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EFFECT OF HYBRIDS AND VARYING PLANTING TIME ON GROWTH AND PRODUCTIVITY IN COTTON (*GOSSYPIUM HIRSUTUM* L.)

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ABSTRACT
Productivity of cotton largely depends upon the agronomic production technologies i.e. availability of high yielding improved varieties and hybrids along with optimum sowing time. The result obtained from the field experiment conducted to find out the effect of hybrids and planting time indicated that sowing of cotton seeds on 19th May recorded higher plant height of 21.2, 56.5, 125.9 and 139.9 cm at 30, 60, 90 and 120 DAS, respectively. The number of monopodial branches/plant (2.9 and 3.5) as well as number of sympodial branches/plant (15.0 and 19.9) at 90 and 120 DAS, respectively. Similarly, seed (3396 kg/ha) and stalk (5386 kg/ha) yields of cotton were recorded higher with planting of cotton on 19th May over 30th May, 9th June and 20th June. Further, Bt cotton hybrid exhibited significantly higher values of the growth as well as yields over non-Bt cotton hybrid. In this way, it can be said that the BT cotton hybrid can be sown on 19th May for acquiring maximum production.

INTRODUCTION

Cotton is one of the most important cash crops next to food grains that play a significant role in Indian national economy. In India, cotton is planted in about 111.61 lakh hectares of land and it occupies second position in production with 312 lakh bales (each of 170 kg) among all cotton producing countries in the world *i.e.,* next to China (Anonymous, 2010-11a). Average productivity of cotton in India is 475 kg/ha which is low as compared to world average of 733 kg/ha (Anonymous 2010-11b). Looking to the world average productivity of this crop, there is huge scope to increase productivity of cotton per unit area. The Bt gene incorporation in cotton and its commercialization has revolutionized the crop scenario around the globe. Indian Bt cotton continues to grow beyond 12.1 m ha occupying 92.0 per cent of the total cotton area up to 2011-12. Transgenic cotton popularly known as Bt. cotton has raised a hope that cotton could be grown without or lesser 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 (AICCIP, 2009). Further, improvement in yield is possible through exploitation of agronomic advantages associated with Bt cotton hybrids, *viz.,* non monetary inputs like planting window (Praharaj *et al*., 2009). The yield potential of this crop can be exploited by adopting high yielding hybrid or Bt varieties coupled with improved agro-techniques, where date of sowing is the most important practice in this regard. Planting 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 (Wankhade *et al.,* 1992). Optimum sowing time provides favourable situation for adequate crop growth as it escort to realization of productivity potential of crop (Praharaj *et al*., 2009). 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 planting time for realizing higher yield though batter crop varieties.

MATERIALS AND METHODS

An experiment comprising of four dates of sowing (19th May, 30th May, 9th June and 20th June) and two varieties of cotton (VICH-5 BG-II as Bt and G.COT-10 as non Bt hybrids) were undertaken at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar (Gujarat) during *kharif* season of the year 2012-13 in factorial randomized block design with four replications. The loamy sand textured soil of the experimental field with pH of 7.7 was low in organic carbon (0.23%) and available nitrogen (160.0 kg/ha) and medium in available phosphorus (38.9 kg/ha) and high in available potash (286.0 kg/ha). The cotton seeds of both the varieties (Vikram-5 Boll Guard-II as Bt and G.COT Hybrid-10 as non Bt) were sown keeping 120 cm distance between two rows and 45 cm between two plants by hand dibbling at different planting 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 three equal split at 50, 80 and 110 DAS using urea as a source after irrigation/rainfall through ring method. Recommended plant

protection measures were followed to control sucking pests in both the varieties (Bt and non Bt cotton hybrids). Pendimethalin 1.0 kg/ha was applied as pre-emergence to eliminate early crop weed competition.

The observations were recorded on growth attributes, yield determinates and yields of seed cotton yield at harvest. soil samples were drawn from each experimental unit before sowing of the crop and analyzed for available nutrients as per the following methods; Walkely and Black method for organic carbon (Jackson,1967), alkaline potassium permanganate method for nitrogen (Subbiah and Asija, 1956), Olsen's method for phosphorus (Olsen *et al.,* 1954) and flame photometric method for potash (Jackson, 1973).

RESULTS AND DISCUSSION

Effect on growth parameters

The result revealed that, planting time significantly influenced the plant height (cm), number of monopodial and sympodial branches per plant at various growth stages in cotton. Planting of cotton on 19th May exhibited significantly the highest plant height at all the growth stages followed by planting on 30th May. The minimum plant height and number of monopodial and sympodial branches per plant were recorded with planting of cotton delayed on 20th June (Table 1). The magnitude of increase in plant height at 30, 60, 90 and 120 DAS under planting on 19th May was to the tune of 11.58, 32.01, 33.94 and 32.11 per cent, respectively, as compared to the planting on 20th June. Significantly taller plants in May sown crop might be due to early sowing allows the crop to develop its canopy earlier and intercept more of the early season sunlight with the longest day light period of the summer with which potentially more sunlight is available for photosynthesis and growth. Similar results were also reported by Hanuman Prasad *et al*., (2000) and Shrinivasan (2001). The increase in number of monopodial branches with planting on 19th May was to the tune of 31.81 and 29.63 per cent higher than planting on 20th June at 90 and 120 DAS, respectively. Similarly, the magnitude of increase in number of sympodial branches per plant with planting on 19th May (15.0, 19.9) over 20th June (10.1, 13.3) were to the tune of 48.51 and 49.62 per cent at 90 and 120 DAS. More number of monopodial and sympodial branches per plant was observed in early planted crop might be due to prevalence of congenial weather condition resulting in better vegetative and reproductive growth of the crop. Active reduction in photosynthetic activity under late planting may resulted into shortening of total crop duration which affected vegetative growth adversely. Similar findings were made by Singh and Warsi (1985) and Patil *et al*. (2009).

