



## Efficacy of Vermicompost on Growth and Biochemical parameters of *Vigna mungo* L.

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**Abstract:** Vermicompost is the product of composting or breaking down organic matter through the use of earthworms. It is rich in essential plant nutrients, and has the ability to enhance the condition and increase the quality of the soil. The study was conducted to evaluate the effect of vermicompost and organic fertilizers on growth and yield of *Vigna mungo* L. Various growth and biochemical parameters like seedling length plant height, root length, shoot length, number of leaves and leaf diameter were recorded for each treatment. Almost all the growth and biochemical parameters increased significantly as compared to control, though the increase within the treatments was not found to be significant. The present study suggested that vermicompost is more favorable for vigorous production of *Vigna mungo* L. The vermicompost can be economically and environmentally suitable and also maintenance of soil environment. High length in seedling, high amount of Photosynthetic pigments such as chlorophyll-a, chlorophyll-b, Total chlorophyll and Carotenoid content (0.41, 0.53, 0.94, 0.61 mg /g fr.wt), high protein content, amino acid, carbohydrate, phenol and sugar (50, 46, 24, 32 and 14 mg /g fr.wt) were recorded in *Vigna mungo* L. seedlings, grown in soil that had application of 300mg of vermicompost. The optimal plant growth in our study conducted for a period of one month was found in pots containing vermicompost. The study also showed distinct differences between vermicompost and garden soil (control) in terms of their biochemical changes and their effect on plant growth.

**Key words:** Vermicompost, *Vigna mungo*, root length, Plant growth, Pigment changes and Growth.

### I. INRODUCTION

Vermicompost technology is an eco-friendly approach for solid waste management. It not only helps in improving the soil fertility, but also helps in minimizing the use of chemical fertilizers to the extent of 25% to 50% and increase the crop yield by 15% to 20% [1]. It is also useful as it increases soil porosity, aeration and water holding capacity. Vermicompost increases the surface area, provides strong absorbability and retention of nutrients as well and retain more nutrients for a longer period of time. It has been found that soil amended with vermicompost had significantly greater soil bulk density and the soil does not become compacted [2,3]. Humic acids isolated from vermicompost enhanced root elongation and formation of lateral roots in maize. Vermicompost enhance the nutrient uptake by the plants by increasing the permeability of root cell membrane, stimulating root growth and increasing proliferation of root hairs [4]. The suppressing, repelling or by inducing biological resistance in plants to fight them or by killing them through pesticide action of Vermicompost aids in protecting crop plants against pests and diseases [5]. The use of vermicompost appears to affect plant growth in ways that cannot be directly linked to physical or chemical properties [6]. However, the improvements in physical and chemical structure of the growth media are attributed to the increase in plant growth. It is argued that growth promotion may be due to micro flora associated with vermicomposting that induce hormone-like activity on the production of metabolites [7].

The increase the soils plant available nutrient content, growth regulators and useful bacteria population. The Vermicompost has lower C/N ratio and phosphorus than normal compost irrespective of the source of organic waste. Microbial population is also considerably higher in vermicompost than in compost [8]. Addition of different vermicomposts, produced from different sources, like cattle manure, pig manure, food waste, poultry waste etc., increases the rate of germination and growth, and yield of many high value crops [9]. Vermicompost contains plant-growth regulating materials, such as humic acids and plant growth regulators like auxins, gibberellins and cytokinins, which are responsible for increased plant growth and yield of many crops. These plant growth-regulating materials are produced by action of microbes like fungi, bacteria, actinomycetes etc., and earthworms. Vermicompost provides large particulate surface areas that provide many micro sites for microbial activities and for strong retention of nutrients.

In India-as also many other parts of the world-vermicasts are believed to have several components, which improve the soil to which they are applied. Vermicast generated from animal dung is universally believed to be beneficial to soil and plants. Vermicompost significantly stimulate the growth of a wide range of plant species including several horticultural crops such as tomato, pepper, garlic, aubergine, strawberry, sweet corn and green gram [10]. Moreover, in comparison with mineral fertilizers, compost produces significantly greater increases in soil organic carbon and some plant nutrients [11-14]. Vermicompost an organic source of plant nutrients contains a higher percentage of nutrients necessary for plant growth in readily available forms [15].

