Effect of Panchagavya, vermiwash and vermicompost on the growth and yield of brinjal and chilli

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ABSTRACT

Investigations were conducted at Agriculture College and Research Institute, Vazhavachanur located at Thiruvannamalai, Tamil Nadu during 2022-2023 to study the effect of Panchagavya, vermiwash and vermicompost on brinjal (*Solanum melongena*) and chilli (*Capsicum annum*). Experiment was conducted in pots and comprised six treatments in a completely randomized block design. The treatments used were soil + vermicompost + Panchagavya, soil + vermicompost + vermiwash, soil + vermicompost + vermiwash + Panchagavya, soil + Panchagavya, soil + vermiwash and soil alone (control). In case of brinjal, maximum plant height was recorded in the treatment soil + vermicompost + vermiwash + Panchagavya (54.6 cm). In case of chilli also, maximum plant height (56.66 cm) was recorded in the same treatment. This treatment resulted in maximum number of branches per plant in brinjal (7.3) and chilli (13.66). Again, this treatment recorded maximum number of leaves per plant in brinjal (20.0) and chilli (25.33). The same treatment was also proved most beneficial in case of yield parameters. Number of buds and flowers (11 and 21) and number of fruits (11 and 20) was also highest in brinjal and chilli respectively in the same treatment.

Keywords: Panchagavya; vermicompost; vermiwash; foliar spray; brinjal; chilli

INTRODUCTION

Chilli is a day-neutral crop making it fit for cultivation throughout the year in tropical and sub-tropical climates but it cannot withstand long frost. A temperature range of 15-35°C is optimum for a satisfactory crop growth rate and yield (Pandit et al 2020). The area and production of chilli in India were 702 thousand hectares and 2,049 thousand MT in 2020-2021 (Anon 2023). Brinjal (*Solanum melongena* L) is a warm-weather crop mostly cultivated in tropical and sub-tropical regions of the world (Taher et al 2017). It needs a 10-12 h photoperiod and 23-26°C temperature for normal growth (Sekara et al 2007). The area and production of brinjal in India were 749 thousand hectares and 12,874 thousand MT in 2020-2021 (Anon 2023).

The major disadvantage in vegetable cultivation is addition of more fertilizers and pesticides which reduce the quality of the produce. Bio-inputs have the ability to increase the quality of produce. Among bio-inputs, vermicompost is a finely divided, peat like material with high porosity, good aeration, drainage, water holding capacity, microbial activity, excellent nutrient status and buffering capacity, thereby, resulting in the required physio-chemical characters congenial for soil fertility and plant growth (Pathma and Sakthivel 2012). Sir Charles Darwin called earthworms as the 'unheralded soldiers of mankind and farmer's friends working day and night under the soil' (Sinha et al 2009).

The behavioural activity of earthworms that is feeding, burrowing and casting, modify the physical, chemical and biological properties of organic matter and soil for plant growth and nutrient acquisition. Due to large surface area, vermicompost offers several micro-sites for nutrient retention and exchange and microbial activity (Zhao and Huang 1991).

Vermicomposting, is a bio-oxidative process in which earthworms interact intensively with microorganisms in the decomposer community, accelerating the organic matter by stabilization with modified physical and biochemical properties. The earthworms actively participate in the degradation of organic matter by physical and biochemical action (Rakkini et al 2017).

Vermitechnology is the use of surface and sub-surface local varieties of earthworm in composting and management of soil (Ismail 2005). Vermiwash is a liquid that is collected after the passage of water through a column of worm action and is very useful as a foliar spray. It is a collection of excretory products and mucus secretion of earthworms along with micronutrients from the soil organic molecules. These are transported to the leaves, shoots and other parts of the plants in the natural ecosystem.

Vermiwash, if collected properly, is a clear and transparent, pale yellow coloured fluid (Ismail 1997). Verrmiwash is a substitute for chemical fertilizers and its effect on growth parameters, flowering and fruiting ratio was significantly improved in crop plants (Sundararasu and Jeyasankar 2014). Vermiwash contains vitamins, enzymes, hormones with macro and micronutrients, which helps in efficient crop growth.

