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Response of *Bt* and non *Bt* cotton (*Gossypium hirsutum* L.) hybrids to varying sowing time

PINKY PATEL*, J. C. PATEL, R. S. MEHTA AND K. G. VYAS
Department of Agronomy, Dantiwada Agricultural University, Sardarkrushinagar - 385 506
**E-mail : kgvyas09@gmail.com*

ABSTRACT : A field experiment was conducted at Dantiwada Agricultural University, Sardarkrushinagar during *kharif* 2012-2013 to find out the effect of sowing time on *Bt* and non *Bt* cotton hybrids. The experiment comprised of 4 dates of sowing *i.e.* 19th May, 30th May, 9th June and 20th June and 2 varieties of cotton (VICH 5 BG II *Bt* and G. COT 10 as non *Bt* hybrids) were evaluated in factorial randomized block design with 4 replications. The soil of experimental field was loamy sand having good drainage capacity. It was low in organic carbon and available nitrogen, medium in available phosphorus and high in available potash. The results of the experiment indicated that the maximum number of bolls/plant at various growth stages and the highest seed cotton yield/plant (205.2 g), seed cotton yield (3396 kg/ha) and stalk yield (5386 kg/ha) were recorded with sowing on 19th May. Fiber quality parameters *i.e.,* fiber length (mm), fiber fineness (ìg/inch), fiber strength (g/tex), short fiber index, maturity ratio, uniformity ratio and ginning percentage were not significantly affected by the different time of sowing. Though, early sowing (19th May) recorded higher values of these parameters as compared to rest of the treatments. *Bt* hybrid of cotton produced significantly higher seed cotton yield (3065 kg/ha) and stalk yield (4702 kg/ha) as compared to non *Bt* hybrid. *Bt* hybrid of cotton recorded significantly higher values of the fiber quality parameters like fiber length (31.0 mm), fiber fineness (4.28 ìg/inch), fiber strength (21.4 g/tex) and maturity ratio (0.86) than that of non *Bt* cotton hybrid except short fiber index. In terms of economics, it is inferred that, sowing of cotton seed on 19th May and *Bt* cotton hybrid increased the net monetary return and benefit cost ratio. Thus, it is found that sowing of *Bt* hybrid cotton on 19th May is better for realizing higher yield and quality of cotton.

Key words : *Bt* cotton, economics, hybrids, quality, sowing time, yield

Cotton as "King of Fiber" is one of the most ancient and important cash crop next to food grains in India and plays a significant role in Indian national economy. The *Bt* gene incorporation in cotton and its commercialization has revolutionized the crop scenario around the globe. Indian bollworms, the Lepidopteron insects are the important pests of cotton which may cause loss in crop yield up to 70 to 80 per cent. Potent chemicals are available to control these pests, but their injudicious and indiscriminate use has played havoc with the ecosystem, environment and human health. Continuous efforts to breed varieties tolerant or resistant to bollworm have failed since tolerance is governed by many morpho biochemical characters. Transgenic cotton popularly known as *Bt* cotton has raised a hope that cotton could be grown without or lesser use of pesticides. Concomitant with the step increased in adoption of *Bt* cotton hybrids between 2002 and 2007, its average lint yield has increased from 308 to 560 kg/ha in India. Further, improvement in yield is possible through exploitation of agronomic advantages associated with *Bt* cotton hybrids, *viz.,* non monetary inputs like sowing window (Praharaj *et al.*, 2009). Sowing time differs from place to place for obtaining higher yields as climate play an important role in growth and development of this crop and final yield of seed cotton. Optimum sowing time provides favorable situation for adequate crop growth as it escort to realization of productivity potential of crop. Very meager information is available on efficient agro technique for *Bt* cotton. Therefore, present investigation was carried out with an object to

find out optimum sowing time for realizing higher yield.

The field experiment comprising of 4 dates of sowing and 2 varieties of cotton, *i.e.* (19th May, 30th May, 9th June and 20th June) and (VICH 5 BG II as *Bt* and G. COT 10 as non *Bt* hybrids), respectively, were undertaken at Agronomical Research Farm, Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during *kharif* 2012-2013 in factorial randomized block design with 4 replications. The soil of experimental field was loamy sand with pH of 7.7 having 0.23 per cent organic carbon and 160.0, 38.9 and 286.0 kg/ha available N, P_2O_5 and K_2O, respectively. Both the varieties were sown keeping 120 cm distance between 2 rows and 45 cm between 2 plants by hand dibbling at different sowing dates as per treatments. At the time of sowing one fourth of recommended dose (160 kg/ha) of nitrogen in the form of urea was applied for all the dates of sowing as basal application. Remaining dose of nitrogen was top dressed in 3 equal split at 50, 80 and 110 DAS using urea as a source after irrigation or rainfall through ring method. Recommended plant protection measures were followed to control sucking pests in both the varieties. Pendimethalin 1.0 *a.i.* kg/ha was applied as pre emergence to eliminate early crop weed competition. The observations were recorded on growth and yield determinates and yields of cotton at harvest. Cotton samples were tested for fiber quality parameters from CIRCOT unit of Mumbai with HVI instrument (in ICC mode) by the method adopted from ASTM D 5867 procedure. The economics of different treatments was worked out in terms of net returns/ha and B:C (benefit cost) ratio.