Organic vegetables fetch a premium price of 10%- 50% over conventional products. Market of organic products is growing at faster rate (20%) as compared to conventional ones (5%). This growth rate is highest in Japan, USA, Australia and EU. Export preference of organic vegetables offers a great scope to a country like India, which has inculcated the skill of growing organically since time immemorial.

India, only 30% of total cultivable area is covered with fertilizers where irrigation facilities are available and in the remaining 70% of arable land, which is mainly rain-fed, negligible amount of fertilizers is being used. Farmers' in these areas often use organic manure as a source of nutrients that are readily available either in their own farm or in their locality. The North Eastern region of India provides considerable opportunity for organic farming due to least utilization of chemical inputs. It is estimated that 18 million hectare of such land is available in the NE, which can be exploited for organic production. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the world's organic market. The report of the Task Force on Organic Farming appointed by the Government of India also observed that in vast areas of the country, where limited amount of chemicals issued and have low productivity, could be exploited as potential areas for organic agriculture [16].

Agriculture plays a pivotal role in the Indian economy. Although its contribution to gross domestic product (GDP) is now around one sixth, it provides employment to 56 per cent of the Indian workforce. Also, the forward and backward linkage effects of agriculture growth increase the incomes in the non-agriculture sector. Present paper deals with the study of the effects of various levels of vermicompost on different parameters like root and shoot length, root, shoot total dry weight and biochemical and pigment content of *Vigna mungo* L.

## II. MATERIALS AND METHODS

*Vigna mungo* L. vegetable seeds were selected for the present investigation undergone for a period of 30 days January 2018.

### Collection of Vermicompost

Pot culture studies were conducted in the Department of Botany, Rani Anna Government College for Women, Tirunelveli to evaluate the effect of the vermicompost on the growth performance and biochemical constituent of *Vigna mungo* L.

### Experimental design for pot culture studies:

- T<sub>0</sub> - Control Garden loamy soil (3 kg soil)
- T<sub>1</sub> - 3 kg loamy soil + 100 mg Vermicompost
- T<sub>2</sub> - 3 kg loamy soil + 200 mg Vermicompost
- T<sub>3</sub> - 3 kg loamy soil + 300 mg Vermicompost

### Seed selection, processing and sowing:

Certified seed of were procured from the Tamilnadu Government Agricultural supportive centre, Palayamkottai. Healthy hand sorted seeds were washed with distilled water. Fifteen healthy, undamaged seeds were sown per pot containing the experimental medium as given above. All the pots were watered regularly and observed periodically for growth parameters ie., seed germination, fresh and dry weight, plant height, shoot length, stem length, Number of leaves, leaves diameters and biochemical estimations like Chlorophyll, protein, starch, amino acid, phenol and nitrate reductase activity were studied of using a standard procedures.

## RESULT AND DISCUSSION

Vermicomposting appears to be the most promising as high value biofertilizer which not only increases the plant growth and to be enhanced the productivity. Vermicompost is one of the best highest-grade and most nutrient rich natural fertilizers in the world. Its soil conditioning properties and plant strengthening effect encourage the growth and yield of the plants. The use of worm farms for vermicomposting is becoming a favorite way of converting waste to a valuable product while also growing more worms to increase the capacity of the worm farms.

### Effect of Vermicompost on seed germination

Seed germination of *Vigna mungo* L. plant treated with 3kg of soil + 300mg of vermicompost reported high seed germination content, compare to other concentrations and control. The control plant exhibit less seed germination of *Vigna mungo* L. plant, compare with vermicompost treated plants (Figure: 1).

### Effect of vermicompost on growth parameters of *Vigna mungo* L.

Fresh weight contents of whole plant of the *Vigna mungo* L. were carried out after treated with different concentrations of soil and vermicompost. Among the different concentrations, the plant treated with 3 kg soil + 300 mg vermicompost was

reported with high fresh weight compared to other concentrations and control (Figure: 2). The high dry weight was significantly increased with the highest percentage of 3 kg soil + 300 mg vermicompost respectively in the treatment 3. The growth performance of *Vigna mungo* L. were studied after the treatment of different concentrations of vermicompost. All the concentrations were showed good performance compared to control. Among all of 3 kg soil + 300 mg vermicompost concentration was showed over all good performance in different growth parameters like plant length, root length, stem length, number of leaves and leaf diameter. The plant length 35 cm, 44 cm and 55 cm respectively for Treatment 1, Treatment 2 and Treatment 3.

