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Impact of Bt cotton on soils of Kurnool district, Andhra Pradesh

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Abstract
A survey was undertaken to study dry matter production, nutrient uptake and yield of Bt cotton grown in soils belonging to three different orders (inceptisols, alfisols and vertisols) in Kurnool district of Andhra Pradesh. There is no much variation in dry matter production of Bt cotton grown in inceptisols, alfisols and vertisols. Bt cotton grown in vertisols recorded the maximum mean uptake of N, P and K as compared to Bt cotton grown in alfisols and inceptisols. Similarly,Bt cotton grown in vertisols exhibited maximum mean uptake of Mg and S as compared to Bt cotton grown in inceptisols and alfisols. However, Bt cotton grown in inceptisols showed maximum mean uptake of Ca. The highest seed cotton yield was observed in Bt cotton grown in vertisols.

Keywords: Bt cotton, inceptisols, alfisols, vertisols, dry matter production, uptake and yield

Introduction
Cotton (*Gossypium hirsutum* L.) popularly known as the 'White Gold' is a leading fibre crop and the second most important oilseed crop in the world. Commercial cultivation of Bt cotton in India began in 2002-03 with 3 hybrids *viz.,* MECH 12Bt, MECH 162Bt and MECH 18Bt (APCoAB, 2006) [2]. In India, it is grown to an extent of 69.00 lakh ha with a production of 290.00 lakh bales in the year of 2008-2009 (Narayanan and Phundansingh, 2009) [7] while in Andhra Pradesh, 91 per cent of area is under Bt cotton. The soils of cotton growing areas are low in organic carbon, nitrogen and available P (Blaise, 2004).Though Bt cotton became popular among the farmers of drylands of Kurnool district. There is no information regarding the performance of Bt cotton grown in three different orders in Kurnool district. Hence, present survey was undertaken to study the performance of Bt cotton in different soil orders of Kurnool district in Andhra Pradesh.

Materials and Methods
A survey was undertaken in Bt cotton growing soils of Kurnool district in Andhra Pradesh. The study area lies in between the East longitude of 76°.58' and 79°.34 ' and North latitude of 14°.54' and 16°.18' on eastern side of peninsular India.
Based on the status report of Scarce Rainfall Zone (2001), Bt cotton grown in three predominant orders namely inceptisols, alfisols and vertisols were identified. From each of the three orders 30 holdings totaling to 90 holdings were selected. Plant samples were collected at flowering stage (60 DAS) from these 90 holdings, by counting 3rd leaf from top. At the same time whole plant (5 numbers) were also collected for recording dry matter production and also to determine the uptake of nutrients.
The nitrogen content of foliar tissue was estimated by microkjeldahl distillation method (A.O.A.C., 1970) [1]. The phosphorus content of foliar tissue was determined by vanado-molybdo phosphoric yellow colour method and the concentration of potassium was determined by using flame photometer (Jackson, 1973) [4]. Ca and Mg contents were determined by versenate method while sulphur content was determined by turbidometric method (Vogel, 1978) [10]. The yield was recorded after the harvest of the crop from different farm holdings.

Results and Discussion
Nitrogen, phosphorus and potassium uptake
The N uptake of Bt cotton in inceptisols, alfisols and vertisols was ranged from 18.46 to 38.59, 18.76 to 40.36 and 17.54to 38.78 with a mean values of 30.64, 31.06 and 33.28 kg ha^{-1}, respectively whereas P uptake of Bt cotton in inceptisols, alfisols and vertisols was ranged

between 1.64 and 3.14, 1.76 and 3.01 and 1.90 and 3.16 with a mean values of 2.37, 2.43 and 2.59 kg ha^{-1}, respectively. However, the K uptake of Bt cotton in inceptisols, alfisols and vertisols was ranged from 4.23 to 8.13, 3.54 to 7.78 and 6.38 to 8.85 with a mean values of 6.00, 4.80 and 8.12 kg ha^{-1}, respectively (Table 1).

