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Assessment of nutrients status in *Bt* cotton growing areas of Jewargi Taluka, Kalaburagi district

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Abstract
The study was conducted during 2017 to know the nutrients status of the *Bt* cotton growing fields of Jewargi taluka, Kalaburagi district. The experiment was conducted in 10 different villages. 100 surface soil samples were collected. The results revealed that soil pH ranging from 7.08 to 9.23 with EC 0.2 to 1.12 dS/m. Organic carbon values range from 1.0 to 1.14 g/kg soil. In majority of study area available nitrogen, was medium (67%), available phosphorus was medium (85%), available potssium was high (49%) and available sulphur was medium (70%). Soils of the study area were dominated by calcium and magnesium. Available Fe status was high and ranging from 2.46 mg kg^{-1} to 8.20 mg kg^{-1}. Available Zn ranged from 0.28 and 0.71 mg kg^{-1}. Available Cu ranged from 0.22 to 0.81 mg kg^{-1}. Available Mn was in the range of 3.62 to 8.68 mg kg^{-1}.

Keywords: Global positioning system, soil fertility status and available nutrients

Introduction
Cotton (*Gossypium* spp.) the 'king of fibers' also popularly known as the 'white gold' enjoys a pre-eminent position amongst cash crops in the world and in India as well. It is the nature's most precious gift to the mankind, contributed by the genus *Gossypium*. Globally, cotton is cultivated in 70 countries with a total coverage of 32.3 million ha (Anonymous, 2016) [1]. Area-wise, India ranks first in global scenario (about 33% of the world cotton area) where, the crop contributes nearly 85% of total raw material needs of textile industry and therefore, plays a major role in the country's economy both in terms of providing employment directly or indirectly to about 60 million people and earning foreign exchange for the country to the tune of Rs. 60,000 crores (Anonymous, 2016) [1]. In Karnataka, cotton occupies an area of 4.64 lakh ha with a production of 19.90 lakh bales and productivity of 769 kg ha^{-1} (Anonymous, 2016) [1]. In the northern dry zones (Zone 2 and 3) covering partly the Tungabhadra and the Upper Krishna Command areas (TBP and UKP), *Bt* cotton is intensively cultivated on black clayey soils under irrigation. The area under cotton crop in these command areas driven by market price and high crop productivity has been increasing rapidly over the past decade. Of late, however, there is gradual decline in productivity in the region for varied reasons.

The reasons for decreasing productivity of cotton in these regions is continuous and imbalanced use of chemical fertilizers without adequate organic manures has resulted in deterioration of soil health and occurrences of physiological disorders like square dropping, square drying, leaf reddening *etc*., Among these, imbalanced use of major and micro nutrients is the major problem. The optimization of the mineral nutrition is the key to maximize the productivity of cotton, as it has very high nutrient requirement crop. To overcome these constraints, assessment of nutrients status with extent of nutrient deficiency status is required to manage the cotton for increasing the yield. This is one of the most efficient ways of supplying major and micro nutrients to a growing crop. Hence an attempt was made to know nutrients status in *Bt* cotton growing fields.

Materials and methods
The surveyed area was *Bt* cotton growing farmers fields in Jewargi taluka it is located between 16^0 54' 14.5" and 17^0 02' 12.9" N latitude and between 76^0 46' 18.4" and 76^0 77' 39.5" E longitude and at an altitude on an average of 393 m above mean sea level. The climate is tropical with maximum temperature of 40.67 °C and minimum temperature of 11.87 °C. The area receives a

mean annual rainfall of 628 mm. Soil samples were collected and dried in shade. The air-dried samples were grind with a wooden pestle and mortar and passed through a 2 mm sieve to separate the coarse fragments (>2 mm). The fine earth samples were stored in separate containers and used for various analyses. Fertility status of N, P, K and S were analysed and interpreted as low, medium and high and that of calcium, magnesium, zinc, iron, copper and manganese were analysed and interpreted as deficient, and sufficient by following the criteria given by (Arora, 2002) [2].

Results and Discussions

In the present investigation, soil reaction was neutral (6.5–7.5) in 02 per cent of the samples, 17 per cent were slightly alkaline (7.5-7.8), 50 per cent were moderately alkaline (7.9-8.4), 23 per cent were strongly alkaline (8.5-9.0) and remaining 08 per cent samples were very strongly alkaline in reaction (>9.0) (Table 1). Prevalence of higher soil pH in black soils could be attributed to the accumulation of exchangeable bases and free calcium carbonate. Similar results were reported for black soils by Vijayasekhar *et al*. (2000) in Upper Krishna command. The EC in surface soil samples ranged from 0.2 to 1.12 dS m^{-1} (Table 1). Except 04 samples all the samples were non-saline. Due to the enough annual rainfall and good natural drainage provision leaches out salts and maintains low salt balance in the soil. The organic carbon content of the soils ranged from 1.0 to 11.4 g kg^{-1}. About 80 per cent of samples were low in organic carbon followed by 19 per cent with medium and only 01 per cent was high range (Table 1). Lower and medium organic carbon content in these soils may be attributed to the practice of less organic matter addition to the soil through manuring. Lesser organic carbon content in these soils may be due to prevalence of tropical climate condition, where the degradation of organic matter occurs at a faster rate. Monocropping and Intensive cropping was also one of the reasons for low organic carbon content. Similar observations on organic carbon content were made by Mahalingam and Durairaj (1968) [4].