Root length was observed in 3 kg soil + 300 mg vermicompost concentration was 17cm for treatment 3. The shoot length value was also showed more variation in different concentration and control, but maximum was found in 38 cm in 3 kg soil + 300 mg vermicompost concentration respectively for T3.

Total numbers of leaves (9) were observed maximum in *Vigna mungo* L. 15, treated with 3 kg soil + 300 mg vermicompost concentration. Leaf diameter was showing different ranges in different concentrations. The maximum leaf diameter was found in above concentration and the value is 3.28cm respectively for 3 kg soil + 300 mg vermicompost concentration.

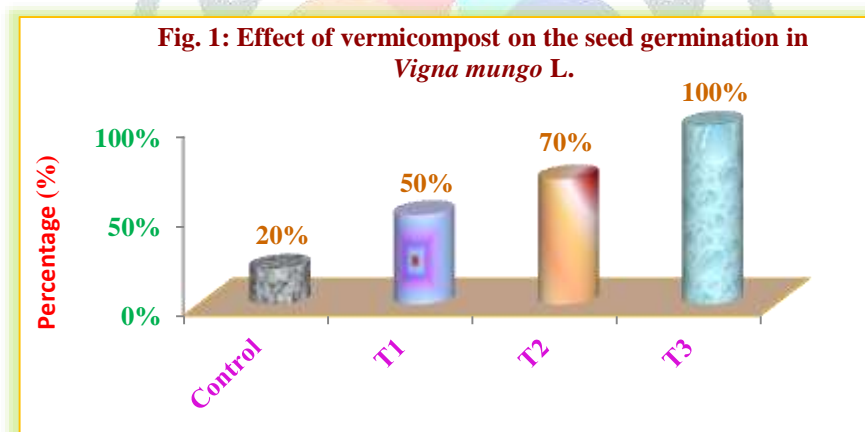
#### Effect of vermicompost on Biochemical Analysis of *Vigna mungo* L.

The biochemical like amino acids, proteins, carbohydrates, starch and phenol content were observed more in *Vigna mungo* L. treated with 3 kg soil + 300 mg vermicompost compared to control and other concentrations. The various biochemical contents of *Vigna mungo* L. treated with different concentrations of vermicompost was displayed in (Table: 1). The nitrate reductase enzyme activity was also studied for the different concentration of vermicompost treated plant and the result was compared with control. The enzyme activity was observe more in plant treated with 3kg soil + 300mg vermicompost, compared to control and other concentrations.

The carbohydrates content of *Vigna mungo* L. were 21, 22 and 24mg/g/FW respectively is T1, T2, T3. Protein content of plant was 48, 50 and 50mg/g/FW for various different concentration respectively T1, T2, T3. The starch content of *Vigna mungo* L. were 11, 12 and 13mg/g/fw respectively T1, T2, T3. Phenols content is more in soil + 300mg vermicompost concentration (32mg/g/FW).

