

PERFORMANCE OF BT COTTON VARIETIES UNDER KHANEWAL CONDITIONS

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Abstract

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Since 2002, farmers in Pakistan have been growing cotton that contains the first generation of *Bacillus thuringiensis* (Bt). Although, formally unapproved and unregulated, a large number of Bt cotton varieties have been cultivated now a days in Khanewal. In order to identify the superior genotype for this area, we studied the comparative growth and yield performance of ten cotton cultivars namely, MNH-886, BH-178, FH-142, VH-301, IUB-222, CIM-602, MNH-456, Tarzen-1, BH-180, FH-114 on clay loam soil. All the treatments were arranged in a randomized complete block design with three replicates. At 160 days after sowing, numbers of bolls plant⁻¹, seed cotton weight boll⁻¹(g) and seed cotton yield (kg ha⁻¹) were recorded for each treatment by selecting five random plants per plot. The results revealed that all these parameters differed significantly ($P < 0.05$) among Bt cultivars. FH-142 had the highest value for the no. of bolls plant⁻¹ weight boll⁻¹ and seed cotton yield. A positive co-relation was found between no. of bolls plant⁻¹ and seed cotton yield, whereas no such relation could be established between seed cotton weight boll⁻¹ and overall seed cotton yield. It was concluded that FH-142 performed best in all of the studied traits than other cultivars and may be recommended for cultivation in Khanewal agro-ecological conditions.

Key words: Cotton, Genotype, Seed cotton yield, Ecological conditions, Khanewal

Introduction

Cotton, undoubtedly an important cash crop, plays a vital role in the economy of Pakistan. Contribution of cotton itself, and its intermediate as well as final products such as yarn, textile and apparel, is significant in the growth domestic product (8%) and foreign exchange earnings (54%). Pakistan is ranked at 4th position in the world with respect to its production and 3rd in case of consumption.

In Pakistan, cotton is grown on about 15% of the total cultivated area and the production is mainly concentrated in Punjab province which represents 80% of its total cultivation. Since early 1990, cotton production in all over the country is under many threats i.e. pest infestation, diseases, heat and drought stresses. All these contributing to reduction in the cotton yields and thereby the economic losses ranging from 10-15% in a typical year to 30-40% in a bad crop year (Salam,

2008; Nazli, 2010). To cope with these problems, a wide range of pesticides as well as soil, crop and irrigation management practices have been introduced and/or implemented which not only have increased the cost of production but also resulted in some health problems. In late 1990s, plant breeders developed some new cotton varieties through genetically modified (GM) technology, which are resistant to some pests and disease. The introduction of these cotton varieties (also known as Bt cotton after the name of *Bacillus thuringiensis* involved in the technology) greatly reduced the yield loss through the control of some of the pest infestation. Thereafter, area under cotton crop increased rapidly, especially in years 2010-2012 by 5.4% as compared to the previous years due to control of cotton leaf curl virus and growing Bt cotton cultivars (statistic Beau rue 2011-12). In the recent years production of cotton crop in Pakistan has been remained encouraging due to release of high yielding Bt varieties as well as application of

proper package of production technology by the farmers of agro-ecological zone especially in Multan division.

Some studies have already been made to compare the performance of Bt cotton varieties with those of the recommended non-Bt varieties in Pakistan based on semi-structured questionnaires, informal interviews and research trials (Ahmed et al., 2003; Hassan et al., 2004; Hayee, 2004; Sheikh et al., 2008; Arshad et al., 2009; Nazli, 2010 and Aziz et al., 2011). The results revealed a huge variations in bolls/plant, boll weight and seed cotton yield of some Bt vs. non-Bt cotton varieties with the greatest values in the former case. However, to the best of our knowledge, no solid data sets exist regarding all the above parameters among the existing Bt cotton varieties especially under Khanewal conditions. Thus aim of the present study was to quantitatively estimate and compare the performance of new BT cotton strains under Khanewal conditions.

