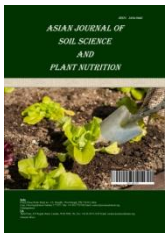

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Combined Effect of Vermicompost and Inorganic Fertilizer on Yield and Yield Contributing Characters of Tomato Plant

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

To evaluate the combined effect of organic and inorganic fertilizer a field experiment was conducted on tomato for yield and yield contributing character of fruits using vermicompost and different types of inorganic fertilizers at the farms of Ishurdi Sub-station of Bangladesh Institute of Nuclear agriculture (BINA) during Rabi season, 2020. One variety (Binatomato-11) and ten different treatments T_1 = control (no fertilizer), T_2 = 100% CF (Chemical Fertilizer), T_3 = 70% CF, T_4 = 70% CF + 1 t ha^{-1} VC (Vermicompost), T_5 = 70% CF + 2 t ha^{-1} VC, T_6 = 70% CF + 3 t ha^{-1} VC, T_7 = 85% CF, T_8 = 85% CF+ 1 t ha^{-1} VC, T_9 = 85% CF+ 2 t ha^{-1} VC and T_{10} = 85% CF + 3 t ha-1 VC were used as experimental materials. The field trial was laid out in a randomized complete block design with three replications. Results showed that plant height (120.67 cm), number of fruits/plant

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(53.33), single fruit weight (95 gm), fruit yield (63.33 t/ha), number of fruit picking (5 times) were higher in T_5 (70% Chemical fertilizers + 2t ha^{-1} VC) than control and other treatments. No significant difference was observed in days to 1st flowering response to the treatments. The study revealed that combined effect of vermicompost and inorganic fertilizers affected tomato plant significantly.

Keywords: Vermicompost; inorganic fertilizer; combined effect; tomato; yield.

1. INTRODUCTION

Tomato (*Solanum lycopersicum* L.) belongs to the *Solanaceae* family, and it is amongst the main important and popular vegetables. It is a good source of vitamins and minerals as it supplies Vitamin A, B, C, and D, minerals, Ca, P, and Fe [1]. One medium ripe tomato (~145 grams) can provide up to 40% of the Recommended Daily Allowance of vitamin C and 20% of vitamin A [2]. Tomato (*Solanum lycopersicum* L.) is one of the most economically valuable fruit or vegetable crops worldwide, valued at 93.9 billion US dollars in 2018, with yield estimated at 180.8 million tons in 2019 [3].

Vermicompost is the product of the decomposition process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and vermicast [4]. Vermicompost contains water-soluble nutrients and is an excellent nutrient-rich organic fertilizer and soil conditioner. It is used in farming and small scale sustainable, organic farming. Organic fertilizers are environmentally friendly, since they are from organic sources. Vermicomposting is one of the biological process in which the organic wastes has been converted into nutrient rich manure by the action of earthworms. The characteristic feature of vermicompost such as high porosity and moisture holding capacity increases the growth of pathogen free plants [5].

However, considering the recent concept of eco-friendly and increase in cost of organic and inorganic fertilizers, the use of cost effective, eco-friendly and with suitable integration of organic manures and inorganic fertilizers restores the soil health while keeping the soil productive and sustainable. Keeping in view all the above factors, an experiment has been conducted to access the effect of organic manures and inorganic fertilizers on plant growth and yield of tomato along with various treatment combinations.

2. MATERIALS AND METHODS

The Field experiment was conducted at the farms of BINA Sub-Station, Ishurdi during Rabi, 2020 to observe the effect of organic and inorganic fertilizer in tomato cultivation. The experiment site lies between 25-27°N latitude, 8.5°E Longitude and 98 meters altitude. The climate is characterized by the alternate hot rainy season. One variety (Binatomato-11) and ten different treatments were used as experimental materials.

Table 1. Organic & Inorganic Fertilizer treatments and doses

Treatments (T)	Doses/ha
T_1	Native soil fertility (No fertilizer and Vermicompost)
T_2	100% Chemical fertilizers (CF)
T_3	70% Chemical fertilizers (CF)
T_4	70% Chemical fertilizers (CF) + 1t ha^{-1} Vermicompost (VC)
T_5	70% Chemical fertilizers (CF) + 2t ha^{-1} Vermicompost (VC)
T_6	70% Chemical fertilizers (CF) + 3 t ha^{-1} Vermicompost (VC)
T_7	85% Chemical fertilizers (CF)
T_8	85% Chemical fertilizers (CF) + 1t ha^{-1} Vermicompost (VC)
T_9	85% Chemical fertilizers (CF) + 2t ha^{-1} Vermicompost (VC)
T_{10}	85% Chemical fertilizers (CF) + 3 t ha^{-1} Vermicompost (VC)

Table 2. Nutrient content in Vermicompost

Items	Percent
Organic C	15.2 %
N	1.42 %
P	1.45 5
K	1.52%
S	0.35 %

The experiment was laid out in a randomized complete block design with three replications. Unit plot size was 4.5m^2 (3m × 1.5m), plot to plot distance was 1m and plant to plant distance was 50cm. Recommended production packages like application of different doses of inorganic fertilizers and vermicompost as per treatment, weeding, thinning, irrigation, application of pesticide etc. were followed to ensure normal tomato plant growth and development. Plant height, number of fruits/plant, single fruit weight, yield, days to 1st flowering, number of fruit picking were taken from 5 randomly selected plants from each plot. Data were then analyzed by analysis of variance (ANOVA) using Statistix 10 package and the means were compared according to Least Significant Different Test at 1% significance.

