

## **Effect of nitrogen and phosphorus levels on growth, yield attributes and yield of *Bt* cotton**

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**ABSTRACT :** The significant higher growth, seed cotton yield and yield attributes were obtained with the application of 100 per cent RD of nitrogen and phosphorus. Among the tested doses of fertilizers 100 per cent RD of phosphorus and nitrogen recorded significantly higher yield (3849 kg/ha) and (3723 kg/ha), respectively over 75 per cent RD. However, the further increase in nitrogen and phosphorus doses had no significant increase in seed cotton yield. Significantly higher bolls/plant (52.1 and 51.0) was obtained with 100 per cent RD of phosphorus and nitrogen, respectively. The seed cotton yield of *Bt* cotton increased to the tune of 17.22 and 16.42 per cent with the application of 100 per cent RD of nitrogen and phosphorus, respectively as compared to 75 per cent RD of each nutrient.

**Key words :** *Bt* cotton, fertilizer levels, growth, yield attributes, yield

Cotton is one of the most important cash crops in India and plays a major role in the agricultural economy of the country. Nutritional stresses and imbalance affect vegetative as well as reproductive growth that ultimately lowers down the average seed cotton yield as well as fibre and seed quality. Nitrogen and phosphorus are important nutrients for increasing the crop production. Among them, nitrogen is one of the decisive as well as expensive input which is given for increasing the crop production. It has quickest and the most pronounced effect on plant growth. Phosphorus is another essential element for formation and better development of root system, help plant to combat a variety of climatic and biological stresses. Therefore, present investigation was undertaken to study the effect of different doses of nitrogen and phosphorus on growth, yield attributes and yield of *Bt* cotton under the site specific agro climatic conditions of Sirsa district of Haryana.

A field experiment was conducted at KVK Farm, CCSHAU, Sirsa during *khariif* 2011 to study the effect of different levels of nitrogen and phosphorus on growth, yield and yield attributing characters of *Bt* cotton hybrid, comprising of 3 levels of P<sub>2</sub>O<sub>5</sub> (P<sub>1</sub>=75 % RD, P<sub>2</sub>=100 % RD, P<sub>3</sub>=125 % RD) and 4 levels of N (N<sub>1</sub>= 75 % RD, N<sub>2</sub>= 100 % RD, N<sub>3</sub>=125 % RD, N<sub>4</sub>=150 % RD) was tried in split

plot design with 4 replications. The recommended dose of N and P<sub>2</sub>O<sub>5</sub> was applied 175 kg/ha and 60 kg/ha, respectively. The experimental soil was slightly alkaline (pH 8.4) and sandy loam in texture, low in available N (91.0 kg/ha), medium in available P (11.6 kg/ha) and available potassium (218.2 kg/ha) with EC (0.76 dS/m) at 0-15 cm soil depth. *Bt* cotton hybrid RASI 134 BG II was sown on 18<sup>th</sup> May, 2011 by dibbling method keeping row to row and plant to plant spacing of 100 and 45 cm, respectively. Nitrogen was applied in the form of urea and phosphorus in the form of DAP. The nitrogen was applied in 3 equal splits. The first dose of nitrogen alongwith full dose of phosphorus was applied as a basal dose at the time of sowing, while the other 2 doses of nitrogen were applied at the time of square and boll formation. The growth and yield parameters and seed cotton yield were recorded.

**Effect of phosphorus:** A perusal of data revealed that phosphorus levels had no significant effect on plant height and monopodial branches/plant. Dry matter accumulation/plant and leaf area index increased significantly with the application of 100 per cent RD of phosphorus over 75 per cent RD and remained statically *at par* with 125 per cent RD of phosphorus. This may be attributed to increase in the number of lateral

branches with increase in phosphorus levels, which resulted in higher dry matter accumulation at 100 per cent RD of phosphorus over 75 per cent RD of phosphorus. This is in conformity with Pawar *et al.*, (2010) and Devraj *et al.*, (2011). Sympodial branches/plant increased significantly with 100 per cent RD of phosphorus over 75 per cent RD and remained statically *at par* with 125 per cent RD of phosphorus. This may be due to the fact that phosphorus helped in early root development, photosynthesis and cell division leading to increased number of fruiting branches. Significant variation in sympodial branches/plant and their further role to produce reproductive structures has played a greater role in the difference observed in yield and yield components.

Bolls/plant increased significantly with increasing levels of phosphorus from 75 per cent RD to 100 per cent RD of phosphorus. The data pertaining to seed cotton yield/ha presented in Table 1 revealed that increasing level of phosphorus resulted in a significant increase in seed cotton yield/ha at 100 per cent RD of phosphorus (3849 kg/ha) over 75 per cent RD of phosphorus (3306 kg/ha). Positive effects of phosphorus on yield may be due to the fact that it regulate nutrients uptake and help in

preventing abscission of squares and bolls. Higher boll/ plant with the application of phosphorus levels may also be attributed to more sympodial branches/ plant. Similar results were obtained by Kalaichelvi (2009). Various phosphorus levels did not have any significant change in stick yield/ha.

