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Research Article

EFFECT OF FYM AND VERMICOMPOST ON YIELD AND ECONOMICS OF *RABI* TOMATO (*Lycopersicon esculentum*)

BAIRAGYA M.D., SARATH KUMAR D.*, MAITRA S., ROJA M. AND SHANKAR T.
Department of Agronomy, M S Swaminathan School of Agriculture, Centurion University of Technology, Parlakhemundi, Gajapathi, 761211, Odisha, India
*Corresponding Author: Email - sarathkumarduvvada010@gmail.com

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Abstract: A field experiment was carried out during *rabi* season of 2018-19 at the organic research farm of M S Swaminathan School of Agriculture, Centurion University of Technology, Parlakhemundi, Gajapathi, Odisha, to study the appropriate dosage of FYM and vermicompost in terms of yield and economics of tomato crop. The experiment was laid out in a randomized block design (RBD) with five treatments (T_1: FYM @ 20 t/ha + vermicompost @ 10 t/ha at 30DAT, T_2: FYM @ 20 t/ha + vermicompost @ 5 t/ha at 30DAT, T_3: FYM @ 15 t/ha + vermicompost @ 5 t/ha at 30DAT, T_4: FYM @ 10 t/ha + vermicompost @ 5 t/ha at 30DAT and T_5: Control) replicated four times. Results indicate that the growth parameters, yield attributes and yield (109.34 t/ha) found highest in combined application of FYM @ 20 t/ha + vermicompost @ 10 t/ha at 30DAT treatment. Gross return (256200 Rs/ha), net return (399840 Rs/ha) and B:C ratio (2.6) were calculated highest also in combined application of FYM @ 20 t/ha + vermicompost @ 10 t/ha at 30DAT treatment plot.

Keywords: *FYM, Vermicompost, Tomato, Yield and Economics*

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Introduction

In present day, heavy doses of synthetic products are used by farmers for getting higher yield but these synthetic products decrease the soil fertility, causes effects on both environment and human health. By considering the above affects many show the interest towards the organic cultivation by using manures and vermincompost [1]. Vermicompost and Farm Yard Manure (FYM) are an excellent soil amendment and source of nutrients for main fields and nursery beds of vegetables. Role of vermicompost in nourishing agricultural crops has attracted the attention of researcher's throughout the globe in past few decades [2]. Tomato (*Lycopersicon esculentum*) is one of the important and widely cultivated and consumed among solanaceous fruit vegetables of the world. In India, it occupies 882 thousand hectare area with a production of 18735.9 thousand MT [3]. Higher yield and profit in short duration motivates farmers to grow tomato. From tomato various forms of salad, soup, ketchup, sauce, chutney, pickles, powder, paste, juice, puree and whole canned fruits which are economically high [4]. The 100% vermicompost treatment fruit weight, fruit number, shoot and root weight were three, four, five and nine times more than the control treatment respectively [5] and increase in growth, yield, EC of fruit juice and percentage of fruit dry matter and the content of K, P, Fe and Zn in the tissue of tomato plant, when addition of vermicompost @ 15 tonnesha-1 [6]. By application of compost and vermicompost there was a significant improvement in plant growth and morphology (higher number of leaves and leaf area, and increased root volume and branching) of tomato plant [7]. The maximum fruit yield, vitamin C, TSS and produced the highest net return with cost-benefit ratio of 1:3.1 and also build-up of organic carbon in the soil after harvest of tomato were recorded with NPK @ 60:30:30 kg/ha+ FYM @ 10 tonnes/ha + Vermicompost @ 5 tonnes/ha + biofertilizers [8]. Organic manure has been widely used as it is available at low-cost [9] and it improves crop plants characteristics compared with synthetic fertilizer [10]. Application of FYM and vermin compost can improve soil organic carbon, nitrates, phosphates and exchangeable bases for plants [11].

An economic analysis was carried out using partial budget analysis, to indicate economically superior treatments over the control treatments by estimating the varying costs and benefits based on the local market prices for 2017 [12]. Keeping this view in mind, a field experiment has been conducted in organic research plot to find out the appropriate dosage of FYM and vermicompost in terms of yield and economics.

Materials and methods

The experiment was carried out in *rabi* seasons (2018 - 2019) at the organic research farm of M S Swaminathan School of Agriculture, Centurion University of Technology, Parlakhemundi, Gajapathi, Odisha. The site is located at latitude of $18^{0}47'$ N and longitude of $84^{0}4'$ E in North Eastern Ghats Agro Climatic Zone of Odisha. During cropping season, the total rainfall 35.8mm with a temperature range of 11.7ºC-33.1ºC minimum and maximum respectively [Table-1]. The soil texture of the experimental site was red sandy loam. To determine some chemical properties of the soil, sample was collected and analysed in the laboratory for N, P, K, pH, organic carbon. Available N was 251(kg/ha), available P was 118 (kg/ha), available K was 385 (kg/ha), 6.44 pH and low organic content 0.44 (%). An experiment was laid out in a randomized block design (RBD) with four replications. The experiments comprised of five treatments were as follows: T_1: Combined application of FYM @ 20 t/ha + vermicompost @ 10 t/ha at 30DAT, T_2: Combined application of FYM @ 20 t/ha + vermicompost @ 5 t/ha at 30DAT, T_3: Combined application of FYM @ 15 t/ha + vermicompost @ 5 t/ha at 30DAT, T_4: Combined application of FYM @ 10 t/ha + vermicompost @ 5 t/ha at 30DAT, T_5: Control. All FYM applied as basal dose. One month aged seedlings of F1 hybrid (shreshtha) were transplanted with spacing of 60cm × 30cm. Plots were weeded manually at three weeks interval. Plant height, fruit number, fruit diameter, fruit yield and dry matter yield were taken to complete the experiment. Yield data obtained from six picking (harvest) starting from 60 DAT to 80 DAT with an interval of four days.

