**Appropriation of Tillage and Sowing Pattern for Enhancing Productivity of Bt Cotton**

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***Abstract***

*An experiment was carried out at Junagadh (Gujarat) during 2010 to 2012 to assess the response of Bt cotton (NHH-44) to three tillage practices (Conventional tillage i.e. cross cultivation + blade harrowing + planking, Ploughing + blade harrowing + planking, and Tillage through rotavator) and four sowing patterns (Flat bed sowing, Furrow sowing, Ridge sowing, and Paired row sowing). The results revealed that ploughing + blade harrowing + planking significantly improved growth and yield attributes viz., plant height, number of bolls/plant, single boll weight and seed cotton weight/plant and thereby increased seed cotton yield (2257 kg/ha) and stalk yield (5352 kg/ha along with higher net return (Rs. 69,183/ha) and B:C (4.08) over conventional tillage. The ridge sowing enhanced growth and yield parameters viz. plant height, number of bolls/plant, single boll weight and seed cotton weight/plant and ultimately increased seed cotton yield (2244 kg/ha) and stalk yield (5316 kg/ha), net return (Rs. 68,547/ha) and B:C (4.04) over flat bed sowing.*

***Key words:*** *Cotton, tillage, flat bed, ridge, furrow, paired row*

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**INTRODUCTION**

Cotton (*Gossypium hirsutum* L.), the white gold, is one of the most important commercial and industrial crops and plays a key role in economic and social affairs of the world. It is considered as “King” of fibres and being important cash crop of the country, benefits several million people who are engaged in its cultivation, trade, processing, manufacturing *etc*. India now stands first in area *i.e.* 11.1 million ha and second in total production with an annual production of 32.5 million bales.

The cultivation of cotton is increasing day by day in Saurashtra region of Gujarat due to change in rainfall pattern, sustained price at higher level, demand for export and introduction of pest resistant Bt cotton varieties. Cotton yield is affected by various agronomic practices. Chief among these are high yielding, pest and diseases resistance hybrids, preparatory tillage practices, water management, nutrient, weed management and sowing method. Conventionally cotton is grown by shallow tillage comprised of shallow cultivation, harrowing, and planking. But for efficient utilization of rain and irrigation water, reducing the soil loss, compaction and enhancing microbial activity as well as organic matter status, different tillage practices have been advocated [1].

Manual dibbling of seeds in flat bed is the most common method for sowing Bt hybrids. Cotton is severely suffers from moisture stress during dry spells. Therefore suitable sowing method needs to be evolved which conserve moisture during dry spell, drain excess water under waterlogging, provide sufficient sunlight and protect the crop against lodging. The present experiment was, therefore, carried out to evaluate different tillage practices and sowing patterns for enhancing productivity of Bt cotton.

**MATERIALS AND METHODS**

A three-year field experiment was undertaken at Tillage Technology Research Centre, Department of Agronomy, Junagadh Agricultural University, Junagadh during 2010 to 2012. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction (pH 7.7 and EC 0.29 dS/m) as well as low in available nitrogen (216 kg /ha), available phosphorus (24.5 kg/ha) and medium in available potash (223 kg/ha).

The trial comprising three tillage practices   
(T1: Conventional tillage i.e. cross cultivation + blade harrowing + planking, T2: Ploughing + blade harrowing + planking, and T3: Tillage through rotavator) and four sowing patterns (S1: Flat bed sowing, S2: Furrow sowing, S3: Ridge sowing, and S4: Paired row sowing i.e. 60-120-60 cm) were laid out in strip plot design and replicated thrice.

The Bt cotton hybrid NHH-44 was sown at 120 cm x 60 cm except the paired row   
(60-120-60 cm). FYM @ 15 t/ha was incorporated in soil at the time of land preparation. The fertilizer dose of 160-0-120 kg N-P2O5-K2O/ha was applied to the crop, of which 120 kg K2O/ha as muriate of potash and 40 kg N/ha as ammonium sulphate were applied just before sowing, whereas 40 kg N/ha as urea was top-dressed each at 30, 60 and 90 DAS. The recommended package of practices was adopted for raising the crop.

**RESULTS AND DISCUSSION**

**Tillage Practices**

A perusal of data presented in Table1 showed that tillage practices significantly influenced the available soil moisture content at 60 days after sowing. The highest available soil moisture of 7.34% was observed under the treatment comprising ploughing + blade harrowing + planking (T2), while the lowest soil moisture was registered under the conventional (T1). The results (Table 1) further revealed that growth and yield attributes of cotton *viz*., plant height, number of bolls/plant, single boll weight and seed cotton weight/plant were significantly influenced by various tillage practices. Ploughing + blade harrowing + planking (T2) registered significantly the highest plant height (118.5 cm), number of bolls/plant (33.4), single boll weight (5.87 g) and seed cotton weight/plant (115.3 g). On the other hand, significantly the lowest values of these growth and yield parameters were found under the conventional tillage (T1).

Different tillage treatments manifested significant effect on seed cotton and stalk yields of cotton (Table 1).