Effect on yield attributes and yield : Sowing of cotton on 19th May exhibited significantly highest number of bolls/plant at all the growth stages as well as all yield attributes and yield of cotton followed by sowing on 30th May. As the date of sowing was advances there was reduction in number of bolls/plant and yield. However, sowing on 30th May and 9th June produced statistically equal number of bolls/plant at all growth stages (Table 1). Early planted crop initiated reproductive growth earlier in the season and allowed the early sown crop to set more bolls utilizing the beneficial early season rains and sunlight. Similar results were also reported Patil *et al.*, (2009) and Sankarayanan *et al.,* (2011). Early sown crop produced bigger boll size due to higher accumulation of photosynthates and more time was available for boll development and maturity which increase the boll weight than late sowing of crop. Similar results was reported by, Shrinivasan (2001). Higher seed cotton yield/plant and/ha might be due to higher values of the all yield attributing character in early sown crop. Sowing of cotton

Table: 1. Effect of planting time and hybrids (*Bt* and non *Bt*) number of bolls /plant and yield of cotton

Treatments	Number of bolls/plant				Boll weight (g)	Seed cotton yield/ plant (g)	Seed cotton yield (kg/ha)	Stalk yield (kg/ha)
	90 DAS	120 DAS	150 DAS	180 DAS				
Planting time								
D_1 : 19th May	26.5	41.2	46.5	55.8	4.10	205.2	3396	5386
D_2 : 30th May	23.0	39.0	42.5	49.5	3.76	182.8	3007	4364
D_3 : 9th June	21.8	34.8	35.8	44.5	3.73	173.5	2890	4266
D_4 : 20th June	19.0	24.3	27.6	37.0	3.69	141.9	2435	3567
SEm±	1.0	1.6	1.7	2.2	0.10	5.3	126	195
P=0.05	3.0	4.8	5.1	6.6	0.31	15.5	371	574
Hybrids								
V_1 : *Bt* Hybrid	25.8	37.4	40.6	50.2	4.06	187.2	3065	4702
V_2 : Non *Bt* Hybrid	19.4	32.3	35.6	43.3	3.58	164.5	2799	4090
SEm±	0.7	1.2	1.2	1.6	0.07	3.7	89	138
P=0.05	2.1	3.4	3.6	4.6	0.22	10.9	262	406
Interaction (D × V)	**25.8**	**37.4**	**40.6**	**50.2**	**NS**	**NS**	**NS**	**NS**