**Effect of nitrogen:** Application of nitrogen significantly increased the plant height at 100 per cent RD of nitrogen over 75 per cent RD of nitrogen. Increased plant height with the increasing level of nitrogen was also reported by Narayana and Aparna (2011).

Application of 100 per cent recommended dose of nitrogen produced significantly higher dry matter accumulation/plant and leaf area index over 75 per cent recommended dose. The growth rate and plant development is more when fertilizer is applied to nitrogen deficient soil. More dry matter production is an index of higher photosynthetic capacity of plant. Higher rate of N application improved the growth and yield components by enabling the plant to trap higher quantity of radiant energy to convert into chemical energy. Increased dry matter and LAI with increasing levels of nitrogen, wherein maximum dry matter and LAI was produced after peak blooming. Devraj *et al.*, (2011) opined that

**Table 1:** Effect of treatments on growth, yield parameters and yield of *Bt* cotton

Treatments	Plant height (cm)	Dry matter accumulation/plant (g)	Leaf area index	Monopods/ plant	Sympods/ plant	Bolls/ plant	Seed cotton yield (kg/ha)	Stick yield (kg/ha)
<b>Phosphorus levels</b>								
<b>P<sub>1</sub></b> (75% of RD)*	151.1	202.9	0.56	4.8	17.9	44.9	3306	12101
<b>P<sub>2</sub></b> (100% of RD)	154.5	211.3	0.64	5.1	19.9	52.1	3849	13134
<b>P<sub>3</sub></b> (125% of RD)	156.6	214.5	0.65	5.3	20.1	53.8	3963	13809
S.Em. ±	3.08	2.28	0.01	0.49	0.46	1.49	152	518
CD (p=0.05)	NS	8.05	0.03	NS	1.64	5.27	476	NS
<b>Nitrogen levels</b>								
<b>N<sub>1</sub></b> (75% of RD)*	146.4	201.3	0.58	4.5	17.9	43.3	3176	12141
<b>N<sub>2</sub></b> (100% of RD)	153.7	209.7	0.62	5.1	19.3	51.0	3723	12915
<b>N<sub>3</sub></b> (125% of RD)	156.5	212.3	0.64	5.3	20.1	54.1	3972	13307
<b>N<sub>4</sub></b> (150% of RD)	159.6	214.9	0.65	5.4	19.9	52.6	3953	13696
S.Em. ±	2.76	1.86	0.01	0.22	0.39	2.61	104	245
CD (p=0.05)	8.07	5.44	0.02	0.64	1.14	7.61	304	711

\*RD = Recommended dose ; (RD of N:P<sub>2</sub>O<sub>5</sub> 175:60 kg/ha)

both vegetative and reproductive plant components responded to N application, with an increase in dry matter of the plant.

With the application of 100 per cent RD of nitrogen significant increase in monopodial branches was recorded over 75 per cent RD, which remained statically *at par* with further increase in nitrogen levels. However, maximum sympodial branches were observed at 125 per cent RD of nitrogen which was significantly higher over 75 per cent RD and was *at par* with 100 per cent RD and 150 per cent RD of nitrogen, respectively. This may be due to the fact that nitrogen helps in cell division and cell elongation leading to increased number of lateral branches. Similar results were reported by Kalaichelvi (2009) and Kumar *et al.*, (2011).

Nitrogen levels had significant effect on bolls/plant and maximum number of bolls was observed at 125 per cent RD of nitrogen which remained statically *at par* with 100 per cent RD and 150 per cent RD of nitrogen, respectively, but significantly higher over 75 per cent RD of nitrogen. Different levels of nitrogen significantly affected seed cotton yield. The maximum seed cotton yield (3972 kg/ha) was recorded with 125 per cent RD of nitrogen which was significantly higher than 75 per cent RD (3176 kg/ha) of nitrogen but it remained statistically *at par* with 100 per cent RD (3723 kg/ha) and 150 per cent RD (3953 kg/ha) of nitrogen. Further, it was revealed that the application of nitrogen increased the stick yield. The maximum stick yield (13,696 kg/ha) was recorded with 150 per cent RD of nitrogen which was statistically *at par* with 100 per cent RD and 125 per cent RD of nitrogen, but significantly higher than 75 per cent RD of nitrogen. Nitrogen application significantly increased the yield attributes. The increase in yield may be attributed to favorable

effect of nitrogen application on yield attributing characters *i.e.* plant height, monopodial branches, sympodial branches and bolls/plant. Similar positive response was observed by Meena *et al.*, (2007).

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**Received for publication : February 5, 2013**

**Accepted for publication : March 21, 2013**