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Biofertilizer Consortia and Foliar Nutrition Effect on Rainfed Bt Cotton Soils Enzyme Activity

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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 enzymatic activity at 60, 90 and 120 DAS. Enzymatic activity was highest during the flowering period (60DAS) and thereafter the activity decreased with the age of the crop and lowest activity was recorded at final harvest. Consortia of microbes applied to soil + foliar application of 18:18:18 @ 1.5 per cent recorded significantly higher enzymatic activity at 60 DAS viz., dehydrogenase (11.3 µg TPF g-1 day^{-1}), acid phosphatase (142.2 µg PNP released g^{-1} h^{-1}), alkaline phosphatase (101.3 µg PNP released g^{-1} h^{-1}) and urease (95.3 µg NH_4^+ g^{-1} 2 h^{-1}) 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}).

Key words: *Consortia, Biofertilizers, foliar nutrition, Urease, Dehydrogenase, Phosphatase*

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 (CAB, 2015). 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.

Although there are diverse benefits of Bt cotton, public concern also exist because both *in vitro* and *in vivo* studies on Bt cotton showed that Bt toxin produced in leaves, stems and roots of Bt cotton plants is introduced ion soil. Bt-toxin from Bt cotton plants introduced into the soil through two pathways, i.e., biomass incorporation and root exudates. Bt cotton released in soil adsorbed or bound on clay particles, humic components, or organic mineral complexes and then be protected against degradation by soil microorganisms. Although Bt toxin also found naturally in many soils, but continuous growing of Bt crops on same location enhance its existing levels to a certain concentrations that might affect the composition and activity of soil biochemical properties.

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Soil enzymes are important bio-chemical constituents of the soils influencing the nutrient transformations, determining the nutrient availability to plant and ultimately the soil quality. Soil enzyme activity is known to be significantly influenced by the soil/climatic conditions as well as plant nutrition through bio-fertilizers and foliar applied fertilizers[3,4]. Studies on impact of soil applied microbial consortia alone or in combination with foliar nutrition of N, P and K on soil important soils enzyme activity in Bt cotton growing soils, under rainfed conditions, is scanty. With this view a experiment was formulated to study the influence of microbial consortia of Phosphate solubulizing Bacteria (PSB) + Potassium solubulizing Bacteria (KSB)+ *Azotobacter* + Vesicular Arbusular Mycorrhizha (VAM) fungi and foliar nutrition on the soil enzyme activity.

MATERIAL AND METHODS

A field experiment was conducted at College Farm, Rajendranagar during rainy season (*kharif*) 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}), 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 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. Enzymatic activity v*iz.*, dehydrogenase, phosphatases and urease in rhizosphere soils was studied by employing standard procedures at the time of flowering (60, 120 DAS) and harvest (153 DAS).

RESULTS AND DISCUSSION

Dehydrogenase

Dehydrogenase activity during the crop growth period varied from 3.2 to 11.3 µg TPF g^{-1} day^{-1}. Highest soil dehydrogenase activity was observed during the flowering stage and reduced as the crop reached maturity. Significantly higher dehydrogenase activity of 11.3 µg TPF produced g^{-1} day^{-1} at 60 DAS was recorded with consortia of microbes applied to soil with foliar application of 18:18:18 @ 1.5 per cent which was at par with consortia + foliar application of KNO_3 (10.8 µg TPF produced g^{-1} day^{-1}) @ 2per cent and sole consortia of microbes applied to soil (10.4 µg TPF produced g^{-1} day^{-1}) than other treatments. Significantly lower activity of 7.4 µg TPF produced g^{-1} day^{-1} at 60 DAS than remaining

treatments. At final harvest also significantly higher dehydrogenase activity 5.4 µg TPF produced g^{-1} day^{-1} recorded with consortia of microbes with foliar application of18:18:18 @ 1.5 per cent than all the treatments. Control recorded significantly lower activity of 3.2 µg TPF produced g^{-1} day^{-1} at final harvest, respectively. Similar results reported with Sarkar *et al*[4].

Phosphatases (Acid and Alkaline):

Activity of acid and alkaline phosphatase was significantly higher 142.2 (µg TPF g-1 day^{-1}) and 101.3 µg PNP released g^{-1} h^{-1} in soils at 60 DAS recorded with microbial consortia applied to soil and foliar application of 18:18:18 @ 1.5per cent than all other treatments. Significantly lower acid and alkaline activity (99.5 µg PNP released $g^{-1}h^{-1}$ and 54.9 µg PNP released $g^{-1}h^{-1}$) in soils recorded with control. At final harvest, significantly higher acid phosphatase activity of 116 µg PNP released g^{-1} h^{-1} in soils was recorded with application of microbial consortia with foliar application of 18:18:18 @ 1.5 per cent which was at par with combination of microbial consortia and foliar application of KNO_3 (106.8 µg PNP released g^{-1} h^{-1} in soils) @ 2 per cent, alkaline phosphatase activity of 82.6 µg PNP released g^{-1} h^{-1} in soils was recorded with (T9). Phosphotase activity in these treatments was significantly superior to other treatments. Significantly lower acid and alkaline phosphotase activity than the remaining treatments (73.2 µg PNP released g^{-1} h^{-1} and 50.0 µg PNP released g^{-1} h^{-1}) in soils recorded with control. Acid phosphatase at this stage was at par with foliar application of urea (84 µg PNP released g^{-1} h^{-1} in soils) @ 2 per cent. Alkaline phosphatase activity at final harvest on par with Foliar application of urea (50.7 µg PNP released g^{-1} h^{-1} in soils), KNO_3 (50.7 µg PNP released g^{-1} h^{-1} in soils),17:44:0 (53.3 µg PNP released g^{-1} h^{-1} in soils) final harvest @ 2 per cent and 18:18:18 @ 1.5 per cent (74.9 µg PNP released g^{-1} h^{-1} in soils) at final harvest than the remaining treatments. This might be due to large quantity of phosphorus fertilizer addition to soil as well as foliar application to meet the crop demand and low initial soil available P. Insect-resistant Bt crops have the potential to change the microbial dynamics, biodiversity and essential ecosystem functions in soil, because they usually produce *cry* protein through all parts of the plant, similar reports given by Gregory *et al*[2].

