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RESEARCH PAPER

Growth, seed cotton yield and yield attributes of American cotton (*Gossypium hirsutum* L.) hybrids under different spacing and nitrogen levels

KULVIR SINGH
Regional Research Station (P.A.U.), FARIDKOT (PUNJAB) INDIA (Email : kulvir@pau.edu)

Abstract : Field studies were conducted at Punjab Agricultural University, Regional Station, Faridkot during *Kharif* 2013 to evaluate the performance of two hirsutum hybrids (FHH200 and LHH144) in main, two spacing levels (67.5×75 cm and 67.5×90 cm) in sub and three nitrogen levels (*i.e.* 112,150 and 187 kg N/ha) in sub plots of Split Plot Design replicated thrice. FHH200 recorded significantly highest seed cotton yield (SCY) of 2953.1 kg/ha followed by LHH144 (2495.2 kg/ha), while among spacing levels differences were non-significant. Among tested N levels, 150 kg N resulted in highest SCY (2868.1 kg/ha) followed by 187kg N (2738.1 kg/ha) while statistically least SCY was recorded with 112 kg N (2566.3 kg/ha). Though cost of cultivation increased with each increase of nutrient levels, but gross as well as net returns improved significantly only up to 100 per cent RD and declined thereafter. B:C ratio was significantly higher under 150kg N/ha (2.34) as compared to 187 kgN/ha (2.15). Farmers should opt for FHH200 and a spacing level of 67.5×75cm for hirsutum hybrids and must apply N @150kg/ha to realize higher SCY and consequently remunerative returns.

Key Words : Fertilizer use efficiency (FUE), Nitrogen levels, Seed cotton yield (SCY), Water productivity (WP)

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INTRODUCTION

Cotton is one of the most important cash crop grown in southwestern zone of Punjab state during *Kharif* season .In Punjab, total cotton acreage of 4.8 thousand hectare resulted in production of 1627 thousand bales with an average lint yield of 575kg/ha (Anonymous, 2014). Among different agronomic manipulations, selection of potential genotypes along with optimum plant stand and ideal fertilization play crucial role in increasing the productivity of cotton crop. The yield parameters and their components have been found to vary with fertilizer application under variable population pressure (Ahlawat *et al.*, 1973 and Shrinivasan *et al.*, 1979). Higher SCY due to improved yield contributing parameters per plant under elevated levels of nutrients has also been observed by Bhalerao *et al.* (2010) and Sunitha *et al.* (2010). Significant improvement in SCY and consequently better monetary parameters with application of optimum nutrient levels has also been reported in Bt cotton (Singh *et al.*, 2013). Development of new varieties with high yield potential is a continuous phenomenon meant for replacement of old ones. However, their agronomic requirements need to be ascertained in relation to the new genotypes under a given set of environment and edaphic conditions. Farmers also demand information on cultivar differences in response to location specific needs. Obviously, the best way to achieve these aims is through the scientific evaluation of cultivars (Singh *et al.*, 2014). Therefore, present studies were undertaken to evaluate the yield potential of hirsutum hybrids FHH200 and LHH144 under the specific agro-climatic conditions, work out their

optimum spacing and nitrogen requirement for achieving high productivity and also their economic viability.

MATERIAL AND METHODS

The experiment was conducted during *Kharif* 2013 at Punjab Agriultural University, Research Station, Faridkot which lies in Trans-Gangetic agro-climatic zone, representing the Indo-Gangetic alluvial plains (30^0 40'N and 74^0 44 'E) of Punjab [a typical representative of semi-arid south-western cotton belt (Zone IV)] situated at 200m above MSL. The soil of the experimental field was loamy sand in texture, slightly alkaline (pH 8.8), normal EC (0.19 mmhos/cm), medium in OC (0.27%) and available P (16.8 kg/ha) but high in available K (375 kg/ha). The experiment comprised of two hirsutum hybrids (FHH200 and LHH144) in main, two spacing levels (67.5×75 cm and 67.5×90 cm) in sub and three nitrogen levels (*i.e.* 112 kg N/ha 75% of recommended),150 kg N/ha (100% of recommended) and 187 kg N/ha (125% of recommended) in sub plots of Split Plot Design was replicated thrice. Sowing was done on May, 15 by dibbling 2-3 seeds/hill which were later thinned to one seedling per hill. A uniform inter row spacing of 67.5 cm was maintained. Full dose of 30kg P_2O_5/ ha was applied before sowing while N dose was given in two splits *i.e.* first half at the time of thinning and remaining half at flowering stage. Data on growth and yield attributes were recorded from five randomly selected plants in each treatment plot. SCY was recorded from whole plot. Water productivity (WP) and Fertilizer use efficiency (FUE) was worked out by dividing the SCY with total amount of irrigation water and fertilizer applied for the respective parameter. Monetary parameters were calculated on the basis of prevailing market price of inputs and seed cotton. The data were analyzed statistically using SAS proc to test the significance (SAS Institute Inc., 2009). The least significant difference (LSD) at 5 per cent probability level was used for comparing the differences among the treatments and mean values have been used to discus results.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect on growth, yield and ancillary characters of *hirusutum* hybrids :