The highest mean uptake of Nitrogen, phosphorus and potassium was recorded in Bt cotton grown in vertisols as compared to Bt cotton grown ininceptisols and alfiisols, might be due to high water holding capacity and higher availability of N, P and K in vertisols. These observations were in agreement with findings of Mohan Das and Govind Reddy (2009) [6].

Calcium, magnesium and sulphur uptake

The mean Ca uptake in Bt cotton grown in inceptisols, alfisols and vertisols was 21.10, 19.70 and 19.86 kg ha^{-1}, respectively whereas mean Mg uptake in Bt cotton grown in inceptisols, alfisols and vertisols was 1.73, 1.64 and 2.51 kg ha^{-1}, respectively. Further, the mean S uptake in Bt cotton grown in inceptisols, alfisols and vertisols was 2.04, 2.19, and 2.28 kg ha^{-1}, respectively (Table 2). The highest mean uptake of Mg and S was noticed in Bt cotton grown in vertisols as compared to Bt cotton grown in inceptisols and alfisols, might be due to high buffering capacity, higher water holding capacity and availability of Mg and S in vertisols. These findings were in agreement with the findings of Srinivas *et al.*, (1998) [9].

Dry matter production and seed cotton yield

The dry matter production of Bt cotton grown in inceptisols, alfisols and vertisols was ranged from 575 to 724, 579 to 735 and 564 to 726 with a mean values of 674, 676 and 691 kg ha^{-1}, respectively. There is no much variation between the three soil orders in respect of dry matter production of Bt cotton. These findings were in confirmation with those reported by Kumar *et al.*, (2010) [5]. The mean values of seed cotton yield of Bt cotton grown ininceptisols, alfisols, and vertisols was 17.37, 17.23, and 18.33 q ha^{-1}, respectively (Table 3). The highest seed cotton yield of 18.33 q ha^{-1} was recorded in Bt cotton grown vertisols as compared to Bt cotton grown in inceptisols and alfisols. This might be due to the fact that vertisols have higher water holding capacity, nutrient availability and higher organic carbon content. Similar findings were reported by Raghu Rami Reddy *et al.*, (2010) [8].

Table 1: Nitrogen, phosphorus and potassium uptake by plants at flowering stage in Bt cotton grown soils

Sl. No.	Soil orders	Number of samples	Major nutrients (kg ha^{-1})					
			N		P		K	
			Range	Mean	Range	Mean	Range	Mean
1.	Inceptisols	30	18.46-38.59	30.64	1.64-3.14	2.37	4.23-8.13	6.00
2.	Alfisols	30	18.76-40.36	31.06	1.76-3.01	2.43	3.54-7.78	4.80
3.	Vertisols	30	17.54-38.78	33.28	1.90-3.16	2.59	6.38-8.85	8.12

Table 2: Calcium, magnesium and sulphuruptake by plants at flowering stage in Bt cotton grown soils

Sl. No.	Soil orders	Number of samples	Secondary nutrients (kg ha^{-1})					
			Ca		Mg		S	
			Range	Mean	Range	Mean	Range	Mean
1.	Inceptisols	30	15.21-31.57	21.10	0.82-2.15	1.73	1.11-2.85	2.04
2.	Alfisols	30	14.51-27.01	19.70	1.00-2.32	1.64	1.21-3.67	2.19
3.	Vertisols	30	13.73-31.70	19.86	1.91-3.70	2.51	1.23-2.90	2.28

Table 3: Dry matter production at flowering stage and seed cotton yield of Bt cotton grown in different soils**.**

Sl. No.	Soil orders	Number of samples	Dry matter production (kg ha^{-1})		Seed cotton yield (q ha^{-1})	
			Range	Mean	Range	Mean
1.	Inceptisols	30	575-724	674	14.99-24.02	17.37
2.	Alfisols	30	579-735	676	14.66-23.51	17.23
3.	Vertisols	30	564-726	691	15.31-25.56	18.33

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