Plant height, number of monopodial and sympodial branches per plant at various growth stages were significantly influenced with planting of Bt. and non-Bt. Hybrids except height at 30 and 60 DAS. Significantly higher plant heights, number of monopodial and sympodial branches per plant were recorded with Bt. Hybrids cotton than non-Bt. hybrid. The magnitude of increase in plant height at 90 and 120 DAS in Bt. hybrid was 9.01 and 8.66 per cent higher as compared to non-Bt Hybrid. It might be due to better growth and development of Bt. hybrid plants as compared to non-Bt. hybrid. The magnitude of increase in number of monopodial branches per plant under planting with Bt. hybrid was to the extent of 30.43 and 29.62 per cent, respectively as compared to non-Bt Hybrid at 90 and 120 DAS, respectively. Number of sympodial branches per plant at 90 DAS (13) and 120 DAS (17.5) in Bt. hybrid was to the tune of 9.24 and 9.37 per cent, respectively, than that of non-Bt. hybrid (Table 1). Higher number of monopodial and sympodial branches in Bt. hybrid might be due to more vegetative and reproductive growth of plants as boll worms infestation was controlled by Bt. gene during initial growth stage of crop. Similar result was also reported by Patil *et al*. (2009).

Effect on yields

Planting time significantly influenced seed cotton and stalk yields. Planting of cotton on 19th May resulted significantly the highest seed cotton yield (3396 kg/ha) and stalk yield (5386 kg/ha) followed by planting on 20th June. Though, planting on 19th May produced 39.47 per cent higher seed cotton yield than latter planting (20th June). Planting of cotton early in the season allows the crop to develop its canopy earlier and intercept more of sunlight for photosynthesis and growth. Early planted crop initiated reproductive growth earlier and produced more bolls resulted into higher seed cotton yield per hectare which might be due to higher growth as plant height, number of monopodial and sympodial branches per

Table 1: Effect of planting time and hybrids (Bt. and non-Bt.) on plant height, number of monopodial and sympodial branches per plant

Treatments	Plant height(cm)				Number of monopodial branches/plant		Number of sympodials branches/plant	
	30 DAS	60 DAS	90 DAS	120 DAS	90 DAS	120 DAS	90 DAS	120 DAS
Planting time								
D_1: 19th May	21.2	56.5	125.9	139.9	2.9	3.5	15.0	19.9
D_2: 30th May	20.7	53.0	113.7	125.8	2.7	3.3	13.7	18.6
D_3: 9th June	19.3	44.8	98.3	110.3	2.6	3.0	11.1	15.2
D_4: 20th June	19.0	42.8	94.0	105.9	2.2	2.7	10.1	13.3
SEm±	0.6	1.8	4.19	4.8	0.1	0.1	0.5	0.7
CD(P=0.05)	1.7	5.3	12.3	14.1	0.3	0.4	1.3	2.1
Hybrids								
V_1: Bt. hybrid	20.3	50.8	112.6	125.5	3.0	3.5	13.0	17.5
V_2: Non-Bt. hybrid	19.8	47.7	103.3	115.5	2.3	2.7	11.9	16.0
SEm±	0.4	1.3	3.0	3.4	0.1	0.1	0.3	0.5
CD(P=0.05)	NS	NS	8.7	9.9	0.2	0.3	0.9	1.5
Interaction (D × V):	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of planting time and hybrids (Bt. and non-Bt.) on yields

Treatments	Seed cotton yield(kg/ha)	Stalk yield(kg/ha)
Planting time		
D_1: 19th May	3396	5386
D_2: 30th May	3007	4364
D_3: 9th June	2890	4266
D_4: 20th June	2435	3567
SEm±	126	195
CD(P=0.05)	371	574
Hybrids		
V_1: Bt. hybrid	3065	4702
V_2: Non-Bt. hybrid	2799	4090
SEm±	89	138
CD(P=0.05)	262	406
Interaction (D × V):	NS	NS

plant in early planted crop (19thMay). Reduction of yield in late sowing is also due to shortening of total crop duration which affected reproductive process of the crop adversely. Higher retention of bolls in early sown crop and shedding of floral structure in late sown crop may also affect the seed cotton yield. These results are in conformity with the findings of Patil *et al*., (2009), Singh (2010) and Sankarayanan *et al*., (2011).

Significantly the higher seed cotton yield (3065 kg/ha) was registered under the planting of Bt. Hybrid than of non-Bt. hybrid (2799 kg/ha). The increase in seed cotton yield with Bt. hybrid was to the extent of 9.50 per cent over non-Bt. hybrid. These results are in conformity with findings of those reported by Patil *et al*. (2009), Singh (2010) and Sankarayanan *et al*. (2011).

Interaction Effect

There were no any interaction effect found between different planting time and hybrids on growth characters as well as yields.

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