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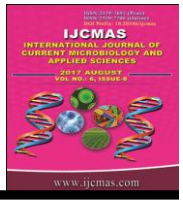

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Yield and Yield Attributes of Bt Cotton as Influenced by the Biofertilizer Consortia and Foliar Nutrition under Rainfed

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A B S T R A C T

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 yield and yield attributes 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}).

Introduction

Cotton (*Gossypium hirsutum* L.) is the most important commercial crop of India cultivated in an area of 12.65 million ha with a production of 40 million bales of lint. Cotton contributes to 80 per cent of the raw material to the textile industry and provides employment to nearly 60 million people. India ranks first in area and second in global cotton production.

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 nutrients demand. Augmentation of nutrient supply through foliar application at such critical stages may increase yield (Bhatt and Nathu, 1986). 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). Biofertilizers play a very significant role in improving soil fertility by fixing atmospheric nitrogen through plant roots. They solubilise insoluble soil phosphates to soluble forms and produce plant growth substances in the soil. *Azatobacter* is a free living, non-symbiotic in nature and fixes nearly 20 to 40 kg nitrogen ha^{-1}, and produces growth promoting substances. Potassium solubilizing bacteria convert unavailable potassium in the soil into a form that plants can access. 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 cotton.

Materials and Methods

A field experiment was conducted at College Farm, Rajendranagar during rainy season (*kharif*) 2014on 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}), P_2O_5 (49.3kg ha^{-1}) and K_2O (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 T_1- Control (RDF-150:60:60 N, P_2O_5 and K_2O kg ha^{-1}), T_2- Consortia of microbes (PSB + KSB + VAM + *Azotobactor*) to soil @ 1 L ha^{-1}, T_3- Foliar application of urea @ 2 per cent, T_4- Foliar application of KNO_3 @ 2 per cent, T_5- Consortia of microbes + Foliar application of urea @ 2 per cent, T_6- Consortia of microbes + foliar application of KNO_3 @ 2 per cent, T_7- Foliar application of 18:18:18 @ 1.5 per cent, T_8- Foliar application of 17:44:0 @ 2 per cent, T_9- Consortia of microbes + foliar application of 18:18:18 @ 1.5 per cent and T_{10}- 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.

Results and Discussion

Number of bolls $plant^{-1}$

The total number of bolls $plant^{-1}$ was significantly influenced by the different treatments and significantly higher number of bolls $plant^{-1}$ (25.1) were recorded with consortia of microbes applied to soil with foliar nutrition of 18:18:18 @ 1.5 per cent than rest of the treatments except foliar nutrition of KNO_3 and urea @ 2 per cent (22.5 and 22.3, respectively) along with consortia of microbes applied to soil. Significantly lower number (14.1) of bolls $plant^{-1}$ was recorded by the control over rest of the treatments.

Boll weight

Significantly higher boll weight was recorded by the biofertilizer consortia applied to soil @ 1 L ha^{-1} along with foliar nutrition of 18:18:18 @ 1.5 per cent (6.62 g) than the rest of other treatments. Control recorded significantly lower boll weight (5.06 g) than rest of treatments.

Seed cotton yield $plant^{-1}$ (g)

Seed cotton yield (98.2 g) $plant^{-1}$ recorded with biofertilizers consortia applied to soil @ 1 L ha^{-1} in combination with foliar nutrition of 18:18:18 @ 1.5 per cent was significantly higher than the rest of the treatments.

Control (RDF) recorded significantly lower seed cotton yield (59.1 g) $plant^{-1}$ than remaining all other treatments.

Table.1 Yield and yield attributes of Bt cotton as influenced by biofertilizer consortia and foliar nutrition under rainfed

S.No	Treatments	Total number of bolls plant^{-1}	Boll weight (g)	Seed index (g)	Seed cotton yield plant^{-1} (g)	Seed cotton yield (Kg ha^{-1})
1	Control (150:60:60)	14.1	5.06	9.83	59.40	1004
2	Consortia of microbes* to soil @ 1 L ha^{-1}	17.1	5.42	10.33	73.62	1275
3	Foliar application (FA**) of 2 per cent Urea	13.4	5.78	9.33	77.27	1318
4	Foliar application (FA) of 2 per cent KNO_3	18.7	5.81	9.17	81.33	1342
5	Consortia of microbes + FA of 2 per cent Urea	20.3	5.89	9.50	84.14	1411
6	Consortia of microbes + FA of 2 per cent KNO_3	22.5	5.91	11.17	84.85	1454
7	Foliar application of 1.5 per cent 18:18:18 WSF	18.9	5.63	10.50	82.80	1358
8	Foliar application of 2 per cent 17:44:0 WSF	17.1	5.79	9.50	79.15	1237
9	Consortia of microbes + FA of 1.5 per cent 18:18:18 WSF	25.1	6.62	11.00	96.41	1670
10	Consortia of microbes + FA of 2 per cent 17:44:0 WSF	18.6	5.66	10.17	81.13	1343
SEm ±		**1.0**	**0.18**	**0.44**	**1.46**	**57**
CD		**2.8**	**0.54**	**1.31**	**4.33**	**170**
Mean		18.6	5.8	10.1	80.0	1341.2

CM* - (PSB+KSB+ VAM + Azotobactor), FA** at 60 DAS, 90 DAS and 120 DAS

Seed index

Soil applied microbial consortia @ 1 L ha^{-1} along with foliar nutrition of KNO_3 @ 2 per cent (11.17) was recorded significantly higher seed index among different treatments and lower seed index (9.17) was recorded by control (RDF) with a mean of 10.29.

Seed cotton yield

Significantly higher seed cotton yield was recorded with the application of biofertilizer consortia (PSB + KSB + VAM + *Azotobactor*) to soil @ 1 L ha^{-1} along with foliar nutrition of 18:18:18 @ 1.5 per cent (1670 kg ha^{-1}) over rest of the treatments. Significantly lower seed cotton yield of 1004 kg ha^{-1} was recorded by the control (RDF) than all other treatments. There was no significant difference in seed cotton yield among foliar applied KNO_3, urea and 17:44:0 @ 2 per cent and 18:18:18 @ 1.5 per cent applied to foliage without microbial consortia, though there was an increase of 33.7, 31.2, 23.2 and 35.2 per cent seed cotton yield, respectively with foliar application of above nutrients over control (RDF). Similar results were reported by Ratna Kumari *et al.,* (2014), Sritharan *et al.,* (2013) and Shah *et al.,* (2012). The lower yields were mainly due to non-availability of potassium during boll development stages as applied potassium have fixed in soil (Pervez *et al.,* 2008) under moisture stress conditions of rainfed agriculture. In addition to this, the stress condition resulted in poor uptake of N, P and K and might have not met the plant requirement of these nutrients for growth and development as evidenced by lower growth parameters resulting in lower yield attributes there by lower yield (Table 1).

Based on the results obtained in the present investigation, it can be concluded that soil application of biofertilizer consortia at sowing will help the plant for uptake of nutrient during the early stages by improving soil fertility by fixing atmospheric nitrogen by plant roots and these solublise insoluble soil phosphates to soluble and produces plant growth substances in the soil. Foliar application of 18:18:18 @ 1.5 per cent at 60, 90 and 120 DAS, 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 there by the higher seed cotton yield can be achieved.

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