Application of vermicompost resulted in appreciable increase in plant height, number of tillers per clump, number of leaves per plant and girth of turmeric plants (Tania et al 2021). Aritonang and Sidauruk (2020) reported that vermicompost significantly affected the number of branches, number of pods and seed weight in soybean. The biofertilizer and vermicompost showed positive effect in improving quality and quantity of okra and the best results were obtained in the plot with combination of chemical fertilizers, biofertilizer and vermicompost. Similarly, the biochemical characteristics of fruits of okra showed improvement by the addition of fertilizers and vermicompost (Gupta et al 2011).

Dey et al (2019) showed that application of vermicompost in the soil in soybean increased the nutrients in soil and plants showed more growth and produced higher yields. The study of Ansari and Sukhraj (2010) revealed that combination of vermicompost and vermiwash compared with control and chemical fertilizers had greater influence on plant growth parameters of okra. In a study conducted by Das et al (2014), it was found that the application of 50 per cent chemical fertilizer + 50 per cent vermicompost had a significant effect on growth and yield of okra.

Panchagavya is a treasure of health benefits and medicinal properties. The Ayurvedic system of medicine has described the significance of using cow milk, ghee, urine, dung and curd for the treatment of various diseases. Each product possesses different components and uses for human health, agriculture and other purposes. 'Panchagavya' has been derived from two words, 'Panch' meaning five and 'Gavya' meaning obtained from 'Gau*'* means cow (Dhama et al 2005).

Panchagavya sprayed plants produce larger leaves and denser canopy. More lateral shoots are produced on stem which are sturdy to bear heavier yields. Its use results in profuse rooting which penetrates deeper layers for better uptake of nutrients and water. Plants are also able to withstand prolonged drought conditions and need a smaller number of irrigations (Sivakumar 2014).

Velmurugan et al (2005) observed that seed treatment + foliar application of Panchagavya 3 per cent produced the tallest plants (26.75 cm) and higher number of leaves (14.0) as compared to other treatments in radish. Vennila and Jayanthi (2008) reported that spraying of 2 per cent Panchagavya + 100 per cent recommended dose of fertilizer resulted in enhanced plant height (131.7 cm) and production of dry matter (5.9 g/plant) in okra.

Nileema and Sreenivasa (2011) observed that the soil treatment of RDF + Beejamrit (seed treatment) + Jeevamrit (soil application) + Panchagavya 3 per cent foliar spray showed improvement in plant height (143.21 cm), root length (19.80 cm) and dry matter (7.94 g/plant) compared to other treatments and control in tomato.

Mudigora et al (2009) reported that application of Panchagavya + neem seed kernal extract 5 per cent recorded highest yield of 14.16 q per ha in vegetable crops.

MATERIAL and METHODS

The study was conducted in the horticultural block farm of Agricultural College and Research Institute, Vazhavachanur, Tamil Nadu. The experimental materials vermicompost, Panchagavya and vermiwash were obtained from vermicompost unit

farm of Agricultural College and Research Institute, Vazhavachanur, Tamil Nadu. Brinjal and chilli seedlings were brought from the nursery garden at Thiruvannamalai, Tamil Nadu.

The experiment was conducted in a completely randomized block design. In the experiment, soil and vermicompost were mixed in the ratio of 3:1. Foliar application of Panchagavya 3 per cent (30 ml/l) (3 critical stages) and vermiwash 10 per cent (100 ml/l) (3 critical stages) were used for betterment of growth and flowering.

The Panchagavya and vermiwash were applied as foliar spray at critical stages like seedling stage (S-I), vegetable stage (S-II) and flowering stage (S-III). All the pots were transplanted with brinjal and chilli seedlings. The six treatments were soil + vermicompost + Panchagavya (T_1), soil + vermicompost + vermiwash (T_2), soil + vermicompost + vermiwash + Panchagavya (T_3), soil + Panchagavya (T_4), soil + vermiwash (T_5) and control (soil) (T_6) with five replications.

RESULTS and DISCUSSION

Growth parameters

Data on the effect of treatments on various growth parameters at different stages of growth of brinjal and chilli are given Tables 1 and 2.

Plant height: Significant differences in plant height were observed throughout the plant growing stages with different treatments. In case of brinjal, maximum plant height was recorded in T_3 (soil + vermicompost + vermiwash + Panchagavya) (54.6 cm) and minimum in T_6 (Control) (40.6 cm). At S-II growth stage, T_3 resulted in maximum plant height (58 cm) and minimum (41 cm) was recorded in T_6. At S-III, maximum plant height was recorded in T_3 (71 cm) and T_4 (Soil + Panchgavy) (68 cm), which were at par and minimum in T_6 (46 cm).