The tested *hirusutum* hybrids differed significantly for growth, yield attributing characters as well as for SCY (Table1). FHH200 recorded significantly better yield (2953.1 kg/ha) by 18.3 per cent than LHH144 (2495.2 kg/ha) due to statistically higher number of bolls/plant. However, plant height, monopods and boll weight per plant were not affected. Singh *et al.* (2007) also found significant differences for SCY among tested cultivars due to difference in number of bolls and sympods per plant. Boll number of FHH200 (66.4) was also found to be significantly higher by 24.5 per cent than LHH144 (53.3). Kaur and Brar (2005) also reported significant differences among American cotton genotypes for SCY and other attributes. Manjunatha *et al.* (2010) also reported significant differences for SCY among cotton hybrids particularly due to improved number of bolls per plant. The results in the Table 2 indicated that ginning out turn (GOT %) varied non-significantly among cotton hybrids but lint and seed yield were significantly influenced with statistically higher values for FHH200. The data further revealed statistically highest values of 6.53 and 656.2 gm^3 under FHH200 for fertilizer use efficiency (FUE) and water productivity (WP) indices, respectively while least FUE (5.55) as well as WP (554.5g^3) was recorded for LHH144. Due to higher SCY under

Table 1 : Effect of different treatments on growth, seed cotton yield and yield attributes

Treatments	Plant height (cm)	Monopods/ plant	Sympods/ plant	Bolls/ plant	Boll weight (g)	Seed cotton yield (kg/ha)	Biomass (q/ha)	Plant stand/ha
Hybrids								
FHH200	148.1	5.2	41.9	66.4	3.98	2953.1	169.5	17340
LHH144	146.6	4.2	34.0	53.3	4.01	2495.2	163.7	17431
LSD (0.05)	NS	NS	3.8	12.8	NS	409.1	NS	NS
Spacing (cm)								
67.5×75	150.0	4.6	36.3	58.1	3.90	2729.0	169.0	19071
67.5×90	144.7	4.8	40.0	61.6	4.08	2719.3	164.2	15701
LSD (0.05)	NS	NS	3.2	NS	NS	NS	NS	320
N levels								
112kg/ha (75% Rd)	142.1	4.4	35.1	55.6	3.90	2566.3	157.6	17459
150 kg/ha (100% Rd)	147.7	4.7	39.0	62.8	4.05	2868.1	168.4	17459
187 kg/ha (125% Rd)	152.1	5.0	40.3	61.0	4.03	2738.1	173.9	17240
LSD (0.05)	6.7	NS	2.8	4.4	NS	189.5	10.8	NS

NS=Non-significant

FHH200, picking cost was also higher resulting into significantly higher cost of cultivation (Rs. 38926/ha) as compared to LHH144 (Rs. 36179/ha). Highest net returns of Rs. 93964/ha were also observed for FHH200 while LHH144 recorded least (Rs. 76108/ha). Statistically improved B:C ratio (2.40) owing to significantly improved net returns again indicated superiority of FHH200 over LHH144 (1.69) was clearly indicative of its being more remunerative.

Effect of spacing on growth, yield and monetary parameters :

Perusal of Table 1 revealed that plant height, monopods, boll weight, bolls per plant, SCY and biomass were not significantly affected by spacing levels. However, significantly higher number of sympods per plant was recorded in spacing combinations of 67.5×90 (40.0) over that of narrow spacing of 67.5×75 cm (36.3). Spacing levels failed to influence GOT, lint and seed yield significantly. Kaur and Brar (2005) also recorded significantly more number of bolls per plant under wider spacing (90×60cm) as compared to narrow spacing combinations (67.5×45 and 67.5×60 cm). Narayana *et al.* (2007) also reported significantly better number of bolls/plant was under wider (120×60cm) than the closer plant geometry (90×60 cm) owing to the reasons discussed above. Reddy and Gopinath (2008) also observed statistically improved bolls per plant under wider plant geometry due to lesser competition among plants for the available resources. However, Srinivasulu *et al.* (2006) and Brar *et al.* (2008) reported non-significant differences for SCY with respect to plant geometries. All other studied parameters varied non-significantly.

