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Influence of liquid organic manures on growth, nutrient content and yield of tomato (*Lycopersicon esculentum* Mill.) in the sterilized soil*

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Abstract: An experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the influence of liquid organic manures *viz.*, panchagavya, jeevamruth and beejamruth on the growth, nutrient content and yield of tomato in the sterilized soil during *kharif* 2009. The various types of organic solutions prepared from plant and animal origin are effective in the promotion of growth and fruiting in tomato. The Panchagavya is an efficient plant growth stimulant that enhances the biological efficiency of crops. It is used to activate biological reactions in the soil and to protect the plants from disease incidence. Jeevamruth promotes immense biological activity in soil and enhance nutrient availability to crop. Beejamruth protect the crop from soil borne and seed borne pathogens and also improves seed germination. In the present study, significantly highest plant growth and root length was recorded with the application of RDF + Beejamruth + Jeevamruth + Panchagavya and it was found to be significantly superior over other treatments. The application of Beejamruth + Jeevamruth + Panchagavya was next best treatment and resulted in significantly highest yield as compared to RDF alone. The N, P and K concentration of plants was significantly highest in the treatment given RDF + Beejamruth + Jeevamruth + Panchagavya.

Keywords: panchagavya, jeevamruth, beejamruth, tomato

Introduction

Tomato is one of the important vegetable crops grown throughout the world and ranks next to potato in terms of the area but ranks first as a processing crop. In India, it occupies an area of 571.70 M ha with a production of 10054 million tones with a productivity of 17.58 Mt/ha. Karnataka is one of the important tomato growing states covering an area 47.2 M ha with a production of 1285.10 million tones with a productivity of 27.2 Mt/ha (Anon., 2008).

The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. The Panchagavya, Jeevamruth and Beejamruth are ecofriendly organic preparations made from cow products. The use of organic liquid products such as Beejamruth, Jeevamruth and Panchagavya results in higher growth, yield and quality of crops. These liquid organic solutions are prepared from cow dung, urine, milk, curd, ghee, legume flour and jaggary. They contain macro nutrients, essential micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms (Palekar, 2006; Natarajan, 2007; Sreenivasa *et al.*, 2010).

Material and methods

The liquid organic manures (panchagavya, jeevamrutha and beejamrutha) were analysed for the nutrient status and microflora present in them following standard methodologies and the results are presented in table A and B respectively. The present trial was aimed to study the influence of these nutrients and microflora on plant growth and yield of tomato. Hence to get the correct picture, sterilized soil was used in this study.

An experiment was conducted during *kharif* 2009 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The sterilized soil was mixed with FYM and recommended dose of fertilizers according to treatment schedule and filled into earthen pots (15 cm dia) of 10 kg capacity. The recommended dose of fertilizers (150:100:60 N: P_2O_5:K_2O kg and FYM 25 t per ha) were mixed with soil as per treatment schedule. The tomato (var. Megha) seedlings were raised in the pots containing sterilized soil. Thirty day old seedlings were uprooted and transplanted @ three seedlings per earthern pot containing sterilized soil. The experiment consisted of eight treatments including fermented liquid organic manures, recommended dose of chemical fertilizers (check) and FYM (standard practice) which were replicated fifteen times. The seeds were treated with Beejamruth by dipping for 10 min. Jeevamruth was applied (500 l per ha) as per the treatments at the time of transplanting. Panchagavya (3%) was sprayed at 25th, 70th and 100th day after sowing as per treatments (500 l per ha).

The different biometric observations were recorded at 75 DAS (days after sowing) and at harvest (160 DAS) from all the three plants in each pot. The mean of three plants were considered for analysis. The plant height was measured from ground level to the tip of main shoot. The root length was measured from bottom end of the shoot to the end of root. All three plants from each pot were harvested and kept in brown paper bags having holes to enable air drying and then oven dried at 70^{0}C to achieve constant weight. Afterwards, the plant dry weight was recorded and expressed as total dry matter per plant.

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The matured red fruits in each plant were collected from three pickings in all the three plants of each pot. Then the mean of replications represented the number of fruits per plant. The fruit weight per plant at harvest was recorded and the mean fruit weight per plant was expressed in grams per plant.

The plant samples were collected at 75 DAS and at harvest (160 DAS). They were used for chemical analysis. The dried samples were ground in a Willey mill and passed through 40 mesh sieve. The ground material was collected in butter paper bags and used for chemical analysis. The total nitrogen in the plant samples was determined by micro-kjeldahl method (Jackson, 1973). The phosphorus content in plant samples was determined by Vanadomolybdate phosphoric yellow colour method (Jackson, 1967). The potassium content in plant samples were determined by Flame photometer method (Jackson, 1973). Completely randomized design (CRD) was used to analyse the data recorded.