Materials and Methods

To pursue the objective outlined above, a field experiment was carried out at agronomic research station Khanewal.

Experimental set up and treatments

The experiment was done on beds of clay loam soil. The seedbeds were prepared mechanically followed by formation of the beds with a bed planter. Thereafter, sowing was done manually on 24th May 2012 on plot size, each measured 3x10 m. The plant to plant distance was maintained at 1x1 foot, whereas row to row distance at 2.5 feet. Treatments included were ten Bt cotton varieties: MNH-886, BH-178, FH-142, VH-301, IUB-222, CIM-602, MNH-456, Tarzen-1, BH-180 and FH-114. All the treatments were arranged in a randomized complete block design with three replicates. In each treatment standard doses of phosphorus (P), potassium (K) and nitrogen (N) fertilizers were applied at a rate of 145, 56 and 62 kg ha⁻¹ respectively. The N, P and K were applied in the form of Urea, Diammonium phosphate and Sulphate of potash, respectively. All the P and K were applied at the time of sowing while N in three splits each synchronized with irrigation event. Weeds from the experimental area were controlled by spraying the standard dose of pendimethaline (pre-emergence) while all other agronomic practices were kept constant for all the treatments.

Data collection and analysis

Data were collected at 160 days after sowing (DAS) for the numbers of bolls plant⁻¹ and bolls weight (grams) of 10 bolls plant⁻¹ and seed cotton yield. For this purpose, 5 plants per plot were selected randomly and bolls were carefully counted

from each individual plant. Out of all the bolls plant⁻¹, ten bolls were randomly selected and weighed using a digital balance. Thereafter, the seed cotton yield per plot was estimated after picking the cotton from the whole plot and adding the weight of the collected bolls. The values were up scale from kg plot⁻¹ to kg ha⁻¹ for each treatment and replication.

After collection, data were statistically analyzed using analysis of various in Genstat (13th Edition, VSN International, Hemel Hempstead, UK). For each variable, difference among the varieties was further compared using Tukey's test at 5% probability level (Steel and Torrie, 1984).

Results and Discussion

Results revealed significant differences among all the cotton genotypes for number of bolls plant⁻¹, boll weight (g) and seed cotton yield (kg ha⁻¹). Among all varieties, FH-142 gave maximum seed cotton yield (3655 kg ha⁻¹), whereas this value was the lowest in case of CIM-602 (2296 kg ha⁻¹, Table 1). The behavior of most of the varieties regarding number of bolls and boll weight (g) per plant was not much different. However, the variety FH-142 produced maximum number of bolls per plant (47.5) followed by MNH-456 (46.6) and BH-178 (46.5) while BH-180 produced the least numbers (34.7). In case of boll weight FH-142 gave maximum value (4.8 g) followed by MNH-886 (4.7 g) while FH-114 produced the lowest (3.2 g).

The regression of the data revealed a relationship ($R^2 = 0.66$) between the number of bolls per plant and the seed cotton yield; the seed cotton yield apparently increased with the number of bolls per plant (Figure 1a). However, no relation could be established between the boll weights vs. seed cotton yield (Figure 1b). Consequently, the highest observed seed cotton yield of FH-142 in all probability might be attributed to the greatest number of bolls per plant. Numbers of bolls per plant play a vital role in determining final yield of a cotton cultivar, which is influenced directly or indirectly by the growing conditions and its genetic ability to perform in the given environmental condition. The observed significant differences in boll number per plant among the cotton cultivars in our study might be due to inherent capacity and inability of some genotypes to provide photosynthates to a large number of bolls. This corroborates with Asad et al. (2002), Tahira et al. (2007) and Aziz et al. (2011) who reported inequality in the number of bolls per plant with different cotton varieties, when grown under identical conditions.

