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Effect of biofertilizers on physiological parameters in *Trigonella foenum-graecum*

KEYWORDS: Biofertilizers , growth, protein, carbohydrate, *Trigonella foenum-graecum*

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ABSTRACT *A pot culture experiment was conducted in Botanical Garden , Modern College, Shivajinagar, Pune 411005, to study the effect of organic and inorganic fertilizers on growth, leaf area, protein and carbohydrate content in different organs ,root, stem and leaf in Trigonella foenum-graecum at pre and post flowering stage. The results indicated that height, leaf area and protein content was at maximum under vermicompost and rhizobium treatment as compared to inorganic treatments and control. However, average content of reducing sugars decreased at all treatments and also when compared to control in Trigonella foenum-graecum L*

INTRODUCTION

Vegetables are important edible plants , rank next to cereals and are a source of carbohydrate, mineral and vitamins. However, due to excessive population, the consumption rate is more than production rate and, therefore, it is necessary to increase the production of vegetables. Chemical fertilizers contain high amounts of salts in the soil which retard nutrient uptake ability of the plant making it difficult for the plant to take up water decreasing growth of the plant. It is necessary to practice sustainable agriculture which is very much dependent upon the availability of cheap and good quality organic manures. Biofertilizers is one of the important components of integrated nutrient management, cost effective, ecofriendly and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture. Several microorganisms and their association with crop plants are being exploited in the production of biofertilizers. Biofertilizers can provide to the small and marginal farmers an economically viable lever for realizing the ultimate goal of increasing productivity.

Amongst the sources of available organic manures, vermicompost is a potential source due to the presence of readily available plant nutrients, growth enhancing substances, and a number of beneficial microorganisms like nitrogen fixing, P solubilising and cellulose decomposing organisms. Vermicomposts are finely-divided mature peat-like materials with a high porosity, aeration, drainage and water-holding capacity and microbial activity which are stabilized by interactions between earthworms and microorganisms in a non-thermophilic process (Edwards and Burrows, 1988). Vermicompost contains most nutrients in plants in available form such as nitrates, phosphates and exchangeable calcium and soluble potassium (Edwards, 1998) and Orozco et al.(1996). Vermicompost have large particulate surface areas that provide many micro sites for microbial activity and for the strong retention of nutrients. (Shi-wei and Fu-Zhen, 1991). Vermicomposts are rich in microbial populations and diversity, particularly fungi, bacteria and actinomycetes (Edwards, 1998) and Tomati et al.(1987). Vermicomposts consistently promote biological activity which can cause plants to germinate, flower and grow and yield better than in commercial container media, independent of nutrient availability Arancon et al,(2004) and Atiyeh et al.(2000 a, b).

In developed and developing countries, over-application of organic and inorganic fertilizers has led to environmental contamination of water supplies and soils. (Canway and Pretty, 1991) and (Bunb and Baanante, 1996). Use of synthetic fertilizers is known to increase the productivity of most of the vegetable crops. However, they cause decrease in soil fertility decreasing the production. Thus, it is necessary to use ecofriendly compounds like biofertilizers which are a renewable source of plant nutrients and maintain soil fertility and sustainability and are, therefore, safe to use.

In our present study, it was decided to do a comparative study using organic and inorganic fertilizers treatment on *Trigonella foenum-graecum* plants. Physiological parameters like height, leaf area, protein, carbohydrate content of different organs of the plant like root, stem and leaves at pre and post flowering stage were selected for study.

MATERIAL AND METHOD

A pot experiment was conducted in Botanical Garden of Modern College, Pune-411005, MS, INDIA. Healthy, uniform seeds of *Trigonella foenum-graecum* were sown in twenty four medium sized pots without drainage holes. Two sets of three pots were treated with organic fertilizers. The organic fertilizer used was vermicompost and Rhizobium. Each pot was treated with 10g, 20g, 30g vermicompost respectively and one pot was kept untreated and watered regularly with equal quantity of water. The second set of three sets of 3 pots was treated with chemical fertilizers like urea, P_2O_5, KH_2PO_4 each. Each set was treated with 2g, 4g, 6g of urea, P_2O_5, KH_2PO_4 respectively and one pot was kept untreated and watered regularly with equal quantity of water. The treatment was given to the seedlings with organic and inorganic fertilizers at the interval of eight days from germination to flowering stage. The experiment was done in triplicates. Proteins were estimated by Lowry's method and carbohydrates were estimated by Somogy Nelson's method from root, stem and leaves at pre and post flowering stage.