Results and discussion

In the present study, these growth parameters were significantly higher with the application of RDF + Beejamruth + Jeevamruth + Panchagavya at both stages of crop growth (Table 1), which might be ascribed to the increased availability of nutrients at initial stage through chemical fertilizers in addition to nutritional and other benefits from fermented liquid organics. In the preparation of Panchagavya, tender coconut water is being used and it contains kinetin which has a role in enhancing chlorophyll content in plant leaves, thus in turn, enhance photosynthetic activity, growth and yield. The fermented liquid organic manures also contain microbial load and plant growth promoting substances in addition to nutrients that help in improving plant growth, metabolic activities and resistance to pest and diseases. According to Muthuvel (2002) four sprays of Panchagavya @ 3% and Moringa leaf extract spray @ 25 ml/plant resulted in higher plant height, number of branches per plant. The application of Beejamruth resulted in significantly higher root length than Jeevamruth at both the stages of crop growth. And also its application resulted in higher plant growth at harvest stage which was on par with Beejamruth application (Table 1). Sreenivasa *et al.* (2010) reported that the beneficial microorganisms present in Beejamruth produced IAA and GA and, resulted in improvement in seed germination, seedling length and seed vigour in soybean. The dry matter production was significantly higher with the application of RDF + Beejamruth + Jeevamruth + Panchagavya at both the stages of crop growth. The organic liquid manures provide nutrients and plant growth promoting substances (Tables A & B) but they may not be sufficient to show the early growth and development of the crop. Hence, fertilizer application @ RDF might have provided the required NPK for plant growth at early stages. The application of RDF had better effect on the dry matter production as compared to individual treatments of organic liquid manures, but at crop harvest, it was on par with Panchagavya alone (Table 1).

Table A. Nutrient status of different organic liquid manures

Parameter	Panchagavya	Beejamruth	Jeevamruth
pH	6.82	8.20	7.07
Soluble salt (EC)	1.88 dsm^{-1}	5.50 dsm^{-1}	3.40 dsm^{-1}
Total Nitrogen	1000 ppm	40.00 ppm	770 ppm
Total Phosphorus	175.40 ppm	155.30 ppm	166 ppm
Total Potassium	194.10 ppm	252.00 ppm	126 ppm
Total Zinc	1.27 ppm	2.96 ppm	4.29 ppm
Total Copper	0.38 ppm	0.52 ppm	1.58 ppm
Total Iron	29. 71 ppm	15.35 ppm	282 ppm
Total Manganese	1.84 ppm	3.32 ppm	10.7 ppm

Table B. Microbial population in different organic products

	Panchagavya	Beejamruth	Jeevamruth
Bacteria (cfu/ml)	26.10×10^{5}	15.40×10^{5a}	19.70×10^{5}
Fungi (cfu/ml)	18.0×10^{3}	10.50×10^{3}	13.40×10^{3}
Actinomycetes (cfu/ml)	4.20×10^{3}	6.80×10^{3}	3.50×10^{3}
N_2 – fixers (cfu/ml)	2.70×10^{2}	3.10×10^{2}	4.60×10^{2}
Phosphate solubilizers (cfu/ml)	5.70×10^{2}	2.70×10^{2}	4.20×10^{2}

Table1. Effect of liquid organic manures on plant height, root length and dry matter of tomato crop

Treatments	Plant height (cm)		Root length (cm)		Dry matter (g/plant)	
	Flowering stage (75 DAS)	Crop harvesting (160 DAS)	Flowering stage (75 DAS)	Crop harvesting (160 DAS)	Flowering stage (75 DAS)	Crop harvesting (160 DAS)
RDF	74.90	124.76	11.07	14.69	3.02	5.43
Panchagavya only	66.21	119.50	9.23	11.21	2.06	5.53
Jeevamruth only	59.66	108.62	6.99	8.91	2.17	3.63
Beejamruth only	59.33	108.91	9.22	11.59	2.01	3.86
RDF+ Beejamruth+ Panchagavya	75.66	131.81	13.36	17.29	4.04	7.45
RDF+ Beejamruth+ Jeevamruth	75.60	130.13	13.43	17.15	3.96	7.34
RDF+ Beejamruth+ Jeevamruth+ Panchagavya	83.15	143.21	15.57	19.80	4.06	7.94
Beejamruth+ Jeevamruth+Panchagavya	72.03	119.39	11.38	13.20	3.00	5.41
S.Em±	2.06	3.98	0.58	0.87	0.24	0.47
C.D. (P=0.05)	5.87	11.29	1.65	2.24	0.65	1.35

