regarding the bolls plant^{-1}. These results are also in close analogy with the outcomes of Khan *et al.* (2007) who assessed different cotton genotypes regarding their yield attribute and documented remarkable variances for boll numbers and their

 Digital Object Identifier: https://dx.doi.org/10.33865/ijcrt.005.01.1114

weight. They further added that boll numbers and weight has direct relationship with the seed cotton yield and has a remarkable contribution.

Boll weight (g): Boll weight is straight associated to final seed cotton yield. Data regarding boll weight is offered in Table-1 whereas its ANOVA in table 2.

Varieties	Plant height (cm)	Plant population (ha^{-1})	No. of bolls $plant^{-1}$	Boll weight (g)	Seed Cotton yield (kg ha^{-1})	GOT (%)
FH-Lalazar	134.00 c	39805 b	35.33 a	2.58	3444.0 a	42.25
SLH-4	153.67 ab	39774 b	33.33 ab	2.36	2198.3 d	41.75
SLH-8	146.00 a-c	25354 g	28.00 cd	2.34	2082.8 d	42.16
SLH-12	137.00 c	41408 a	29.33 c	2.22	2053.7 d	42.66
FH-142	143.33 a-c	34036 e	25.66 d	2.15	2129.2 d	42.33
CIM-622	147.33 a-c	39927 b	30.33 bc	2.31	2796.9 b	41.50
Cyto-178	133.33 c	35219 d	28.66 cd	2.43	2064.2 d	41.00
CIM-602	140.00 bc	31591 f	28.33 cd	2.34	2182.4 d	41.41
CEMB-66	156.33a	37470 c	29.66 c	2.38	2599.7 c	42.00
$LSD_{0.05}$	**14.45**	**846.88**	**3.26**	NS	**167.27**	NS

Table 1: Mean performance of seed cotton yield and related attributes of various cotton genotypes under the agro-climatic conditions of D. I. Khan.

Source of variation	Degree of freedom	Plant height (cm)	Plant population (ha^{-1})	No. of bolls $plant^{-1}$	Boll weight (g)	Seed Cotton yield (kg ha^{-1})	GOT (%)
Replication	2	230.78	2.131E+07	8.259	0.01274	96467	0.6551
Varieties	8	201.42*	7.978E+07**	25.259**	0.04567	668155**	0.8269
Error	16	69.73	239386	3.551	0.02029	9338	1.1160
CV%	-	5.82	7.36	6.31	6.06	4.04	2.52

Table 2. Mean squares of seed cotton yield and related attributes of various cotton genotypes under the agro-climatic conditions of D.I.Khan.

Data analysis discovered non-significant variation among treatment means. However, maximum boll weight was recorded in FH-Lalazar (2.58 g), Cyto-178 (2.43 g), SLH-4 (2.36 g), CIM-602 (2.34 g), CAMB-66 (2.38 g) and SLH-8 (2.34 g). Lowest boll weight (2.15 g) was noted in FH-142. Other cultivars also displayed comparable weight. The outcomes are in close agreement with previous results of Ahmad *et al.* (2008) and Khan *et al.* (2009). They too recorded similar variances and proportion for boll weight associated with seed cotton yield in different cultivars. Previously Hofs *et al.* (2006) also recorded significant differences among cultivars regarding boll weight.

Seed cotton yield (kg ha^{-1}): Mean data regarding seed cotton yield (table 1) depicted significant variation among the cultivars. Seed cotton yield among different varieties fluctuated from 2053.70 to 3444.00 kg ha^{-1}. Maximum yield (3444 kg ha^{-1}) was perceived in cultivar Lalazar that was statistically dissimilar to other cultivars. It was shadowed by CIM-622 (2796.90 kg ha^{-1}). Minimum seed cotton yield (2064.20 kg ha^{-1}) was noted in cultivar SLH-12. Copur (2006) Khan *et al.* (2010) observed remarkable variances in various genotypes regarding the seed cotton yield. The study revealed that Lalazar was the most promising genotype considering yield, bolls, boll weight and plant height. Cultivar CIM-622 also represented reasonable yield and its related parameters. The previous findings of Hofs *et al.* (2006) are also in close agreement and support the present findings.

Ginning out turn (%): Results relating to GOT (%) among cultivars ranged from 41.00% to 42.66% (Table-1). Statistical analysis depicted non-significant differences among various cotton cultivars (table 2). The maximum ginning out turn (42.66%) was observed in cultivar SLH-12. The minimum G.O.T of 41.00% was noted in genotype CYTO-178. The current findings are in contrast to the previous discoveries of Wang *et al.* (2004) who recorded lint production was altered in different cultivars.