In case of chilli, maximum plant height was recorded in T_3 (56.66 cm) and minimum in T_6 (41.66 cm). At S-II, maximum plant height was recorded in T_3 (61 cm) and minimum in T_6 (40 cm) and at S-III, maximum plant height was recorded in T_3 (74 cm) and minimum in T_6 (52 cm).

Number of branches: In case of brinjal, the treatment T_3 resulted in maximum number of branches per plant (7.3) and T_6 in minimum number (3). At growth stages S-II and S-III, T_3 resulted in maximum number of branches per plant (9 and 11 respectively) and T_6 in minimum number (3 and 4 respectively).

In case of chilli, maximum number of branches per plant was observed in T_3 (13.66) and minimum in T_6 and T_4 (6.33 and 7.66 respectively), the two being at par. At S-II stage, maximum number of branches per plant (15) was recorded in T_3 and minimum in T_6 (6). At S-III stage, maximum number of branches per plant (21) was recorded in T_3 and minimum in T_6 (9), T_4 (10) and T_2 (Soil + vermicompost + vermiwash) (11), all the three being at par.

Number of leaves: In case of brinjal, T_3 recorded maximum number of leaves per plant (20.0) and T_6 the minimum (10.6). At S-II and S-III, maximum number of leaves per plant (23 and 29 respectively) was recorded in T_3 and minimum in T_6 (10 and 15 respectively). In case of chilli, T_3 recorded maximum number of leaves per plant (25.33) and T_6 the minimum (13.45). At S-II and S-III, maximum number of leaves per plant (28 and 39 respectively) was recorded in T_3 and minimum in T_6 (13 and 17 respectively).

Yield parameters

Data on the effect of different treatments on yield and yield parameters of brinjal and chilli are given in Tables 3 and 4.

Number of buds and flowers: In case of brinjal, number of buds and flowers was highest in T_3 (11) and lowest in T_6 (3). At growth stage S-III also, number of buds and flowers was highest in T_3 (11) and lowest in T_6 (3). In case of chilli, number of buds and flowers was highest in T_4 (21) and lowest in T_6 (11). At growth stage S-III also, number of buds and flowers was highest in T_4 (21) and lowest in T_6 (11).

Number of fruits per plant: In case of brinjal, number of fruits was highest in T_3 (11) and lowest in T_6 (2). At growth stage S-III also, number of fruits was highest in T_3 (11) and lowest in T_6 (2). In case of chilli, number of fruits was highest in T_4 (20) and lowest in T_6 (7). At growth stage S-III also, number of fruits was highest in T_4 (20) and lowest in T_6 (7).

Generally, the application of organic inputs to the soil and foliar application have great influence on growth and yield parameters of crops. In this experiment, different combinations of organic inputs

Table 1. Effect of different treatments on growth parameters of brinjal

Treatment	Plant height (cm)				Number of branches/plant				Number of leaves/plant			
	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean
T_1	33	43	59	45.0	2	6	7	5.0	8	17	24	16.3
T_2	35	45	63	47.6	2	5	6	4.3	7	15	23	15.0
T_3	35	58	71	54.6	2	9	11	7.3	8	23	29	20.0
T_4	33	48	68	49.6	2	5	6	4.3	7	15	23	15.0
T_5	34	47	61	47.3	2	6	7	5.0	7	14	19	13.3
T_6	35	41	46	40.6	2	3	4	3.0	7	10	15	10.6
SEm(±)	NS	1.72	3.54	1.57	NS	0.61	0.71	0.45	NS	1.35	1.51	1.24
$CD_{0.05}$	NS	3.27	6.58	2.12	NS	1.12	1.48	0.92	NS	2.54	3.25	2.40

T_1: Soil + vermicompost + Panchagavya, T_2: Soil + vermicompost + vermiwash, T_3: Soil + vermicompost + vermiwash + Panchagavya, T_4: Soil + Panchgavy, T_5: Soil + vermiwash, T_6: Control (soil); NS: Non-significant