Urease activity:

At 60 DAS, activity of urease was significantly higher (95.3 µg NH_4^+ g^{-1} 2 h^{-1}) in soils treated with consortia + foliar application of 18:18:18 @ 1.5per cent and was on par with all microbial consortia + foliar application combination treatments. Significantly lower 68.8 µg NH_4^+ g^{-1} 2 h^{-1} in soils recorded with control and on par with remaining treatments.

At final harvest, significantly higher urease activity of 82.2 µg NH_4^+ g^{-1} 2 h^{-1} recorded with consortia of microbes applied to soil with foliar application of 18:18:18 @ 1.5 per cent and on par with consortia with foliar application of urea (73.1 µg NH_4^+ g^{-1} 2 h^{-1}) @ 2 per cent than other treatments. Significantly lower urease activity of (53.3 µg NH_4^+ g^{-1} 2 h^{-1}) recorded with control than remaining treatments. This might be due to inhibition of urease activity under elevated levels of N availability. Studies of Yanyu *et al.*[5] also indicate negative correlation between urease activity and soil N concentration. The results of Ajwa *et al.*[1] also support these findings where in inhibitory effect of mineral fertilizers and 15% decreased urease activity with application of excess doses of mineral fertilizer were reported.

Table1: Soil enzyme activity as influenced by soil application of Microbial consortia and foliar nutrition in rainfed Bt cotton

S.No.	Treatments	Urease (µg NH_4^+ g^{-1} 2 h^{-1})		Dehydrogenase (µg TPF g-1 day^{-1})		Phosphatase (µg PNP released g^{-1} h^{-1})			
						Acid phosphatase		Alkaline phosphatase	
		Flowering	Harvest	Flowering	Harvest	Flowering	Harvest	Flowering	Harvest
1	Control (150:60:60)	68.8	53.3	7.4	3.2	99.5	73.2	54.9	50.0
2	Consortia of microbes* to soil @ 1 L ha^{-1}	85.4	67.7	10.4	4.4	122.3	83.5	85.3	62.6
3	Foliar application (FA*) of 2 per cent Urea	78.8	67.8	9.8	3.7	111.5	84.0	57.1	49.3
4	Foliar application (FA) of 2 per cent KNO_3	77.0	64.2	9.1	3.5	109.7	95.7	60.1	52.6
5	Consortia of microbes + FA of 2 per cent Urea	91.3	73.1	10.8	4.1	109.0	100.1	78.6	68.2
6	Consortia of microbes + FA of 2 per cent KNO_3	84.8	70.9	9.3	4.0	119.9	106.8	82.8	62.1
7	Foliar application of 1.5 per cent 18:18:18 WSF	79.8	63.3	9.9	3.6	110.9	95.6	67.5	53.3
8	Foliar application of 2 per cent 17:44:0 WSF	77.8	64.8	9.9	3.8	110.2	94.9	63.2	51.0
9	Consortia of microbes + FA of 1.5 per cent 18:18:18 WSF	**95.3**	**82.2**	**11.3**	**5.4**	**142.2**	**116.0**	**101.3**	**82.6**
10	Consortia of microbes + FA of 2 per cent 17:44:0 WSF	84.0	66.7	9.3	4.1	116.5	102.3	81.9	61.2
SEm ±		**3.8**	**3.2**	**0.4**	**0.3**	**3.7**	**5.6**	**2.6**	**3.0**
CD		**11.3**	**9.6**	**1.2**	**0.8**	**11.1**	**16.8**	**7.6**	**8.9**

CONCLUSIONS

Consortia of microbes applied to soil and foliar application of macro nutrients in *Bt* cotton showed remarkable influence on soil enzyme activity both at flowering and harvesting stages and activity of Dehydrogenase, phosphatases and urease enzymes. These enzyme activities was recorded higher during the flowering period (60DAS) and thereafter decreased with the age of the crop and lowest activity was recorded at final harvest.

REFERENCES

1. Ajwa, H.A., Dell, C.J and Rice, C.W., Changes in enzyme activities and microbial biomass of tallgrass praire soil as related to buring and nitrogen fertilization. *Soil Biology Biochemistry*. **47 (5):** 769-777 (1999).
2. Gregory, D., The devastating effect of GMo's on the future soil (2009).
3. Mastero, R.E., Chhonkar, P.K., Singh, D and Patra, A.K., Changes in soil biological and biochemical chraracteristics in a long term field trial on a subtropical inceptisol. *Soil Biology and Biochemistry*. **38:** 1577-1582 (2006).
4. Sarkar, B., Patra A.K. and Purakayastha, T.J., Transgenic *Bt*-cotton affects enzyme activity and nutrient availability in a sub-tropical Inceptisol. *Journal of Agronomy Crop Science*, **194:** 289-296 (2009).
5. Yanyu, S., Changchun, S., Guisheng, Y., Yingchen, L., Rong, M and Jiaoyue, W., Effects of N additions on soil enzyme activities in marshland ecosystem of Northeast China: an incubation experiment. *Advances in Biomedical Engineering*. **1-2:** 5-8 (2011).