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Quality parameters of BT cotton as influenced by the Biofertilizer consortia and foliar nutrition under rainfed

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Abstract

A filed experiment was conducted during rainy season of 2014 at College Farm, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad to study the effect of biofertilizer consortia of microbes applied to soil and foliar application of macro nutrients on quality parameters of Bt Cotton. Consortia of microbes applied to soil + foliar application of 18:18:18 @ 1.5 per-cent recorded significantly higher total number of bolls plant⁻¹ (25.1), boll weight (6.62 g), seed index (11.00) and seed cotton plant⁻¹ (96.41 g) over other treatments. Significantly higher seed cotton yield also recorded with consortia + foliar application of 18:18:18 @ 1.5 per cent (1670 kg ha⁻¹) over other treatments and control (1004 kg ha⁻¹).

Keywords: consortia, biofertilizers, foliar application, quality parameters

Introduction

Cotton is the major commercial fiber crop in the world with an area of 12.18 m ha 35.6 million bales production and productivity of 496 kg ha⁻¹. Even though India ranks first in area, productivity is far below the world average of 600 kg ha⁻¹ (Annon, 2010). In Andhra Pradesh cotton Cultivated in 17.76 lakh ha with productivity of 372 kg ha⁻¹ respectively. The productivity of cotton is low (491 kg lint ha⁻¹) compared to the world average (725 kg lint ha⁻¹) Similarly in Andhra Pradesh is also low compared to national average productivity.

Actual yield levels are low due to poor agronomic practices, especially fertilization. Squaring, blooming and boll development are the stages where cotton needs the highest nutrient demand. Augmentation of nutrient supply through foliar application at such critical stages may increase yield. Foliar nutrition when used as a supplement the crop gets benefitted from foliar applied nutrients when the roots are unable to meet the nutrient requirement of the crop at its critical stage (Ebelhar and Ware 1998) [2]. Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen through plant roots. Keeping in view of above points, the present investigation was carried out to find out the effect of foliar feeding and liquid biofertilizer consortia on BT cotton.

Material and Methods

A field experiment was conducted at College Farm, Rajendranagar during rainy season (*khari*) 2014 on a sandy clay loam soil with neutral pH (7.4) and low in organic carbon (0.34%). The soil was low, medium and high in the available N (174.8 kg ha⁻¹), P₂O₅ (49.3kg ha⁻¹) and K₂O (422.4 kg ha⁻¹), respectively. The experiment was laid out in a randomized block design (RBD) with 10 treatments replicated thrice with a net plot area of 5.4 m X 3.6 m. An intra hirsutum BT cotton hybrid Jadhu (Boll-Gaurd II) having semi determinate plant type was used as a test cultivar. Treatments in the experiment included T₁- Control (RDF-150:60:60 N, P₂O₅ and K₂O kg ha⁻¹), T₂- Consortia of microbes (PSB + KSB + VAM + *Azotobactor*) to soil @ 1 L ha⁻¹, T₃- Foliar application of urea @ 2 per cent, T₄- Foliar application of KNO₃ @ 2 per cent, T₅- Consortia of microbes + Foliar application of urea @ 2 per cent, T₆- Consortia of microbes + foliar application of KNO₃ @ 2 per cent, T₇- Foliar application of 18:18:18 @ 1.5 per cent, T₈- Foliar application of 17:44:0 @ 2 per cent, T₉- Consortia of microbes + foliar application of 18:18:18 @ 1.5 per cent and T₁₀- Consortia of microbes + foliar application of 17:44:0 @ 2 per cent. Consortia (PSB and *Azotobactor* are in the form of liquid @ 250 ml L⁻¹ and KSB and VAM in the form of powder @ 250 g) were mixed well and the mixture was

spread uniformly on well decomposed FYM (100 kg ha⁻¹) one day before application. FYM was incubated overnight by maintaining optimum moisture and applied to the soil at the time of sowing along with the seed. Foliar sprays were applied as per treatments at 60, 90 and 120 DAS. Recommended dose of fertilizers and other package of practices were uniformly adopted in all the treatments for growing healthy crop.

The quality parameters like ginning percentage, seed index and others viz., lint index (g), 2.5 per cent staple length (mm), uniformity ratio, micronaire value ($\mu\text{g inch}^{-1}$) and fibre strength (g tex⁻¹) were measured with the help of a high volume instrument (HIV) at CIRCOT lab, RARS Lam, Guntur district, Andhra Pradesh.

Results and Discussion

Quality parameters

Fibre quality of BT cotton is the foremost requirement to decide the market value of the produce.

1. Ginning percentage

Significantly higher ginning percentage (39.1) with BT cotton was recorded with application of combined consortia of microbes to soil with foliar nutrition of 18:18:18 @ 1.5 per cent than consortia of microbes applied to soil 1 L ha⁻¹ and it was on par with all soil applied consortia applied treatments in combination with foliar application of different macro nutrients. Control (only RDF) recorded significantly lower ginning percentage (27.4) than rest of the treatments. (Table 1)

Table 1: Quality parameters of rainfed BT cotton as influenced by biofertilizer consortia and foliar nutrition

