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Studies on crop geometries and fertility levels for Bt cotton hybrids

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ABSTRACT : An experiment was conducted at Agricultural Research Station, Borwat Farm, Banswara during *Kharif* -2010 and 2011 to find out optimum pant geometry and fertility levels for Bt cotton hybrid under three plant geometries (90 x 90, 90 x 60 and 90 x 45 cm) and three fertility levels (*i.e.* 75, 100 and 125 % RDF). Significantly higher seed cotton yield was recorded (2301 kg ha^{-1}) under closer geometry of 90 x 45 cm (2301 kg ha^{-1}) than wider plant geometry of 90 x 60 cm (1934 kg ha^{-1}) and 90 x 90 cm (1759 kg ha^{-1}), respectively. Though, yield attributing parameters such as bolls plant^{-1} and boll weight were statically improved in wider as compared to closer spacing but it could not compensate yield due to significantly higher plant population in the later case. Among fertility levels, similar seed cotton yield was recorded with the application of 100% RDF (2204 kg ha^{-1}) and 125 % RDF (2295 kg ha^{-1}) but both were significantly better than that of 75 % RDF (1865 kg ha^{-1}) and plant geometry 90 x 45 cm seemed to be ideal for Bt cotton hybrid for realizing higher productivity under the specific agro climatic zone IV b of (Rajasthan).

KEY **W**ORDS : Bt cotton, Plant geometry, Seed cotton yield, Fertility levels

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Cotton (*Gossypium* spp.) is an important fibre crop of India contributing to 85 per cent of total raw material of textile industries. Cotton is said to be "King of cash crop". In fact it is true because cotton has a great importance in global economy. Spacing is an important factor which influenced the yield as well as plant stand. There is a positive relationship between optimum plant population and yield (Rao, 1985). Cotton can be grown at different crop geometry and fertilizers levels. But hybrids of cotton require tailored crop geometry and fertilizes for yield maximization under rainfed condition. The precise knowledge on adequate crop geometry and fertilizers not only saves the investment of costly input during cultivation, but also enhance the production through adequate plant stand and efficient utilization of input. Besides that, monopodial, sympodial, lint yield, number of functional leaf, dry matter per plant are also influenced by type of cotton hybrids under different levels of fertilizer and crop geometry (Anand, 2006). It is substantially required to fully exploit the production potential of a hybrids by standardizing some of the agronomic practices particularly an optimum crop geometry with efficient and balanced fertilization of NPK influence the growth and development of cotton (Reddy, 2011), because of adequate crop geometry prevents inter plant competition for resources. However, balance application of NPK required for higher productivity and maintains physiological, bio-chemical and metabolic processes of plant to produce good quality bolls and sustained productivity of soil (Charjan and Gaikwad, 2005). Hence, it was needed to rehypothesize the work on crop geometry with different levels of NPK under

rainfed area. The present investigation was, therefore, planned to study the "Studies on crop geometries and fertility levels for Bt cotton hybrids".

RESEARCH PROCEDURE

The field experiment was conducted for two consecutive crop season *Kharif* -2010 and 2011 at Agricultural Research Station, Banswara. The treatments comprised of three plant geometries (90 x 90, 90 x 60 and 90 x 45 cm) in main plot treatment and three fertility levels (*i.e.* 75, 100 and 125 % RDF) in sub plot treatments of split plot design with four replications. Experimental field was well prepared by two ploughing followed by harrowing and cultivator and one planking for uniform levelling were performed for sowing of cotton. The soil was medium in available nitrogen (245 and 253 kg/ha) and phosphorus (48.40 and 50.50 kg/ha) and high in available potassium (320 and 326 kg/ha) during both the years. The crop was sown in first week of June by dibbling 2-3 seeds per hills and full dose of phosphorus and potash were applied before sowing, while nitrogen dose was given in two splits *i.e.* first half at the time of thinning and remaining half at flowering stage. All production and protection measures were applied as per package of the zone.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Growth parameters:

Two years pooled data (Table 1) shows that the sowing of Bt cotton at different plant geometry significantly influence plant growth parameters. The maximum plant height (96.90 cm), monopodial branches plant^{-1} (1.51) and sympodial branches plant^{-1} (19.61) were observed at sowing of 90 x 90 cm wider plant spacing over sowing of 90 x 60 and 90 x 45 cm closer plant spacing. Application of 125 per cent RDF gave significantly higher plant height (96.89 cm), monopodial branches plant^{-1} (1.51) and sympodial branches plant^{-1} (19.49) over application of 75 per cent RDF but it was found at par with application of 100 per cent RDF plant height (93.58 cm), monopodial branches plant^{-1} (1.47) and sympodial branches plant^{-1} (18.83). Rekha *et al.* (2008) also recorded significantly more seed cotton yield due to increase in number of sympodial branches /plant^{-1} under higher fertility levels.

Yield attributes:

It is evident from pooled data (Table 1) the yield attributes of Bt cotton were influence by sowing of different plant geometry. Significantly higher bolls plant^{-1} (25.55) and boll weight (4.03 g) were recorded at sowing of 90 x 90 cm wider plant geometry over sowing of 90 x 60 and 90 x 45 cm closer plant geometry. Significantly increase the bolls plant^{-1} and boll weight with the increasing of RDF, application of 125 per cent RDF bolls plant^{-1} (26.74) and boll weight (4.37 g) and 100 per cent

Table 1: Effect of plant geometry and fertility levels on plant population, growth, yield attributes and yield of Bt cotton

Treatments	Plant height (cm)			Monopodial branches /plant			Sympodial branches/ plant			Bolls / plant			Boll weight (g)			Seed cotton yield (kg/ha)		
	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled	2010	2011	Pooled
Plant geometry																		
90 x 90 cm	91.70	102.10	96.90	1.47	1.55	1.51	18.02	21.20	19.61	24.01	26.43	25.22	3.64	4.42	4.03	1694	1824	1759
90 x 60 cm	85.34	96.04	90.69	1.30	1.37	1.33	16.00	19.55	17.77	21.41	22.98	22.19	3.31	4.00	3.66	1859	2009	1934
90 x 45 cm	81.46	91.23	86.34	1.24	1.33	1.29	15.08	18.24	16.66	20.90	21.48	21.20	3.26	3.94	3.60	2197	2406	2301
S.E. ±	1.68	1.72	1.56	0.05	0.05	0.046	0.42	0.45	0.40	0.71	0.94	0.76	0.11	0.14	0.12	105	102	95
C.D. (P=0.05)	5.24	5.20	4.70	0.16	0.17	0.14	1.26	1.39	1.20	2.24	2.93	2.30	031	0.40	0.35	317	305	287
Fertility levels																		
75 % RDF	80.73	92.69	86.71	1.23	1.30	1.27	16.40	17.90	17.15	20.03	22.54	21.28	3.29	4.24	3.77	1758	1972	1865
100 % RDF	87.36	99.80	93.58	1.42	1.52	1.47	18.08	19.58	18.83	23.65	27.15	25.40	3.75	4.81	4.28	2105	2303	2204
125 % RDF	89.22	104.56	96.89	1.47	1.56	1.51	18.74	20.24	19.49	24.99	28.49	26.74	3.86	4.88	4.37	2174	2415	2295
S.E. ±	2.05	1.87	1.80	0.06	0.06	0.055	0.35	0.41	0.35	0.62	0.60	0.56	0.14	0.12	0.12	112	108	101
C.D. (P=0.05)	6.00	5.64	5.42	0.18	0.19	0.17	1.09	1.27	1.08	1.90	1.85	1.69	0.44	0.38	0.36	330	322	305

RDF bolls plant^{-1} (25.40) and boll weight (4.28 g) were found at par with each other, but it was found significantly superior over application of 75 per cent RDF in pooled analysis. This increase in yield under higher fertility levels over that of lowest one was attributed to significant improvement in number of bolls, monopodial and sympodial branches. Rekha *et al.* (2008) also recorded significantly more seed cotton yield due to increase in number of sympodial branches /plant under higher fertility levels. The increase in seed cotton yield with higher fertility levels has also been observed by Singh and Gill (2007); Sunitha *et al*. (2010) and Anand (2006).