***Table 1:*** *Available Soil Moisture, Growth, Yield and Economics of Bt Cotton under Various Tillage Practices and Sowing Patterns (Pooled Over Three Years).*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Available soil moisture (%)\*** | **Plant height (cm)** | **Bolls/**  **plant** | **Single boll weight (g)** | **Seed cotton weight/ plant (g)** | **Seed cotton yield (kg/ha)** | **Stalk yield (kg/ha)** | **Gross**  **return**  **(Rs./ha)** | **Cost of cultivation (Rs./ha)** | **Net**  **return**  **(`/ha)** | **B:C**  **ratio** |
| **Tillage practices** | | | | | | | | | | | |
| T1 | 6.63 | 104.7 | 26.8 | 4.53 | 98.6 | 1851 | 4378 | 75,115 | 22,138 | 52,977 | 3.39 |
| T2 | 7.34 | 118.5 | 33.4 | 5.87 | 115.3 | 2257 | 5352 | 91,621 | 22,438 | 69,183 | 4.08 |
| T3 | 6.90 | 113.3 | 30.2 | 5.08 | 105.6 | 1997 | 4742 | 81,047 | 22,738 | 58,309 | 3.56 |
| S.Em.± | 0.09 | 1.4 | 0.6 | 0.08 | 1.6 | 36 | 100 |  |  |  |  |
| C.D. at 5% | 0.29 | 4.3 | 1.8 | 0.24 | 4.9 | 110 | 309 |  |  |  |  |
| **Sowing pattern** | | | | | | | | | | | |
| S1 | 7.08 | 114.8 | 30.9 | 5.29 | 108.7 | 2098 | 4944 | 85,158 | 22,100 | 63,058 | 3.85 |
| S2 | 6.77 | 107.1 | 28.8 | 4.61 | 101.3 | 1793 | 4311 | 72,808 | 22,550 | 50,258 | 3.23 |
| S3 | 7.19 | 119.3 | 33.5 | 5.53 | 112.6 | 2244 | 5316 | 91,097 | 22,550 | 68,547 | 4.04 |
| S4 | 6.79 | 111.6 | 29.4 | 4.98 | 104.4 | 2003 | 4724 | 81,313 | 22,550 | 58,763 | 3.61 |
| S.Em.± | 0.08 | 1.4 | 0.9 | 0.09 | 1.4 | 53 | 127 |  |  |  |  |
| C.D. at 5% | 0.24 | 4.2 | 2.7 | 0.27 | 4.2 | 158 | 379 |  |  |  |  |

***Note:*** *\* recorded at 60 days after sowing*

***Selling price (Rs./kg):*** *Seed Cotton: 40, Cotton Stalk: 0.25*

Significantly the highest seed cotton yield (2257 kg/ha) and stalk yield (5352 kg/ha) were given by ploughing + blade harrowing + planking (T2). The conventional tillage (T1) gave significantly the lowest seed cotton (1851 kg/ha) and stalk (4378 kg/ha) yields. On an average over three years, ploughing + blade harrowing + planking (T2) increases seed cotton yield by 21.9% and stalk yield by 22.2% over conventional tillage (T1). Favourable rhizospheric condition created under ploughing + blade harrowing + planking might have enhanced moisture and nutrient availability to plants, which might have enhanced growth and development of the crop and ultimately higher yield. Similar results were obtained by Brar and Kaur [2] and Sekhon *et al.* [3]. The treatment of ploughing + blade harrowing + planking (T2) was also found economical by recording the highest net return (Rs. 69,183/ha) and B: C (4.08). The conventional tillage (T1) has given the lowest net return (Rs. 52,977 /ha) and B: C (3.39).

**Sowing Pattern**

Data furnished in Table 1 indicated that available soil moisture measured at 60 days after sowing was varied under different sowing patterns. The highest available soil moisture (7.18%) was recorded with the ridge sowing (S3) and the lowest with the furrow sowing (S2). The growth and yield attributes of cotton were significantly altered by various sowing patterns (Table 1). Sowing of the crop on ridges (S3) registered significantly the highest values of plant height (119.3 cm), number of bolls/plant (33.5), single boll weight (5.53 g) and seed cotton weight/plant 112.6 g), however it was statistically at par with flat bed sowing in respect of number of bolls/plant, single boll weight and seed cotton weight/plant. Significantly, the lowest values of these growth and yield contributing characters were observed in the furrow sowing (S2). Different sowing patterns significantly influenced seed cotton and stalk yields   
(Table 1). The ridge sowing (S3) produced significantly the highest seed cotton yield (2244 kg/ha) and stalk yield (5316 kg/ha), however it was found statistically comparable to the flat bed sowing (S1). Significantly the lowest seed cotton yield (1793 kg/ha) and stalk yield (4311 kg/ha) were observed under furrow sowing (S2). On an average of three years, the ridge sowing (S3) increased seed cotton yield to the tune of 7.0% and stalk yield 7.5% over flat bed sowing (S1). The ridge sowing might have conserved soil moisture under stress period as well as drained excess water during waterlogging condition, which enhanced overall growth and development of the crop and resultantly higher yield. The results confirm the reports of Sharma *et al.* [1], Buttar *et al.* [4] and Patel *et al.* [5]. The ridge sowing (S3) accrued maximum net return (Rs. 68,547/ha) and B: C (4.04), closely followed by the flat bed sowing (S1) having net return of Rs. 63,058 /ha) and B:C of 3.85. The interaction between tillage practices and sowing patterns remained non-significant for all the characters under study.

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