Table 2. Effect of different treatments on growth parameters of chilli

Treatment	Plant height (cm)				Number of branches/plant				Number of leaves/plant			
	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean
T_1	35	47	60	47.33	5	10	14	9.66	9	21	29	19.66
T_2	34	50	62	48.66	5	8	11	8.00	9	19	26	18.01
T_3	35	61	74	56.66	5	15	21	13.66	9	28	39	25.33
T_4	31	55	69	51.66	5	8	10	7.66	9	17	25	17.12
T_5	34	54	61	49.66	5	9	12	8.66	10	18	27	18.33
T_6	33	40	52	41.66	4	6	9	6.33	9	13	17	13.45
SEm(±)	NS	2.43	2.41	1.72	NS	0.73	1.32	0.71	NS	0.87	1.95	1.27
$CD_{0.05}$	NS	4.57	4.82	2.42	NS	1.43	2.64	1.52	NS	1.57	2.34	2.43

T_1: Soil + vermicompost + Panchagavya, T_2: Soil + vermicompost + vermiwash, T_3: Soil + vermicompost + vermiwash + Panchagavya, T_4: Soil + Panchgavy, T_5: Soil + vermiwash, T_6: Control (soil); NS: Non-significant

viz Panchagavya, vermiwash and vermicompost were tried as soil application and foliar spray on brinjal and chilli crops. The treatments, consisting of soil application of vermicompost and foliar application of vermiwash and Panchagavya, resulted in maximum plant height and number of branches, leaves, buds, flowers and fruits per plant in brinjal. This could be due to enrichment in soil organic carbon and microbial load by vermicompost and foliar application of vermiwash.

The same treatment resulted in maximum plant height and number of branches and leaves per plant in chilli but number of buds, flowers and fruits was maximum in the treatment comprising soil and Panchagavya.

In a study conducted on chilli, Kumar and Dahiya (2013) reported that the plant height was 47.06 cm in vermicompost-treated pots in comparison to 34 cm in cow dung, 32 cm in urea and 14 cm in control treatments. Weight of the fruits was 8.33 g in vermicompost-treated pots followed by those treated with cow dung, urea and control. The number of fruits was 30 due to application of vermicompost, or otherwise, it fluctuated between 12-25 per plant. The stem diameter and dry matter production was also highest due to the application of vermicompost.

Manimegala and Gunasekaran (2020) observed that brinjal plants grown in recommended dose of vermicompost 50 per cent + NPK 50 per cent plots showed enhanced values in all the growth parameters in brinjal. Kumar et al (2011) concluded that the treatment recommended dose of fertilizer and Panchagavya spray 3 per cent at 30, 60 and 75 days after sowing increased the oil content (40.7), protein

Table 3. Effect of different treatments on yield parameters of brinjal

Treatment	Number of buds and flowers/plant				Number of fruits/plant			
	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean
T_1	-	-	5	5	-	-	4	4
T_2	-	-	6	6	-	-	5	5
T_3	-	-	11	11	-	-	11	11
T_4	-	-	7	7	-	-	6	6
T_5	-	-	5	5	-	-	5	5
T_6	-	-	3	3	-	-	2	2
SEm(±)	-	-	0.72	0.82	-	-	-	-
$CD_{0.05}$	-	-	1.43	1.65	-	-	-	-

T_1: Soil + vermicompost + Panchagavya, T_2: Soil + vermicompost + vermiwash, T_3: Soil + vermicompost + vermiwash + Panchagavya, T_4: Soil + Panchgavy, T_5: Soil + vermiwash, T_6: Control (soil)

Table 4. Effect of different treatments on yield parameters of chilli

Treatment	Number of buds and flowers/plant				Number of fruits/plant			
	S-I	S-II	S-III	Mean	S-I	S-II	S-III	Mean
T_1	-	-	17	17	-	-	15	15
T_2	-	-	15	15	-	-	13	13
T_3	-	-	15	15	-	-	14	14
T_4	-	-	21	21	-	-	20	20
T_5	-	-	14	14	-	-	12	12
T_6	-	-	11	11	-	-	7	7
SEm(±)	-	-	0.13	1.25	-	-	1.45	1.42
$CD_{0.05}$	-	-	0.25	2.43	—		2.81	2.81

T_1: Soil + vermicompost + Panchagavya, T_2: Soil + vermicompost + vermiwash, T_3: Soil + vermicompost + vermiwash + Panchagavya, T_4: Soil + Panchgavy, T_5: Soil + vermiwash, T_6: Control (soil)

percentage (22.4) and yield (685.1 kg/ha) compared to other treatments in brinjal.

Mahajan et al (2012) reported that application of neem + Panchagavya spray at 3.0 per cent at 55 and 80 DAS recorded higher yield in chilli crop.

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