Fig. 1. Tomato Experiment Site

3. RESULTS AND DISCUSSION

Combined effect of vermicompost and inorganic fertilizers affect yield and yield contributing characters of tomato plants. The analysis of variance results showed that the effect of mixed fertilizers on tomato yield was significant.

3.1 Plant Height

The results showed significant variations for plant height, Amoung the ten treatments, T_5 produced the tallest plant (120.67 cm), which is statistically similar to T_2, T_3, T_4, T_6, T_7 and T_8 treatments (Fig. 2.)

According to Islam, M.A. et al. (2017) mixed fertilizer (organic+ inorganic) created the highest amount of flower clusters, fruit clusters, fruits yield and plant height than to no fertilizer application [6].

3.2 Number of Fruits/Plant

Here the number of fruits/plant was higher in T_5 treatment (53.33) than other treatments. Lower number of fruits/plant was obtained in T_{10} treatment (31) (Table-3). Number of fruits/plant was significantly affected by combined use of vermicompost and inorganic fertilizer. *Saha et al.* found that, the greatest quantity of fruits/plant was obtained by treatment of Co-compost. On the other hand, the least number of fruits/ plant was found in treatment of only Chemical fertilizer which was significantly low [7]

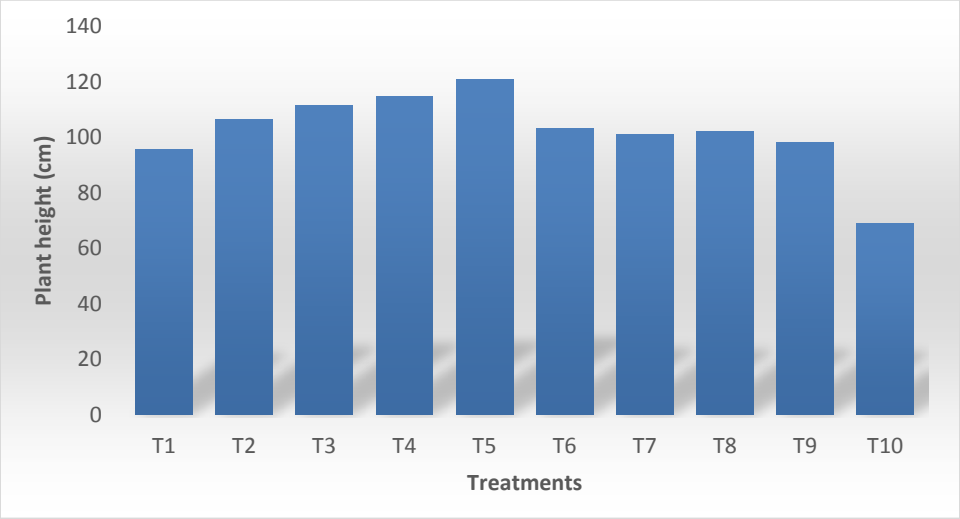

Fig. 2. Effect of organic and inorganic fertilizers level on plant height (cm)

Table 3. Effect of integrated use of vermicompot and inorganic fertilizer on Tomato Plant

Treatment	Plant Height (cm)	No. of fruits/Plant	Single fruit weight (gm)	Yield (t/ha)	Days to 1st flowering	No. of fruit picking
T_1	95.67 ab	32.33 cd	47.67 d	11.67 f	29.00	2.67 c
T_2	106.33 a	36.33 bcd	68.33 bc	36.67 d	28.67	4.33 ab
T_3	111.33 a	40.67 bc	72.67 bc	45.00 bc	28.00	4.67 ab
T_4	114.67 a	42.33 b	83.00 ab	42.33 c	28.67	4.67 ab
T_5	120.67a	53.33 a	95.00 a	60.33 a	27.33	5.00 a
T_6	103.33 a	40.67 bc	74.00 bc	46.33 b	27.33	4.33 ab
T_7	101.00 a	34.00 bcd	79.33 abc	34.67 de	29.33	4.00 ab
T_8	102.00 a	38.67 bcd	63.67 c	32.33 e	27.67	4.00 ab
T_9	98.00 ab	37.67 bcd	65.00 c	31.33 e	27.67	3.67 bc
T_{10}	69.00 b	31.00 d	65.67 c	31.00 e	27.67	3.67 bc
CV (%)	17.65	13.99	12.93	5.95	5.64	15.50
Level of significance	*	*	*	*	NS	*

In a column, the values having same letter do not differ significantly at 5% level by DMRT
NS= Non significant, CV= Co-efficient of variation

3.3 Single Fruit Weight (gm)

Different doses of organic and inorganic fertilizer significantly affect single fruit weight of tomato plant. In table 3, the result show that T_5 treatment produced more weighted fruit (95 gm) than other treatments. Less weighted fruit was found in T_1 treatment (47.67gm). Similarly Charles *et al.* reported that the mixed use of organic with inorganic fertilizers significantly increased total number of collected tomato and weight of harvested tomato [8].

