Research Article

Integrated Plant Nutrition System in *Solanum melongena*

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ABSTRACT

The present study was aimed to analyse the plant growth by using different types of fertilizers. Micronutrients, Vermicompost, Biocompost and Biofertilizers were collected from Biominin Laboratory, S.T.E.T Women's College, Mannargudi. Neem cake was collected from Phytoproducts, Thiruthuraipoondi. Chemical fertilizer was collected from Fertilizers production Unit, Pamani, Mannargudi. The soil samples were subjected to analyse the physico-chemical parameters include pH, Temperature, Moisture and Electrical conductivity before and after treatment. Estimation of Nitrogen, potassium, Phosphorus and Carbon were assessed by titrimetric and turbidity method respectively. The effect of treated fertilizers on growth of *Solanum melongena* was determined by trial plot experiment. After the growth of 90th day seedlings, the better response observed in morphological and phytochemical characteristics of *Solanum melongena* were recorded in T1 (Micronutrients), T2 (Vermicompost) and T5 (Combined inoculation of fertilizers) than other treatments.

Keywords: Vermicompost, Neem cake, Biocompost, Biofertilizer and *Solanum melongena.*

INTRODUCTION

Brinjal (*Solanum melongena*) is the first most important vegetable crop in the world. Total worldwide production is 152.9 million ton valued at $74.1 billion. In spite of increased production due to the use of hybrid varieties and fertilizer applications, organic vegetables in general including brinjal are much sought after.[1]

Vermicompost is the product or process of composting using various worms, usually red wigglers, white worms and other earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials and vermicast. Vermicast, also called worm castings, worm humus or worm manure, is the end-product of the breakdown of organic matter by an earthworm.

These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than do organic materials before vermicomposting. *Eisenia fetida* and *Eudrilus eugeniae* are mostly used for vermicompost production.

Biofertilizer is a substance which contains living microorganisms which, when applied to seed, plant surfaces or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Bio-fertilizers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphorus and stimulating plant growth through the synthesis of growth-promoting substances.

Chemical fertilizers are an essential component of any system in which the aim is to maintain good yield. To increase the yield potential, the crop had to good soil fertility and adequate fertilizer. It is well known fact that adequate fertilizer is required by brinjal for growth and high yield. The fertilizer does this through its ability to replenish the soil with nutrients that are lacking in the soil.

Micronutrients are essential for plant growth and play an important role in balanced crop nutrition. They include Boron (B), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn), Nickel (Ni) and Chloride (Cl). They are as important to plant nutrition as primary and secondary nutrients, though plants don't require as much of them.

A lack of any one of the micronutrients in the soil can limit growth, even when all other nutrients are present in adequate amounts.

Soil fertility is seriously impaired with the excessive use of chemical fertilizers.

Research conducted to study the fall in grain production indicates that the soil is getting drained of organic carbon because of over use of fertilizers, thus effecting soil fertility. The gainful use of bio-manure can help address this threat.

Neem cake organic manure is the by-product obtained in the process of cold pressing of neem tree fruits and kernels, and the solvent extraction process for neem oil cake. It is a potential source of organic manure under the Bureau of Indian Standards, Specification No. 8558. Neem has demonstrated considerable potential as a fertilizer.

The objective of the present study was to determine physico-chemical parameters of trial plot soil before and after treatment and to study the effect of treated fertilizers on growth of *Solanum melongena* was determined by trial plot experiment.

MATERIALS AND METHODS

Fertilizers collection and Physico chemical parameters analysis[2]

Micronutrients, Vermicompost, Biocompost and Biofertilizers were collected from Biominin Laboratory, S.T.E.T Women's College, Mannargudi. Neem cake was collected from Phytoproducts, Thiruthuraipoondi. Chemical fertilizer was collected from Fertilizers production Unit, Pamani, Mannargudi. The soil sample of trial plot were subjected to analyse the physico-chemical parameters include pH, Temperature, Moisture and Electrical conductivity before and after treatment. Estimation of Nitrogen, potassium, Phosphorus and Carbon were assessed by titrimetric and turbidity method respectively.

Plot Treatment

There were eight plots used for the treatment. The plots were maintained in the open shade at the temperature of 27°C - 30°C. The combined inoculation of crop plant *Solanum melongena* was treated with equal part of biocompost and shredder dust (50%), vermicompost (35%), micronutrients (5%), and neem cake (10%). T_1 - Micronutrients, T_2 - Vermicompost, T_3 - Biofertilizers, T_4 - Biocompost, T_5 - Micronutrients + Vermicompost + Biocompost + Coconut shredder Dust + Neem cake, T_6 - Neem cake, T_7 - Pamani complex, T_8 - Control.

Figure 1: Trial plot treatment

Morphological and Phytochemical analysis of Brinjal plant[5]

After 60th, 75th, and 90th day of growth, the morphological parameters such as, height of the plant (in cm), number of leaves (per plant), number of roots (per plant), shoot length (in cm), root length (in cm) of *Solanum melongena* such as, Chlorophyll, Carbohydrates[6], Proteins[7] and Carotenoids were analysed.

Statistical Analysis

Statistical analysis was performed by calculating Mean ± Standard deviation.

The formula for calculating standard deviation is

$$SD = \frac{\sqrt{\Sigma(X-X)^2}}{N-1}$$

RESULTS AND DISCUSSION

In this present study, the fertilizers such as Vermicompost, Biocompost, Micronutrients, Biofertilizers were purchased from Biominin Laboratory, S.T.E.T Women's College, Mannargudi. Neem cake was purchased from Phytoproducts, Thiruthuraipoondi. Chemical Fertilizers were collected from Fertilizers production unit, Pamani, Mannargudi. The effectiveness of the growth of *Solanum melongena* was tested by using fertilizers and control.