All the tested varieties have high yielding potential than observed in our study. In our experiment yield of all the varieties is affected because of persisted heavy rains at the time of fruiting and virus attack due to which the yield of

cotton varieties remained far below their potential. The solution of the virus attack is the only virus resistant variety. The viral infection is one of a major hurdle for yield improvement in cotton crop and the cultivars which showed resistance against it are preferred for general cultivation than the susceptible varieties (Khan et al., 1993). The highest resistance in cotton cultivars for cotton leaf curl virus may be due to (i) genetic alteration created in this genotype and (ii) less susceptibility to insects that are considered to play a role in the transfer of virus from one plant to another. This argument is supported by Azhar et al. (1999) and Asad et al. (2002) who narrated that low susceptibility of Bt cotton to virus infection may be due to inherited resistance against boll worms. All these employed that FH-142 proved to be the most resistant to viral infection and tolerant to adverse environmental conditions.

Conclusion

This study revealed a significant variation among the tested cotton genotypes for parameters like numbers of bolls plant⁻¹, seed cotton weight boll⁻¹ (g) and seed cotton yield (kg ha⁻¹). For all the parameters, FH-142 proved to be the best among all the tested cultivars. Therefore, it is strongly recommended to cultivate FH-142 in the region of Khanewal in order to get maximum benefits from the cotton crop.

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Table 1
Yield parameters of the cotton cultivars under Khanewal conditions

Sr. No.	Variety	No. of Bolls per plant	Boll weight, g	Seed cotton yield, kg ha ⁻¹
1	MNH-886	45.7a	4.7ab	3515b
2	BH-178	46.5a	3.8 cde	3481b
3	FH-142	47.5a	4.8 a	3655a
4	VH-301	36.3bc	3.7 def	2667e
5	IUB-222	35.3c	4.3 abc	2774df
6	CIM-602	39.3b	4.3abc	2296g
7	MNH-456	46.6a	4.0cde	3576ab
8	TARZAN-1	44.8a	3.0def	3026c
9	BH-180	34.7c	4.2 bcd	2541f
10	FH-114	45.4a	3.2 f	2846d
LSD		3.7	6.1	121

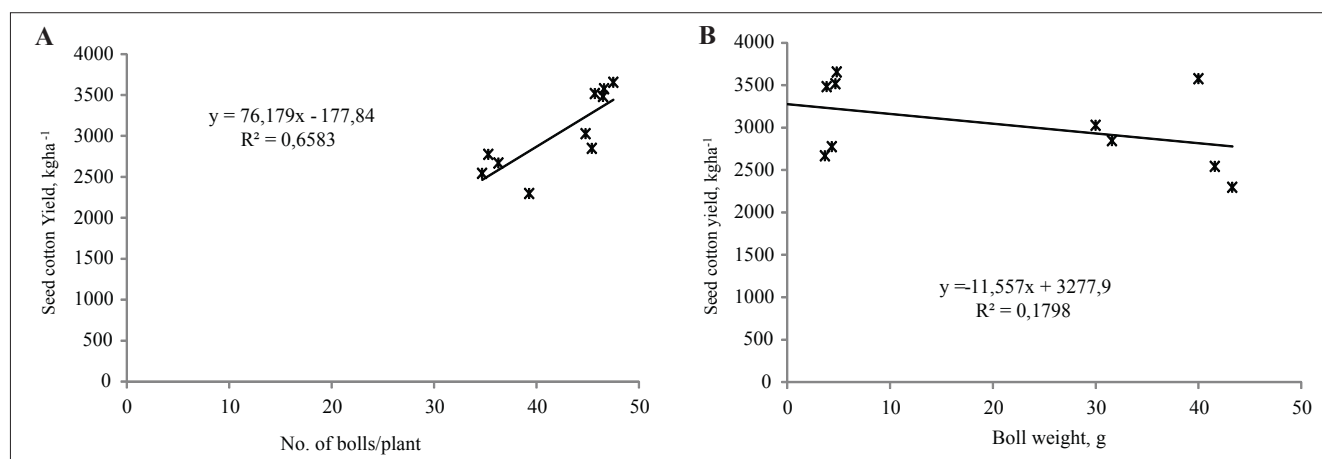


Fig. 1.

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