Major available Nutrients

The data pertaining to available nitrogen content showed that 32 per cent samples comes under low available nitrogen status, 67 per cent were in medium range and only 01 per cent was high range in available nitrogen status (Table 2). Available nitrogen content in soils may be related to soil management, application of FYM and fertilizer to the previous crop (Ashok Kumar, 2000) [5]. With respect to Phosphorus, about 3 per cent of the samples were low in available phosphorus, 85 per cent samples were in medium range and 12 per cent were in high phosphorus availability (Table 2). The *Bt* cotton growing farmers generally use lower dose of P fertilizers such as DAP. Other major reasons for low P availability in these soils was related to their slight to moderate alkaline pH, predominance of calcareousness and low organic matter content. Similar results were obtained by Divakar *et al.* (1989) [6]. Nearly half (49%) of the studied field's samples were high in available potassium status and remaining 36 and 15 per cent samples were medium and low range of potassium availability, respectively. Similar findings were observed by Ravikumar *et al.* (2007a) [7]. Higher availability of potassium due to invariably the surface black soils had higher concentration of water soluble and exchangeable K in Karnataka. Higher content of available potassium in Vertisols may be due to the predominance of potash rich micaceous and feldspar minerals in parent material (Table 2). 22 per cent samples were in low range and remaining 70 and 8 per cent samples were in medium and high range of available sulphur, respectively status respectively (Table 2). Due to lack of sulphur fertilizer application by the farmers and low organic matter content of the soil is also an important reason for low sulphur availability (Tripathi and Singh, 1992) [8].

Available micronutrients

Available iron status of studied soil samples were deficient to the extent of 15 per cent. However, 85 per cent of the fields had sufficient available Fe status. In black soils, low Fe content may be due to precipitation of Fe by $CaCO_3$ thereby decreased availability. Similar results were also found by Ravikumar *et al.* (2007b) [9] and Patil *et al*. (2006) [10] in the North Karnataka. However, available iron was reported to follow no regular pattern of distribution as reported by Nayak *et al.* (2002) [11]. This type of variation may be due to the soil management practices (addition of amendments, organic matter etc.) and cropping pattern adopted by different farmers.Sufficient available Mn was observed in entire sampled fields. The sufficiency of Mn could be attributed to nature of the parent material. Prasad and Sahi (1989) [12] through their experimentation reported that parent rock and minerals influence available Mn. Entire sampled fields were categorized under sufficient rating for available copper status. Manojkumar (2011) [13] revealed that sufficient available copper was present in cultivated fields in Northern transition zone of Karnataka.Available zinc was found deficient in 63 per cent and 37 per cent were in sufficient in field samples. The content of Zn decreases with increase in pH and $CaCO_3$ content (Satyavathi and Suryanarayana Reddy, 2004) [14]. Since most of the soils were slight to moderately alkaline and dominated by $CaCO_3$, zinc might had precipitated as hydroxides and carbonates. As a result, Zn solubility and mobility decreased (Patil *et al.* 2006) [10] (Table 3).

Table 1: Per cent distribution of soil samples from the study area under different category based on soil parameters

Chemical properties	Description	Percentage (%)
pH (1:2.5) (Soil Reaction)	Acidic(<6.5)	00
	Neutral (6.5 – 7.5)	02
	Slightly alkaline (7.5 – 7.8)	17
	Moderately alkaline (7.9 – 8.4)	50
	Strongly alkaline (8.5 – 9.0)	23
	Very strongly alkaline (>9.0)	8
EC (1;2.5) (Total Soluble salts)	Saline	04
	Non-saline	96
OC (Organic carbon)	Low	80
	Medium	19
	High	01

Table 2: Per cent distribution of soil samples from the study area under different fertility ratings based on soil available nutrient status

Sl. No	Nutrient	Nutrient status		
		Low	Medium	High
1	Nitrogen	32	67	01
2	Phosphorus	03	85	12
3	Potassium	15	36	49
4	Sulphur	22	70	08

Table 3: Per cent distribution of soil samples from the study area under different category based DTPA extractable micronutrient status

Sl. No	Nutrient	Fertility status	
		Deficient	Sufficient
1	Fe	15	85
2	Mn	00	100
3	Cu	00	100
4	Zn	63	37

Conclusion

From the above study it can be concluded that soil pH range from 7.08 to 9.23 with EC 0.2 to 1.12 dS/m. Organic carbon values range from 1.0 to 1.14 g/kg soil. Nitrogen, phosphorus, and suphur status in major area was medium and potassium status was high. Available Zn was defiecent and iron was suffiecient in majority of study area. Available Cu and Mg was suffiecient in entire area. Based on this information, we can calculate nutrients based on nutrients requirement of *Bt*cotton to achieve the good yield and we can eliminate the excess application of chemical fertilizer by the farmers and also helps to develop the fertility map of the study area

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