Analysis of physico chemical parameters

The physic chemical parameters of trial plot soil were analysed before and after treatment. After the treatment, the pH level was slightly increased and reached neutral pH.

The physico chemical parameters were calculated as follows, pH (6.8), Temperature (40), Moisture (62), Electrical conductivity (1.22-1.32), Nitrogen (89.9 ppm), Phosphorus (80.5 ppm), Potassium (39 ppm), Carbon (0.98) presented in the Table 1.

This study similar to the increased trend of NPK in the Vermicompost and C/N ratio is about 15 to 20:1 for good compost[10&11]

Table 1: Physicochemical parameters of trial plot soil

S. No	Physicochemical parameters	Before treatment	After treatment
1.	pH	6.4	6.8
2.	Temperature (°C)	40	43
3.	Moisture	60	62
4.	Electrical conductivity	1.18-1.78	1.22-1.32
5.	Nitrogen (ppm)	88.7	89.9
6.	Phosphorus (ppm)	79.32	80.5
7.	Potassium (ppm)	36	39
8.	Carbon	0.75	0.98

Trial plot treatment

The effect of fertilizers on the growth of *Solanum melongena* was studied and compared with control. After growth of *Solanum melongena*, 60th, 75th and 90th days to observe the morphological parameters and phytochemical analysis. After 90th days of growth, the better response observed in Height (32.5±2.62), Number of leaves (22.9±1.3), Shoot length (17.6±2.8) and Root length (16.6±1.8) in T2 than other treatments include T3, T4, T6, T7 and Control[12].

Table 2: Impact of fertilizers on morphological parameters of *Solanum melongena* (90th day)

Treatments	Height of the plant (cm)	Number of leaves/plant	Shoot length(cm)	Root length(cm)	Number of roots/plants
T1	26.4±2.42	19.5±2.6	16.5±2.4	13.9±1.41	17.6±2.8
T2	32.5±2.62	22.9±1.3	21.5±3.4	16.6±1.8	22.8±1.30
T3	28.4±2.52	18.5±2.5	17.6±2.8	11.9±1.9	19.9±1.89
T4	26.4±2.32	20.5±2.56	19.5±3.1	14.8±1.71	16.6±2.6
T5	24.4±2.27	18.5±2.34	18.5±2.9	11.9±1.34	15.5±1.8
T6	25.4±2.43	17.5±2.3	16.8±7.64	12.7±1.54	18.6±1.7
T7	23.4±2.34	15.5±2.2	19.5±3.2	13.5±1.66	14.6±2.9
T8	21.4±2.23	18.5±2.6	20.5±3.3	13.8±1.51	13.6±1.8

Values are triplicates, mean± standard deviation

Table 3: Phytochemical constituents in *Solanam melongena* (90th day)

Treatments	Cholorophyll a (mg / g)	Cholorophyll b (mg / g)	Total Cholorophyll (mg / g)	Carbohydrate (mg)	Carotenoids (mg)	Protein (µg / g)
T1	0.54±0.63	0.04±0.072	0.04±0.20	5.68±0.042	0.47±0.93	4.43± 0.042
T2	0.65±0.65	0.06±0.076	0.05±0.21	7.75±0.67	0.59±0.76	5.64±0.068
T3	0.52±0.59	0.04±0.054	0.04±0.19	5.79±0.045	0.42±0.88	4.40±0.038
T4	0.43±0.49	0.03±0.89	0.038±0.18	4.54±0.039	0.39±0.75	3.49±0.032
T5	0.05±0.53	0.04±0.96	0.054±0.14	4.23±0.032	0.48±0.96	3.54±0.021
T6	0.23±0.35	0.02±0.79	0.026±0.16	3.98±0.029	0.27±0.64	2.98±0.042
T7	0.26±0.27	0.025±0.054	0.023±0.09	3.27±0.023	0.18±0.54	4.45±0.045
C	0.12±0.19	0.01±0.035	0.019±0.04	2.19±0.017	0.13±0.43	2.65±0.021

Values are triplicates, mean± standard deviation

A B C

Figure 2 A: Brinjal from field amended with Vermicompost, **B:** Brinjal from field without vermicompost, **C:** A diseased brinjal from the field without vermicompost

Phytochemical Analysis

Quantitative determination test for Carbohydrate, Chlorophyll, Carotenoids and Proteins were performed. After 90th days of growth, the better response observed in Chlorophyll (0.65±0.65), Carbohydrate (7.75±0.67), Protein (5.64±0.068) and Carotenoids (0.59±0.76) were recorded in T2 than other treatments include T3, T4, T6, T7 and Control (Table-3). This study similar to the biochemical contents such as chlorophyll and protein content were determined to find out variation in these single and dual inoculations of brinjal and control[13&14].

CONCLUSION

In this present study, the fertilizers such as Vermicompost, Biocompost, Micronutrients, Biofertilizers were purchased from Biominin Laboratory, S.T.E.T Women's College, Mannargudi. Neem cake was purchased from Phytoproducts, Thiruthuraipoondi. Chemical Fertilizers were purchased from Fertilizers production unit, Pamani, Mannargudi. The effectiveness of the growth of *Solanum melongena* was tested by using fertilizers and control. Moreover, integrated application of Vermicompost, Combination of fertilizers and Micronutrients showed better performance and gave the highest yield. So, vermicompost can play a vital role in depletion of chemical fertilizer or increasing of soil fertility and this integrated approach can contribute to improve crop production. To conclude hold promise to play a significant role in protecting environment as it uses waste as raw material and in building up of soil fertility and improving soil health for sustainable agriculture.

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