CONCLUSIONS: The instant results suggest that cotton cultivars differed significantly for seed cotton yield on account of variation in quantity of bolls $plant^{-1}$, weight of boll and plant height under local agro ecology of D.I. Khan. Cultivars also depicted significant differences regarding fiber quality attributes. Based on these instant results it is concluded and recommended that FH-Lalazar was the most promising genotype considering yield, bolls $plant^{-1}$ and boll weight. The cultivar CIM-622 & SLH-12 also depicted reasonable yield and its related parameters. It is thus recommended that cotton cultivars Lalazar, CIM-622 and SLH-12 should be cultivated because it produced good yield under the agroclimatic conditions of D.I. Khan.

CONFLICT OF INTEREST: Authors have no conflict of interest

ACLKNOWLEDGEMENT: Pakistan Central Cotton Committee, Cotton Research Station, D. I. Khan, Pakistan is acknowledged for providing all research inputs and bearing the cost of field experiments.

REFERENCES: Ahmad, W., N. Khan, M. Khalil, A. Parveen, U. Aimen, M. J. G. v. Saeed and c. a. i. u. cotton., 2008. Genetic variability and correlation analysis in upland cotton. Sarhad journal of agriculture, 24(4): 195-201.

Anwar, A., M. Gill, D. Muhammad and M. Afzal, 2002. Evaluation of cotton varieties at different doses of nitrogen fertilizer. The Pakistan cottons, 46(1-4): 35-41.

Copur, O., 2006. Determination of yield and yield components of some cotton cultivars in semi-arid conditions. Pakistan journal of biological sciences, 9(14): 2572-2578.

Hofs, J.-L., B. Hau, D. Marais and M. Fok, 2006. Boll distribution patterns in bt and non-bt cotton cultivars: Ii. Study on small-scale farming systems in south africa. Field crops research, 98(2-3): 210-215.

Khan, N. and G. Hassan, 2011. Genetic effects on morphological and yield traits in cotton (*gossypium hirsutum* l.). Spanish journal of agricultural research, 9(2): 460-472.

Khan, N. U., 2013. Diallel analysis of cotton leaf curl virus (clcuv) disease, earliness, yield and fiber traits under clcuv infestation in upland cotton. Australian journal of crop science, 7(12): 1955-1966.

Khan, N. U., G. Hassan, M. B. Kumbhar, S. Kang, I. Khan, A. Parveen and U. Aiman, 2007. Heterosis and inbreeding depression and mean performance in segregation generations in upland cotton. Editorial Advisory Board, 17(4): 531-546.

Khan, N. U., G. Hassan, K. B. Marwat, M. Farhatullah, A. Parveen, U. Aiman, M. Khan and Z. Soomro, 2009. Diallel analysis of some quantitative traits in *gossypium hirsutum* l. Pakistan journal of botany, 41(6): 3009-3022.

Khan, N. U., K. B. Marwat, G. Hassan, S. B. Farhatullah, K. Makhdoom, W. Ahmad and H. U. Khan, 2010. Genetic variation and heritability for cotton seed, fiber and oil traits in *gossypium hirsutum l*. Pakistan journal of botany, 42(1): 615-625.

Lisheng, B., 2005. Comprehensive evaluation of new varieties of insect-resistant hybrid cotton by grey association degree. Shanghai nongye xuebao, 21(1): 12-14.

Sabir, H. M., S. H. Tahir and M. B. Khan, 2011. Bt cotton and its impact on cropping pattern in punjab. Pakistan journal of social sciences, 31(1): 127-134.

Sezener, V., T. Bozbek, A. Unay and I. Yavas, 2006. Evaluation of cotton variety yield trials under mediterranean conditions in turkey. Asian journal of plant sciences.

Steel, R. G. D. and J. H. Torrie, 1960. Principles and procedures of statistics. Principles procedures of statistics.

Ullah, K., Z. Usman, N. Khan, R. Ullah, F. Y. Saleem, S. I. Khattak and M. Ali, 2015. Genetic diversity for yield and related traits in upland cotton genotypes. Pakistan journal of agricultural research, 28(2).

Wang, C., A. Isoda and P. Wang, 2004. Growth and yield performance of some cotton cultivars in xinjiang, china, an arid area with short growing period. Journal of agronomy crop science, 190(3): 177-183.

Except where otherwise noted, this item's licence is described as **© The Author(s) 2023**. Open Access. This item is licensed under a **Creative Commons Attribution 4.0 International License**, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The images or other third party material in this it are included in the article's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.