3.4 Days to 1st Flowering

Results stated that vermicompost and inorganic fertilizer did not significantly affect the days of 1st flowering in tomato plants. Agboola and Odeyemi, 2009 was found that, there was no significant difference in the number of days to 50 % flowering in both the treated plot and the untreated plots, even though flower initiation was fastest under plot treated with inorganic fertilizer at 80 days while it was mostly delayed in organic treated plot till 90 days which may be due to slow release of nutrient [9].

3.5 Number of Fruit Picking

Number of fruit picking in tomato plants significantly affected by combined effect of organic and inorganic fertilizer. In Table-3, it was stated that highest number of fruit picking was obtained at T_5 treatment (5) and lowest number of fruit picking was obtained at T_1 treatment (2.67).

3.6 Yield

Tomato yield was significantly affected by combined effect of vermicompost and inorganic fertilizer. The results stated that highest yield was found at T_5 treatment (60.33 t/ha) and lowest yield was found at control (11.67 t/ha) treatment. (Fig. 3)

The increased growth and flower attributes which in turn lead to the increased photosynthesis and dry matter production affect the yield per plant, per plot and per hectare. Minimum number of fruits and yield in control treatment might be due to non-availability of nutrients during its development [10]. Similar findings were reported by Naidu *et al.* in tomato, Rafi *et al.* in tomato, Poul *et al.* in tomato, Rodge and Yadlod in tomato and Suge *et al*. in brinjal [11,12,13,14,15]. Fertilizer treatment (mixed) produced a higher yield compared to organic fertilizers and inorganic fertilizers alone in cabbage [16]. Rahmatullah Hashimi and Hukum Khan Habibi stated that tomato yield was increased by the combined application of inorganic and organic fertilizers [17]. Khan, A. et al. (2017) conducted an experiment on the “Effect of compost and inorganic fertilizers on yield and quality of tomato” the result showed the yield and quality parameters of tomato fruit increased significantly by mixed use of compost with inorganic fertilizers [18].

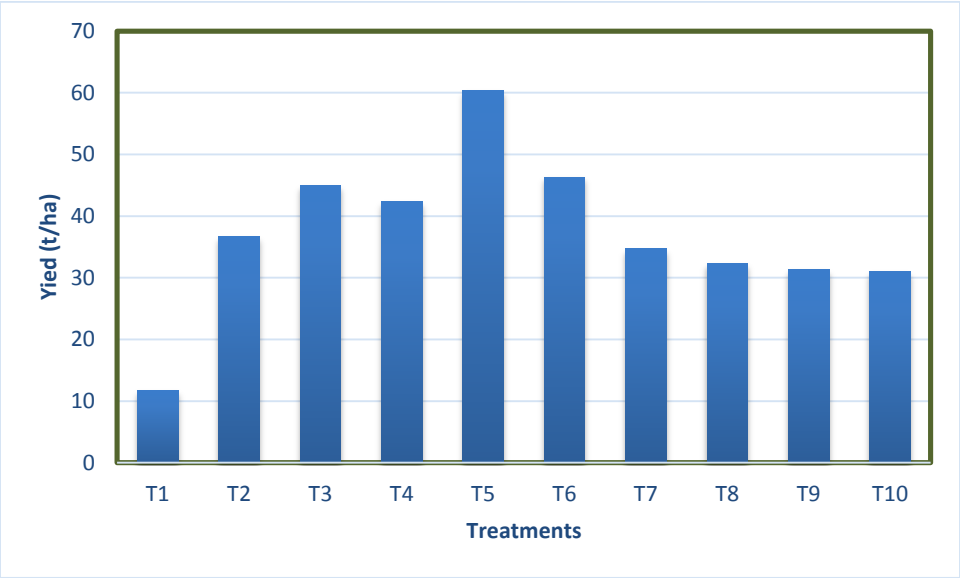

Fig. 3. Effect of organic and inorganic fertilizers level on tomato yield

4. CONCLUSION

Findings suggest that, combined use of organic (vermicompost) and inorganic (chemical fertilizers) fertilizers plays a vital role in achieving higher fruit yield of tomato. Yield contributing characters are also affected by mixed application of vermicompost and inorganic fertilizer in tomato plants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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