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Evaluation of Biofertilizers and *Parthenium* Vemicompost on Tomato Crop

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Abstract

Aim of the present investigation was to assess the efficiency of biofertilizers and *Parthenium* vermicompost on yield of tomato (*Lycopersicon esculantum* L.). A field experiment was conducted at Jalna Education Society's Arts, Commerce and Science College, Jalna with 13 treatments and 3 replications. The biofertilizers were used either independently or in amalgamation as compared to recommended fertilizers and reference control. The analysis of the crop was done at 90 days after sowing (DAS). On the basis of the results obtained, it is concluded that the application of bacterial inoculants along with vermicompost (Vc) were more effective in increasing leaf area, total chlorophyll and yield of tomato.

Key Words: Biofertilizers, *Parthenium*, Vermicompost, Tomato

Introduction

The agriculture development strategy for India in the 21st century must be through increasing productivity of the land under cultivation, with reduced costs of production and higher use efficiency of inputs with no harm to the environmental quality. The prime requisite is the promotion of health of the soil-plant environment system to be free from economic exploitation under overuse and abuse of the input as if with impunity. No doubt, the use of chemical fertilizers was boon for the past but ban for the present. Now, it is time to reanalyze the technological development on the cost of nature destruction. Several mammoth problems related to soil structure and productivity is the results of fossil fuel based energy inputs in intensive cultivations.

The microbial inoculants like *Azotobacter, Rhizobium*, *Trichoderma* etc. are very beneficial for the plant growth and yield of crops (Rouzbeh *et al.,* 2009). They were found to have not only the ability to fix nitrogen but also to release phyto-hormones similar to gibberlic acid and indol acetic acid (IAA), which could stimulate absorption of nutrients, photosynthesis and plant growth. (Fayer *et al.,* 1985). The application of biofertilizers influence percentage of germination, seedling vigor, root and shoot length, chlorophyll content, total biomss, fruit yields etc. (Amujoyegbe *et al.,* 2007; Berova and Karanatsidis, 2008). According to Chandrasekar *et al.*, (2005) combined inoculation of *Azotobacter* and *Azospirillum* in presence of partial application of urea increased growth, biochemical components and crop productivity of *Echinochloa frumentacea.* Also, higher seed and stover yield with highest level of organic matter enrichment along with biofertilizers was reported by Chaudhury and Kabi (2003). Therefore, the present experiment was undertaken to study the combining ability of biofertilizers and *Parthenium* vermicompost on leaf area, chlorophyll content and yield of tomato.

Materials and Methods

Preparation of vermicompost

The fresh leafy vegetation of *Parthenium* was collected from different sites of college campus at 10 - 20 % flowering stage and chopped into the small pieces (2 - 3 cm). Equal amount of weed vegetation (50 kg) was used for each treatment. The material was uniformly spread into the pits to a height of about 5 cm and sprinkled with 10 percent cow dung slurry (1 kg dung in 10 liter water) and soil. Afterward the remaining plant material was added and finally, the pits were sealed with dung slurry and fine clay to prevent loss of heat or exchange of gases. After partial decomposition (15 days), first turning was given for uniform decomposition and sufficient amount of water was sprinkled for maintaining 50 - 60 percent moisture. Then the earthworms of the species *Eisenia foetida* and *Eudrilus eugeniae* (50 - 60 individuals per pit) were released. Identification of earthworms was done by Julka (1988). The vermicomposting process was completed within 15 days and a completely decomposed fine, dark brown colored granular excreta was obtained for the field experiment.

Field site, design and treatments

The experiment was conducted in the Research farm of J. E. S. college, Jalna. The experiment was carried out in a randomized block design (RBD) with thirteen treatments and three replicates. The treatments were i) Az - *Azatobacter*, ii) Rh - *Rhizobium*, iii) Tr - *Trichoderma*, iv) AzVc - *Azatobacter* + Vermicompost, v) AzTr - *Azatobacter* + *Trichoderma,* vi) RhVc - *Rhizobium* + Vermicompost, vii) RhAz - *Rhizobium* + *Azatobacter*, viii) RhTr - *Rhizobium* + *Trichoderma*, ix) TrVc - *Trichoderma* + Vermicompost, x) Vc - Vermicompost, xi) Ben - Benomyl, xii) Cf - Chemical fertilizer and xiii) Co - control. These treatments were applied to the appropriate plots.