Effect of nitrogen on growth, yield and monetary parameters :

The results indicated that various nitrogen levels significantly affected growth attributes like plant height, biomass, yield attributes like bolls and sympods per plant, boll weight and overall SCY (Table 1). There was a significant improvement in SCY when the N level was increased from 112 kg (2566.3kg/ha) to 150 kg/ha though it was at par with 187 kg of N (2738.1kg/ha). It was further observed that SCY improved significantly only up to 100 per cent level of Rd (2868.1kg/ha) and thereafter, it declined. Lint and seed yield also followed the similar trend. Hence, an increase of 11.7 and 6.7 per cent in SCY was observed at N levels of 150 and 187 kg/ha, respectively over that of 112 kg N/ha. The non-significant yield differences at 150 and 187 kg N/ha indicated that recommended level of 150 kg N/ha is sufficient enough to get higher yield from tested hybrids. Ram and Giri (2006) also reported similar results where 50 and 60 kg N/ha resulted in significantly higher SCY than 40 kg N / hectare. Bolls per plant improved from 55.6 to 62.8 and then declined to 61.0 with each successive increase in level of N application. However, Singh *et al.* (2007) also reported significant improvement in SCY with increasing N levels among tested cotton genotypes. Higher SCY due to better number of bolls per plant under elevated levels of nutrients has also been reported by Bhalerao *et al.* (2010) and Sunitha *et al.* (2010). Water productivity also improved significantly with every increase in N levels *i.e.* from 570.2 (112 kg N) to 637.3 (150 kg N) and then indicated declining value of 608.4 g^3 with application of 187kg N/ha. However, Singh *et al.* (2013) observed a significant improvement in WP up to 710.8 g^3 with improved nutrition in cotton over that of control (491.5 g^3). Contrarily, FUE followed the reverse trend as it declined from 7.31 to 6.12 and then to a significantly least value of 4.68 with every successive increase in N levels (Table 2). N application exhibited significantly enhanced cost of cultivation with each

Table 2 : Effect of different treatments on lint and seed yield, FUE, WP and monetary parameters

Treatments	Lint yield (kg/ha)	Seed yield (kg/ha)	GOT (%)	FUE	WP	COC (Rs./ha)	GR (Rs./ha)	NR (Rs./ha)	B:C ratio
Hybrids									
FHH200	989.0	1964.0	33.4	6.53	656.2	38926	132891	93964	2.40
LHH144	841.6	1653.6	33.7	5.55	554.5	36179	112288	76108	2.10
LSD (0.05)	105.3	304.4	NS	0.95	90.8	2456	18406	15952	0.26
Spacing (cm)									
67.5×75	914.4	1814.6	33.5	6.05	606.4	37738	122808	85069	2.24
67.5×90	916.3	1803.0	33.7	6.03	604.3	37367	122371	85003	2.26
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
N levels									
112kg/ha (75% Rd)	861.0	1705.2	33.5	7.31	570.2	35328	115484	80156	2.26
150 kg/ha (100% Rd)	961.0	1907.1	33.5	6.12	637.3	38416	129067	90651	2.34
187 kg/ha (125% Rd)	923.9	1814.1	33.7	4.68	608.4	38914	123216	84302	2.15
LSD (0.05)	68.1	124.8	NS	0.45	42.1	1136	8528	7391	0.12

FUE and WP indicate fertilizer use efficiency (kg seed cotton yield/ kg fert. applied) and water productivity (g/m^3), respectively.
GOT, COC, GR, NR and B:C ratio indicates ginning outturn, cost of cultivation, gross returns, net returns and benefit cost ratio, respectively.
NS=Non-significant

successive increase but gross and net returns increased significantly upto 150 kg N /ha (*i.e.* 100% RD) only and declined thereafter. Highest net returns (Rs. 90651/ha) were recorded with application of 150 kg N /ha (*i.e.* 100% RD). As a result of this, better B:C ratio was recorded under 150 kg N/ha (2.34) as compared to 112 kg N /ha (2.26) and 187kg N /ha (2.15). Contrarily, Biradar *et al.* (2010) reported higher returns with enhanced level of nutrition (150% RD) than 100 per cent recommended level. It can be concluded from the studies that in south-western cotton belt of Punjab state, farmers should opt for FHH200 and a spacing level of 67.5×75cm for hirsutum hybrids and must apply N @150kg/ha to realize higher SCY and consequently remunerative returns.