Table-1 *Meteorological data during cropping season*

Month	Temperature (ºC)		RH (%)		Rainfall	BSS
	MAX	MIN	MAX (Morning)	MIN (Afternoon)	(mm)	(hours)
December, 18	26.6	11.7	83.9	58.1	6.0	4.08
January, 19	29.3	15.5	92.8	53.8	31.9	5.2
February, 19	31.5	18.7	92.5	53.5	34.4	5.3
March, 19	33.1	23.3	81.1	54.0	35.8	7.9

Table-2 *Effect of treatments on growth parameters*

Treatments	Plant height (cm)		LAI	
	30DAT	60 DAT	30 DAT	60 DAT
T_1	34.88	79.50	1.31	2.16
T_2	32.50	68.50	1.25	2.08
T_3	31.28	65.75	1.23	2.01
T_4	29.18	59.75	1.17	1.88
T_5	23.05	52.75	1.00	1.73
SEM±	0.40	1.92	0.02	0.02
CD (0.05)	1.23	5.91	0.05	0.07
CV%	3.17	7.05	3.25	5.97

Table-3 *Effect of treatments on yield and yield attributes of tomato crop*

Treatments	No of fruits	Fruit diameter (cm)	Average Fruit weight (g)	Yield (t/ha)	
				Fruit	Stover
T_1	35.50	5.55	56.00	109.34	181.50
T_2	33.25	4.48	53.50	98.07	159.85
T_3	31.75	3.90	50.50	88.03	141.72
T_4	30.25	3.18	48.25	80.12	126.59
T_5	25.75	3.18	43.25	61.19	95.45
SEM±	0.80	0.13	1.62	3.15	5.07
CD (0.05)	2.46	0.40	5.00	9.69	15.62
CV%	6.12	7.77	7.75	8.65	8.63

Table-4 *Economics of tomato cultivation under different treatments*

Treatments	Cost of cultivation (Rs /ha)	Gross return(Rs /ha)	Net return(Rs /ha)	B:C
T1	656040	256200	399840	2.6
T2	588390	243400	344990	2.4
T3	528165	228700	299465	2.3
T4	480728	206300	274428	2.3
T5	367125	180200	186925	2.0

Results and discussion

Significantly highest plant height observes in T_1 (34.88cm and 79.5cm) at 30 DAT and 60 DAT respectively. Both occasion (30 DAT, 60 DAT) lowest plant height measured in T_5 (23.05cm and 52.75cm) respectively. Statistically highest LAI found in T_1 (1.31 at 30 DAT and 2.16 at 60 DAT). There was no significant difference of plant height and LAI in both dates in between T_2 and T_3 [Table-2]. Application of vermicompost and FYM at 10 t/ha significantly increase the plant height. Vermicompost application had a significant effect on crop plant height [13]. Highest number of fruits was found in T_1 (35.50 cm) followed by T_2 (33.25 cm). Statistically lowest numbers of fruits were counted in T_5 (25.75). Significantly largest fruit size was measured in T_1 (5.55). Lowest fruit size was found in both T_4 (3.18 cm) and T_5 (3.18 cm). Highest fruit weight is found in T_1 (56.0 g), followed by T_2 (53.5 g). Lowest fruit weight is found in T_5 (43.25 g). From the present study it is found that the number and weight of fruits per plant of tomato increased under grown in vermicompost applied soil. These results were similar with the findings of [14]. By applying FYM (20 t/ha) and vermicompost (10 t/ha) it was calculated that the 179 % yield increment over control plot. Significantly highest fruit and Stover yield were found in T_1 (109.34 t/ha, 181.50 t/ha) respectively. Significantly lowest fruit and Stover yield were found in T_5 (61.19 t/ha, 95.45 t/ha) respectively [Table-3]. There was positive correlation between organic manures (FYM and Vermicompost) application on growth, yield and yield attributes of tomato [15]. Highest gross return (256200 Rs /ha), net return (399840 Rs /ha), B:C ratio (2.6) was calculated in T_1. For both T_3 and T_4 the B:C ratio (2.0) were found same [Table-4].

Conclusion

Application of FYM @ 20 t/ha with vermicompost @ 10 t/ha produced highest tomato fruit yield compared to other treatments. The same treatment also produced highest net return and B:C ratio.

Application of research: To bring sustainability in agriculture.

Research Category: FYM and Vermicompost

Abbreviations:

FYM: Farm Yard Manure
T: Treatment
t /ha: Tonne per hectare
B:C ratio: Benefit Cost ratio
MT: Metric Tonne
EC: Electrical Conductivity
TSS: Total soluble solids
^{0}C: Centigrade
%: Percentage
DAT: Date After Transplanting
LAI: Leaf Area Index

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***Research Guide or Chairperson of research: Dr M. D. Bairagya**
University: Centurion University of Technology, Gajapathi, Odisha, 761211, India

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Study area / Sample Collection: Organic research farm of M S Swaminathan School of Agriculture, Gajapathi, Odisha, 761211

Cultivar / Variety name: Tomato (*Lycopersicon esculentum*) - Shreshtha

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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