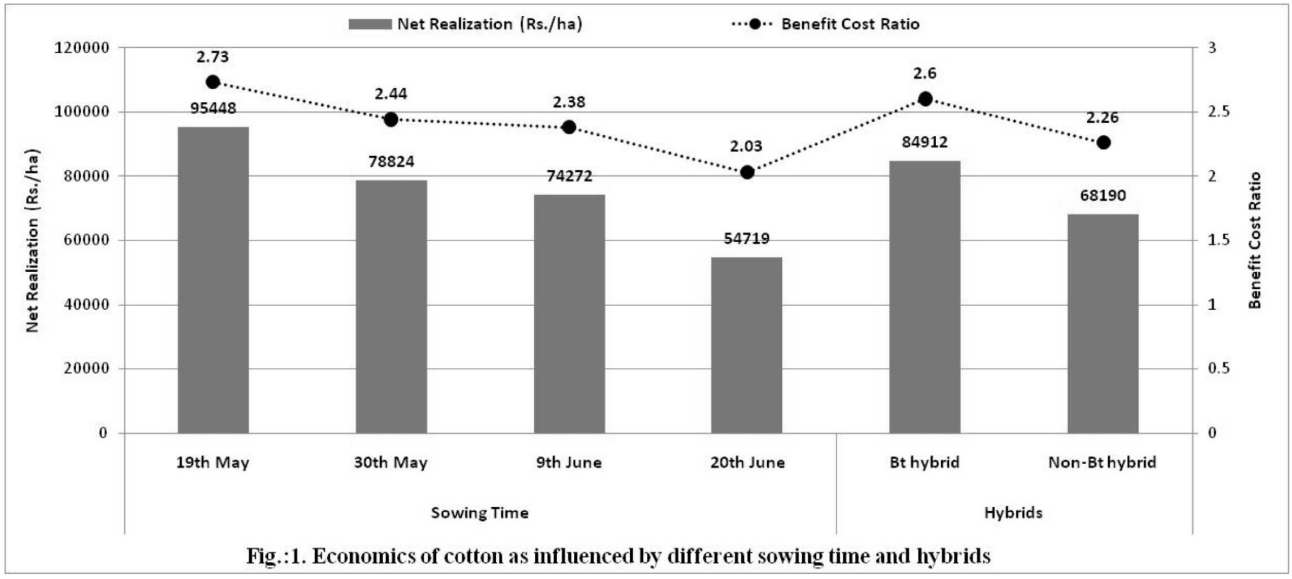

Fig.:1. Economics of cotton as influenced by different sowing time and hybrids

early in the season allows the crop to develop its canopy earlier and intercept more of sunlight for photosynthesis and growth. Early sown crop initiated reproductive growth earlier and produced more bolls resulted into higher yield. These results are in conformity with the findings of Patil *et al.*, (2009) and Sankarayanan *et al.,* (2011).

Significantly higher number of bolls/ plant, yield attributes, seed cotton yield and stalk yield was recorded with *Bt* hybrids than non *Bt* hybrid. Inbuilt resistance to boll worms and early maturing character was observed in case of *Bt* hybrid which helped to retain more number of bolls by avoiding its exposure to unfavorable weather condition during peak period of growth that may commence probably during later stages. Utilization of more photosynthats for the nourishment to bolls favouring reproductive growth could be the key physiological phenomenon in *Bt* cotton resulted into more weight of boll. Higher seed cotton yield was evidently due to cumulative effect of more number of bolls/plant and boll weight in *Bt* hybrid than non *Bt*. These results are in conformity with the results obtained by Sankaranarayanan *et al.,* (2004), Patil *et al.*, (2009) and Sankarayanan *et al.*, (2011).

Table 2. Effect of planting time and hybrids (*Bt* and non *Bt*) on quality, parameters of cotton

Treatments	Oil content (%)	Fiber length (mm)	Fiber fineness (ig/inch)	Fiber strength (g/tex)	Short fiber index	Maturity ratio	Uniformity ratio	Ginning percentage
Planting Time								
D_1 : 19th May	17.8	29.9	4.15	20.8	9.7	0.85	48.1	32.6
D_2 : 30th May	17.5	29.6	4.14	20.7	10.0	0.83	47.0	31.8
D_3 : 9th June	17.3	29.0	4.09	20.5	10.3	0.82	46.5	31.1
D_4 : 20th June	17.2	28.5	4.06	20.3	10.3	0.82	45.4	31.0
SEm±	0.4	0.5	0.07	0.4	0.3	0.02	0.8	0.6
P=0.05	NS	NS	NS	NS	NS	NS	NS	NS
Hybrids								
V_1 : *Bt.* hybrid	18.1	31.0	4.28	21.4	7.9	0.86	47.5	32.2
V_2 : Non-*Bt.* hybrid	16.8	27.6	3.94	19.8	12.2	0.80	46.0	31.0
SEm±	0.3	0.4	0.05	0.3	0.2	0.01	0.6	0.4
P=0.05	0.8	1.1	0.2	0.8	0.6	0.03	NS	NS
Interaction (D x V) :	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Quality parameters : Oil content and other quality parameters *viz*., fiber length, fiber fineness, fiber strength, short fiber index, maturity ratio, uniformity ratio and ginning percentage were not significantly influenced due to the time of sowing. However, except short fiber index, the highest values of oil content and all the quality parameters were recorded with planting on 19th May followed by 30th May and 9th June (Table 2).

Bt hybrid of cotton recorded significantly higher values of the fiber quality parameters like fiber length, fiber fineness, fiber strength than that of non *Bt* cotton hybrids except short fiber index. As oil content is governed by genetical characters, *Bt* hybrid recorded more oil content. The magnitude of increase in fiber length, fiber fineness, fiber strength and maturity ratio were to the tune of 12.31, 8.63, 8.08 and 7.5 per cent, respectively, over non *Bt* hybrid. These results are also in accordance with findings by Sankarayanan *et al.*, (2011). The differences in uniformity ratio and ginning percentage were not obtained due to transgenic technology. These results are in conformity with findings of those reported by Sankarayanan *et al.*, (2011).

Economics : The economic evaluation of different treatments (Fig. 1) indicated that sowing of cotton seed on 19th May fetched maximum net monetary return of Rs. 95448/ha with benefit cost ratio of 2.73, as compared to other dates of sowing. Whereas *Bt* hybrid recorded maximum net return of Rs. 84912 and B:C ratio of 2.60.

CONCLUSION

It is inferred that sowing of *Bt*. cotton hybrid on 19th May and recommended dose of nitrogen (180 kg/ha) to cotton crop is the most appropriate crop production and management strategy for getting higher seed cotton yield, with better fiber quality. Similarly, the net return and benefit cost ratio were recorded higher with sowing of cotton seed on 19th May and *Bt* cotton hybrid seed under prevailing condition of north Gujarat.

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