REFERENCES

Ahlawat, I.P.S., Mundholkar, N.S. and Sahni, V.M. (1973). Effect of fertilizer and population pressure on cotton. *Indian J. Agron.*, **18**: 454-58.

Anonymous (2014). Package of practices for *Kharif* crops. Punjab Agricultural University, Ludhiana (PUNJAB) INDIA.

Bhalerao, P.D., Patil, B.R., Ghatol, P.U. and Gawande, P.P. (2010). Effect of spacing and fertilizer levels on seed cotton yield under rainfed condition. *Indian. J. Agric. Res.*, **44** (1) : 74-76.

Biradar, V., Rao, S. and Hosamani, V. (2010). Economics of late sown Bt cotton as influenced by different spacing, fertilizer and NAA applications under irrigation. *Internat. J. Agric. Sci.*, **6** (1) : 196-198.

Brar, J.S., Sidhu, B.S., Sekhon, K.S. and Buttar, G.S. (2008). Response of Bt cotton to plant geometry and nutrient combinations in sandy loam soil. *J. Cotton Res. Dev.,* **22** : 59-61.

Kaur, M. and Brar, A.S. (2005). Influence of different spacings on yield and yield attributes of cotton. *J. Cotton Res. Dev.,* **19** : 197-199.

Manjunatha, M.J., Halepyati, A.S., Koppalkar, B.G. and Pujari, B.T. (2010). Yield and yield components, uptake of nutrients, quality parameters and economics of Bt cotton genotypes as influenced by different plant densities. *Karnataka J. Agric. Sci.*, **23** (3) : 423-425.

Narayana, E., Hema, K., Srinivasulu, K., Prasad, N.V.V.S.D. and Rao, N.H.P. (2007). Agronomic evaluation of *Gossypium hirsutum* hybrids for varied spacings and nitrogen levels in vertisols under rainfed conditions. *J. Cotton Res. Dev.,* **21** (2) : 197-200.

Ram, M. and Giri, A.N. (2006). Response of newly released cotton (*Gossypium hirsutum* L.)varieties to plant densities and fertilizer levels. *J. Cotton Res. Dev.,* **20** : 85-86.

Reddy, P.R. and Gopinath, M. (2008). Influence of fertilizers and plant geometry on performance of Bt cotton hybrid. *J. Cotton Res. Dev.,* **22** (1) : 78-80.

SAS Institute Inc. (2009). *SAS® 9.2 Macro Languages: Reference*. Cary, NC; SAS Institute Inc., Copyright © 2009 Cary, NC, USA.

Shrinivasan, T.R., Rangaswami, A., Jaganathan, N.T. and Trutharaj, M.R. (1979). Response of cotton to row patterns, population and nitrogen levels. *Indian J. Agron.*, **24** : 245-249.

Singh, Kulvir, Jindal, V., Singh, V. and Rathore, P. (2007). Performance of Bt cotton hybrids under different geometrical arrangements. *J. Cotton Res. Dev.,* **21** (1) : 41-44.

Singh, Kulvir, Singh, Harmandeep, Gumber, R.K. and Singh, Kuldeep (2013). Growth, yield and quality characteristics of Bt cotton as influenced by foliar feeding of nutrients. *J. Cotton Res. Dev.,* **27** (2) : 213-216.

Singh, Kulvir, Rathore, Pankaj and Gumber, R.K. (2014). Productivity potential and monetary evaluation of Bt cotton hybrids under varied agronomic manipulations in semi-arid conditions. *J. Environ. Biol.*, **35**(5) : 839-842.

Srinivasulu, K., Hema, K., Prasad, N.V.V.S.D. and Krishna Rao, K.V. (2006). Performance of cotton hybrids under different spacings and nitrogen levels in black cotton soils of coastal Andhra Pradesh. *J. Cotton Res. Dev.,* **20** : 99-101.

Sunitha, V., Chandrasekhar, K. and Veeraraghavaiah, R. (2010). Performance of Bt cotton hybrids at different nitrogen levels. *J. Cotton Res. Dev.,* **24** (1) : 52-55.

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