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OBSERVATION TABLES

Table 1 Effect of organic and inorganic treatments on plant height, leaf area in Trigonella foenum-graecum HT at pre and post flowering stage

Treatment	Pre flowering 8 days		Pre flowering 16 days		Post flowering 24 days		Post flowering 32 days	
	Height cm	Leaf area/ cm^2	Height cm	Leaf area/ cm^2	Height cm Height cm	Leaf area/ cm^2	Height cm	Leaf area/ cm^2
Control	10.00	0.3	21.0	2.80	17.0	2.10	18.0	3.00
Vermicompost	14.00	0,9	23.0	5.00	27.0	5.20	30.0	5.40
Rhizobium	13.00	1.0	22.0	4.00	28.0	6.00	29.0	7.20
Urea	15.00	1.1	19.0	2.10	16.0	2.30	25.0	3.40
P_2O_5	10.10	0.7	16.5	2.80	18.0	2.00	22.0	3.20
KH_2PO_4	9.20	0.6	14.2	1.80	16.5	2.00	20.0	3.00

Table 2 Effect of organic and inorganic treatments on protein content in Trigonella foenum-graecum at pre and post flowering stage

Treatment	Pre flowering				Post flowering			
	Root gm	Stem gm	Lvs gm	(R+S+L) gm	Root gm		Lvs gm	
Control	8.00	0.80	12.0	3.20	22.0	7.90	27.2	11.0
Vermicompost	14.5	7.00	24.3	12.0	27.8	16.0	35.0	18.6
Rhizobium	10.0	6.20	20.0	10.0	24.0	12.0	34.0	18.2
Urea	9.1	5.76	12.5	9.20	25.2	15.4	30.0	14.2
P_2O_5	9.00	3.24	12.0	4.90	24.8	12.6	32.0	16.4
KH_2PO_4	8.00	0.88	13.0	3.64	23.1	8.20	29.0	10.2

Table 3

Effect of organic and inorganic treatments on reducing sugar content in Trigonella foenum-graecum at pre and post flowering stage

Treatment	Pre flowering				Post flowering			
	Root gm	Stem gm	Lvs gm		Root gm		Lvs gm	
Control	16.0	16.8	31.8	64.0	19.6		26.0	59.6
Vermicompost	10.8	14.2	25.6	50.8	2.80		14.4	34.0
Rhizobium	14.0	15.00	3.80	22.8	6.60		8.20	20.4
Urea	1.60	17.0	24.0	42.6	14.0		14.0	40.4
P_2O_5	4.60	15.0	12.6	32.2	4.60		3.60	22.2
KH_2PO_4	6.40	11.2	5.20	22.8	5.60		11.8	19.2

RESULT AND DISCUSSION

The results (Table 1) indicate that with the application of vermicompost and rhizobium , growth and leaf area was not affected at preflowering stage when compared to control. However, at post flowering stage increase in growth and leaf area was observed with vermicompost and rhizobium treatment when compared to control. Higher yields by the application of organic manures have been reported by(Bidanchandra ,1992) in green gram,(Zachariah, 1995) in chilli and Sudhirkumar *et al.* (1997) in chickpea. (Poinkar ,2006) reported maximum growth with respect to height and leaf area with vermicompost treatment. One of the reasons of such benefit is that the organic carbon in vermicompost releases the nutrients slowly and steadily into the soil and enables plants to absorb these nutrients, (Sharma A K, 2005). According to Arguello *et al.* (2006), vermicompost treatment modified quantity and pattern of sugar accumulation. Vermicompost increased dry weight by accumulating non structural carbohydrates whose distribution pattern change thus favoring metabolism of fructans precursors.

The average content of protein in root stem leaves (Table 3) increased under vermicompost and rhizobium treatment when compared to controland chemical treatment at preflowering and post flowering stage . Tripathi, et. al. (2006) reported that rhizobium application increased protein content in cowpea.

The average content of carbohydrate (Table 3) was found to decrease under all treatments and also when compared to control at preflowering and post flowering stage. The reason of decreased content of carbohydrate content under biofertilizer and chemical treatment needs to be investigated.

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