S. No	Treatments	Ginning per cent (%)	Lint index (g)	2.5 % staple length (mm)	Uniformity ratio	Fibre strength (g tex ⁻¹)	Micronaire ($\mu\text{g inch}^{-1}$)
1	Control (150:60:60)	27.4	3.71	29.6	42.59	20.80	3.91
2	Consortia of microbes* to soil @ 1 L ha ⁻¹	33.4	5.18	30.3	43.33	22.65	4.12
3	Foliar application** of 2 per cent Urea	36.2	5.67	30.4	46.62	21.43	3.91
4	Foliar application of 2 per cent KNO ₃	36.7	5.71	30.7	45.89	22.39	4.14
5	Consortia of microbes + foliar application of 2 per cent Urea	37.5	6.22	30.7	44.54	21.96	4.27
6	Consortia of microbes + foliar application of 2 per cent KNO ₃	38.5	7.00	30.9	46.28	24.00	4.64
7	Foliar application of 1.5 per cent 18:18:18 WSF	37.9	6.40	30.6	46.37	23.42	4.12
8	Foliar application of 2 per cent 17:44:0 WSF	35.2	5.16	29.8	46.22	21.76	4.25
9	Consortia of microbes + foliar application of 1.5 per cent 18:18:18 WSF	39.1	7.19	31.6	47.07	24.26	4.46
10	Consortia of microbes + foliar application of 2 per cent 17:44:0 WSF	37.6	6.12	30.4	45.33	22.73	4.42
	SEm \pm	0.7	0.28	0.46	0.64	0.29	0.19
	CD (0.05)	2.2	0.85	NS	1.89	0.85	NS
	Mean	36.0	5.84	30.5	45.42	22.54	4.22

*Consortia of microbes - (PSB+KSB+ VAM + *Azotobactor*)

** Foliar application at 60, 90 and 120 DAS

2. Lint index

Lint index recorded by combined consortia of microbes applied to soil and foliar nutrition of 18:18:18 @1.5 per cent (7.19 g) was on par with consortia of microbes combination with foliar nutrition of KNO₃ @ 2 per cent (7.00) and foliar nutrition of 18:18:18 @ 1.5 per cent (6.40) and significantly higher than rest of the treatments. Significantly lower lint index was recorded with control (3.71) than rest of the treatments (Table 1).

3. Staple length 2.5%

The fibre quality of 2.5% staple length of BT cotton did not show any significant changes due to addition of consortia, foliar nutrition and combination of consortia with spray of macro nutrient applied over and above the RDF (control). However, it varied from 29.6 (control) to 31.6 (consortia applied to soil + foliar nutrition of 18:18:18 water soluble fertilizer) with a mean of 30.5 (Table 1).

4. Uniformity ratio

The data on uniformity ratio is presented in Table 1. Significantly higher uniformity ratio of Bt cotton was recorded with combination of microbial consortia with foliar nutrition of 18:18:18 @ 1.5 per cent (47.07) than control, consortia of microbes and consortia of microbes + foliar application of 2 per cent urea was on par with consortia of microbes + foliar nutrition of KNO₃ @ 2 per cent (46.28), or 17:44:0 @ 2 per cent (45.33), foliar nutrition of 18:18:18 @

1.5 per cent (46.37), foliar nutrition of 17:44:0 (46.22), KNO₃ (45.89) and urea (46.62) @ 2 per cent. Significantly lower uniformity ratio of 42.59 was recorded when crop fertilized with only RDF than rest of treatments except consortia of microbes applied to soil.

5. Fibre strength

Consortia of microbes applied to soil with foliar nutrition of 18:18:18 @ 1.5 per cent (24.26) recorded significantly higher fibre strength of Bt cotton over rest of the treatments except consortia of microbes + foliar nutrition of KNO₃ @ 2 per cent (24.00) and foliar nutrition of 18:18:18 @ 1.5 per cent (23.42) which were on par with later treatment. Control recorded fibre strength of 20.80 which was on par with foliar nutrition of urea @ 2 per cent (21.43) and significantly lower than rest of the treatments (Table 1).

6. Micronaire

The micronaire data of BT cotton ranged from 3.91 (control and foliar application of urea @ 2 per cent) to 4.64 (consortia of microbes applied to soil combined with foliar application of 2 per cent KNO₃) with mean of 4.22. However, the fibre quality data pertaining to micronaire did not show any significant difference due to addition of either consortia of microbes or foliar nutrition or consortia of microbes combination with foliar spray of macro nutrients applied over and above the RDF.

Decrease in quality parameters in BT cotton could be due to limited supply of K during active fibre growth period which may cause reduction in the turgor pressure of the fibre, resulting in less cell elongation and shorter fibers at maturity (Oosterhuis 1994) ^[4]. Foliar application of K at flowering improves fibre length, uniformity ratio, fibre strength, ginning % and fibre fineness (Shanmugham and Bhatt 1991) ^[6]. Similar findings pertaining to ginning % (Vinayak Hosmani *et al.* (2013) ^[7], fibre strength (Kumara *et al.* (2011), fibre fineness (Rajendran *et al.* (2011) ^[5], and micronaire (Chhabra *et al.* (2004) ^[1], were also reported.

Conclusions

From this study we can conclude that for rainfed Bt Cotton foliar application of fertilizers likes Urea, DAP, KNO₃ and 18:18:18 water soluble fertilizer during the flowering and boll formation stages increases the quality parameter of the seed cotton there by farmer can get the good remuneration. Soil application of microbial consortia has shown its effect during the early stage of the crop growth for better establishment and flowering but not shown any effect on quality parameters of the Bt Cotton.

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