Quantity of Panchagavya: 500 l/ha, Jeevamruth: 500 l/ha and Beejamruth: 200 l/ha

The fruit yield of tomato (Table 2) differed significantly with the application of liquid organic manures. The application of RDF + Beejamruth + Jeevamruth + Panchagavya resulted in significantly higher fruit yield of plants as compared to application of Beejamruth + Jeevamruth + Panchagavya due to adequate supply of required nutrients through chemical fertilizers at early stage of plant growth and also due to overall improvement in soil physico-chemical and biological properties due to combined application of organic liquid manures. The better nutrient availability and nutrient uptake increased the growth and yield of crop. The treatments *viz.*, Beejamruth + Jeevamruth + Panchagavya or RDF + Beejamruth + Jeevamruth or RDF + Beejamruth + Panchagavya were on par with each other with respect to fruit yield. The application of Beejamruth + Jeevamruth + Panchagavya might have resulted in the better availability of nutrients throughout the crop growth. This is mediated through biological processes as noticed by higher microbial activity and soil enzyme activity. The application of Panchagavya alone had better effect as compared to RDF (Table 2), which could be attributed to higher amount of nutrients, microbial activity and plant growth promoters present in it. According to Birendra and Christopher (2007), foliar spray of Panchagavya @ 3% resulted in a significant increase in the yield attributes. Kalarani (1991) reported that the action of the growth regulators in the plant system stimulated the necessary growth and development in plants and better yield. The preparation of Panchagavya includes coconut water, which contains kinetin which increases the biomass and yield (Mamaril and Lopez, 1997).

Table 2. Effect of liquid organic manures on the yield parameters of tomato

Treatments	No. of fruits/plant	Fruit weight (g/plant)
T1:RDF	11.12	167.23
T2: Panchagavya only	16.12	216.60
T3: Jeevamruth only	7.87	149.43
T4: Beejamruth only	8.62	147.51
T5: RDF+ Beejamruth+Panchagavya	20.25	276.87
T6: RDF+ Beejamruth+ Jeevamruth	20.00	274.32
T7: RDF+ Beejamruth+ Jeevamruth+ Panchagavya	23.25	316.64
T8: Beejamruth+ Jeevamruth+ Panchagavya	19.65	271.53
S.Em±	0.55	6.00
C.D. (P=0.05)	1.57	17.00

The nutrient concentrations *viz.*, N, P and K in plants were significantly higher with the application of RDF + Beejamruth + Jeevamruth + Panchagavya as compared to Beejamruth + Jeevamruth + Panchagavya at both stages of crop growth. The supply of N, P and K in more readily available form from chemical fertilizers to the crop during active growth period of crop, resulted in increased the nutrient content (Shwetha, 2008). The lowest concentrations of N, P and K were observed in the plants applied with Jeevamruth or Beejamruth alone as compared to Beejamruth + Jeevamruth + Panchagavya or Panchagavya alone (Table 3). This is because of individual application of liquid organic manures may not provide required quantity of nutrients for plants but they support the crop growth initially due to presence of animal dung, urine and activity of microflora and fauna. They need further inorganic fertilizers or organic sources for their build up. However, the concentration of nutrients in the treatments given RDF + Beejamruth + Panchagavya or RDF + Beejamruth + Jeevamruth did not differ and were on par at both the stages of crop growth (Table 3).

The study clearly revealed that there was significant improvement in the growth and yield with the combined application of liquid organic manures as compared to RDF alone. The plant nutrient concentrations (N, P and K) were the highest with the application of liquid organic manures + RDF followed by Beejamruth + Jeevamruth + Panchagavya.

Table 3. Effect of liquid organic manures on the plant N, P and K concentration (%)

Treatments	N concentration (%)		P concentration (%)		K concentration (%)	
	Flowering stage (75 DAS)	Crop harvesting (160 DAS)	Flowering stage (75 DAS)	Crop harvesting (160 DAS)	Flowering stage (75 DAS)	Crop harvesting (160 DAS)
T1: RDF	2.16	2.54	0.19	0.23	0.62	0.76
T2: Panchagavya only	1.99	2.50	0.24	0.25	0.61	0.74
T3: Jeevamruth only	1.76	1.57	0.16	0.19	0.54	0.59
T4: Beejamruth only	1.72	1.51	0.14	0.19	0.57	0.54
T5: RDF+ Beejamruth+ Panchagavya	2.17	3.18	0.29	0.36	0.60	0.82
T6: RDF+ Beejamruth+ Jeevamruth	1.97	3.08	0.19	0.27	0.60	0.81
T7: RDF+ Beejamruth+ Jeevamruth+ Panchagavya	3.06	4.38	0.29	0.43	0.90	1.03
T8: Beejamruth+ Jeevamruth+ Panchagavya	2.14	3.36	0.20	0.35	0.78	0.87
S.Em±	0.13	0.26	0.03	0.01	0.05	0.06
C.D. (P=0.05)	0.39	0.78	0.1	0.14	0.15	0.26

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