Seed treatment and fertilizers application

The tomato seeds (Bejo Sheetal Hybrid Seeds) were collected from local market and treated with biofertilizers at a rate of 200 gm kg^{-1}. The carrier based inoculum packets were obtained from Agricultural Research Center, Badnapur, Dist. Jalna. Similarly for fungicide treatment, seeds were individually treated with 0.30 % of benomyl. The seeds were allowed to dry for about 30 mins. and sown. The plants were spaced 10 × 10 cm apart and recommended dose of fertilizers were applied at the rate of N 120, P_2O_5 80 and K_2O 40 kg ha^{-1}.

Morphological and biochemical analyses

The growth analysis of the crop was noted at 77 days after sowing (DAS). Chlorophylls (a, b and total) were estimated following Nanjareddy *et al.,* (1990) and leaf area per plant was determined by gravimetric method (Mungikar, 1986).

Statistical analysis

The data were statistically analyzed by using analysis of variance (ANOVA) test and treatments means were compared using the least significant differences (LSD) at $P \leq 0.05$ (Mungikar, 1997).

Results and discussion

The results recorded in Table1 shows significant differences for chlorophyll contents, leaf area and yield of tomato crop. Chlorophyll a, b, and total chlorophyll varied from 122.63 - 300.40, 115.34 - 336.32 and 237.97 - 636.72 mg g^{-1} leaf fresh weight (fw) respectively. The chlorophyll content was higher in all the biofertilizers and with vermicompost based treatments than that of control. Among them, total chlorophyll was greater in RhVc amended plots followed by AzVc, TrVc, RhTr, RhAz, AzTr, Tr, Rh, Az, Vc, Cf and Ben over the Co plots. The positive effects of bacterial inoculation on increased chlorophyll content might have been due to the supply of higher amount of nitrogen to the growing tissues and organs supplied by nitrogen fixing bacteria viz., *Rhizobium, Azotobacter* etc. Nehra *et al.,* (2001) also accounted increased chlorophyll contents in wheat leaves after the application of vermicompost and FYM. The chlorophyll contents play a significant role in the production of total biomass and productivity of the crops.

Table 1. Chlorophylls, leaf area and yield of tomato as influenced by biofertilizers and vermicopost alone and in combination

Treatments	Leaf chlorophyll contents (mg g^{-1})			Leaf area $(cm)^2$	Fruit weight (gm)
	a	b	Total		
AzTr	230.04	245.44	475.48	490	706.84
RhAz	238.09	240.03	478.12	455	754.61
RhTr	224.06	257.87	481.93	505	780.76
AzVc	277.72	296.43	574.15	867	876.02
RhVc	300.40	336.32	636.72	887	888.84
TrVc	245.97	260.01	505.98	822	800.71
Az	210.05	219.25	429.30	152	602.02
Rh	209.06	220.76	429.82	230	624.74
Tr	210.25	222.01	432.26	141	593.07
Vc	201.01	210.11	411.12	500	580.23
Ben	180.38	127.87	308.25	250	402.69
Cf	178.99	131.22	310.21	450	575.07
Cn	122.63	115.34	237.97	150	155.89
S.E.			30.13	74.79	55.65
C.D.			65.68	163.05	121.31

The mean values of leaf area ranged from 150 - 887 sq.cm. $plant^{-1}$. Application of RhVc reported highest leaf area followed by AzVc, TrVc, RhTr, Vc, AzTr, RhAz and Cf as compared to Az and untreated plots. These results are in agreement with the findings of Mohamed and Gomaa (2005). The means of fruit weight ranged from 155.89 - 888.84 gm. The pattern of fruit weight was fairly similar with respect to total chlorophyll. The results are in close conformity with the findings of Sevakumar *et al.,* (2009).

The results of the present study indicate that the combined applications of biofertilizers and with vermicompost are one of the best sources of nutrients for tomato crop as reflected by increased chlorophyll content, leaf area and yield relative to the inorganic fertilizers and absolute control, due to the more readily available forms of essential elements into the soil. The results show a high positive correlation in between chlorophylls, leaf area and fruit yield.

Conclusion

On the basis of the results obtained, it can be concluded that the application of *Rhizobium* along with vermicompost (RhVc) recorded high chlorophyll content, leaf area per plant and yield of tomato than that of all other amendments. The present results are in close conformity with the findings of Chamle *et al.,* (2006).

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