Seed cotton yield :

Pooled data of two years shows that (Table 1) the seed cotton yield was significantly increasing by sowing at different plant geometry. The maximum seed cotton yield was recorded (2301 kg ha^{-1}) at sowing of 90 x 45 cm closer plant geometry over sowing of 90 x 60 cm (1934 kg ha^{-1}) and 90 x 90 cm (1759 kg ha^{-1}) wider plant geometry. Increasing the seed cotton yield with the increasing of fertilizer levels, application of 125 per cent RDF gave maximum seed cotton yield (2295 kg ha^{-1}) over application of 75 per cent RDF in the pooled analysis. However, it was found at par with application of 100 per cent RDF seed cotton yield (2204 kg ha^{-1}). Higher seed cotton yield under closer geometry was observed due to significantly higher plant population. Similar effect of higher plant density has reported by Giri and Gore (2006) and Butter *et al.* (2010).The increase in seed cotton yield with higher fertility levels has also been observed by Singh and Gill (2007) and Sunitha *et al.* (2010).

Economics :

Two years pooled data shows that (Table 2) the monetary returns were significantly influence during both years, by sowing of different plant geometries. The maximum net return (Rs.57553 ha^{-1}) and B: C (2.50) was observed at sowing of 90 x 45 cm closer plant geometries over sowing of 90 x 60 cm (Rs. 45690 ha^{-1}) and 90 x 90 cm (Rs. 40565 ha^{-1}) wider plant spacing. Significantly higher net return (Rs. 57805 ha^{-1}) and B:C (2.56) was recorded, under application of 125 per cent RDF over application of 75 per cent RDF net return (Rs. 44775 ha^{-1}) and B: C (2.18) in the pooled analysis. However, it was found at par with application of 100 per cent RDF net return (Rs. 55640 ha^{-1}) and B:C (2.58) during both the years as well as in the pooled analysis. Similar results observed by Rao (1985).

Conclusion:

It could be concluded that the significantly higher seed cotton yield (2301 kg ha^{-1}) was recorded under closer plant geometry of 90 x 45 cm than wider plant geometries of 90 x 60 cm and 90 x 90 cm, respectively. Application of 100 per cent RDF gave significantly higher seed cotton yield (2204 kg ha^{-1}) over application of 75 per cent RDF. The maximum net return (Rs.57553 ha^{-1}) and B: C (2.50) were observed at sowing of 90 x 45 cm closer plant geometry over wider plant geometries. Significantly higher net return (Rs. 55640 ha^{-1}) and B: C (2.58) were observed under application of 100 per cent RDF over application

Table 2: Effect of plant geometry and fertility levels on economics of Bt cotton

Treatments	Net return (Rs./ha)			B:C		
	2010	2011	Pooled	2010	2011	Pooled
Plant geomatry						
90 x 90 cm	38290	42840	40565	1.82	2.04	1.93
90 x 60 cm	43065	48315	45690	1.96	2.19	2.07
90 x 45 cm	53895	61210	57553	2.34	2.66	2.50
S.E. $\pm$	1542	1785	1530	0.04	0.04	0.036
C.D. (P=0.05)	4680	5400	4598	0.13	0.12	0.110
Fertility levels						
75 % RDF	41030	48520	44775	2.00	2.36	2.18
100 % RDF	52175	59105	55640	2.42	2.74	2.58
125 % RDF	53590	62020	57805	2.38	2.75	2.56
S.E. $\pm$	1760	1837	1655	0.06	0.07	0.059
C.D.(P=0.05)	5340	5560	4972	0.19	0.23	0.179

of 75 per cent RDF.

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