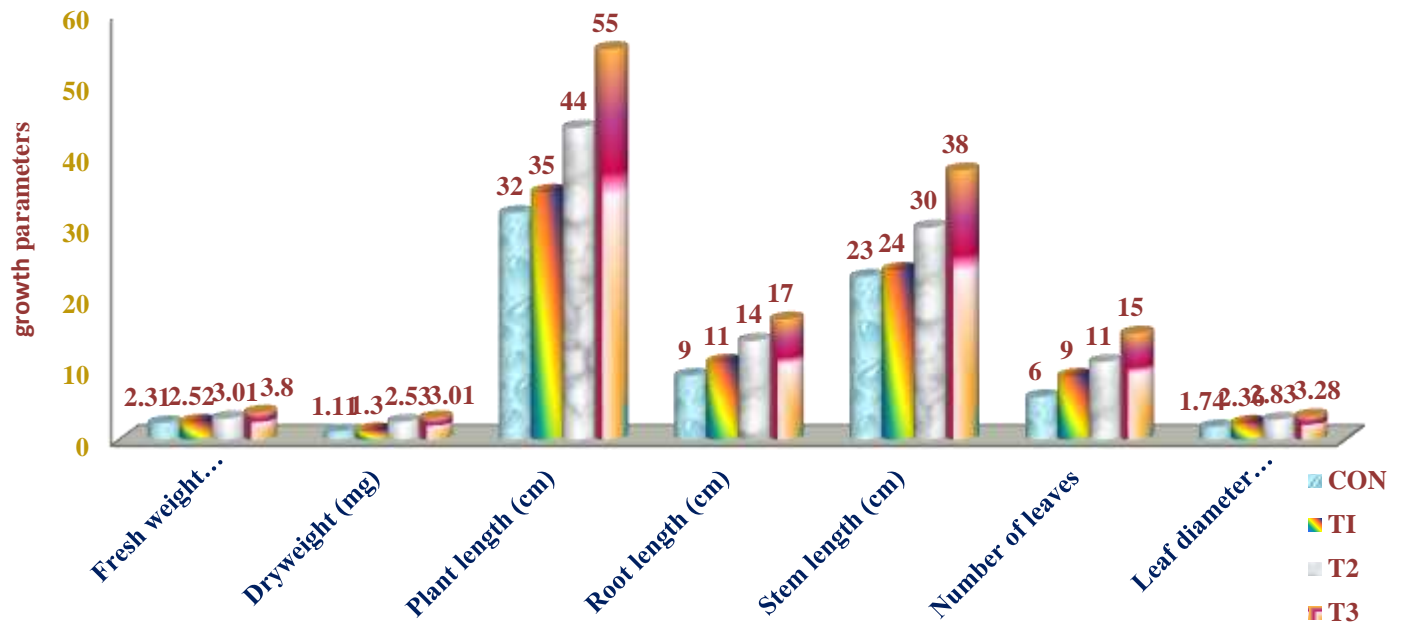
#### Effect of vermicompost on the pigment changes in *Vigna mungo* L.

Chlorophyll content was also observed more in plant treated with *Vigna mungo* L. 3 kg soil + 300 mg vermicompost compare to control and other concentrations. The Chlorophyll-a content of *Vigna mungo* L. were 0.31, 0.39 and 0.41mg/g/FW. The Chlorophyll-b content of *Vigna mungo* L. were 0.39, 0.42 and 0.53mg/g/FW. The Total Chlorophyll content of *Vigna mungo* L. were 0.7, 0.81 and 0.94mg/g/FW. The Carotenoides content of *Vigna mungo* L. were 0.48, 0.53 and 0.61 mg/g/FW. The results for chlorophyll a, chlorophyll b, and total chlorophyll were tabulated in (Table: 2).



Control - 3kg soil, T1 - 3kg soil + 100mg VC, T2 - 3kg soil + 200mg VC, T3 - 3kg soil + 300mg VC.



Fig. 2: Vermicompost effect on the growth parameters in *Vigna mungo* L.Table 1: Vermicompost effect on the biochemical changes in *Vigna mungp* L.

S. No	Phytochemical analysis	Control	T 1	T 2	T 3
1	Amino acid (mg/g/fw)	42	43	44	46
2	Protein (mg/g/fw)	47	48	50	50
3	Carbohydrate (mg/g/fw)	20	21	22	24
4	Starch (mg/g/fw)	10	11	12	14
5	Phenol (mg/g/fw)	28	30	30	32
6	Nitrate Reductase Activity (μ mole)	40.62	43.65	51.75	62.25

Table 2: Vermicompost effect on the pigment changes in *Vigna mungp* L.

S. No	Pigment Changes (mg/ fw)	Control	T 1	T 2	T 3
1	Chlorophyll a	0.26	0.31	0.39	0.41
2	Chlorophyll b	0.34	0.39	0.42	0.53
3	Total Chlorophyll	0.6	0.7	0.81	0.94
4	Carotenoids	0.42	0.48	0.53	0.61

#### IV. DISCUSSION

Changing scenario of herbal market and expanding global trade has opened up a new prospective for Indian agriculture. The demand on plant based therapeutics has increased many folds in both developing and developed countries. Agro-technologies for cultivation of number of species have been developed but large scale cultivation of plants on farmland not yet begins. Many factors are influencing plants cultivation. Biofertilizers and vermicompost applications may be promote the growth and yield of plants.

The soil sample and vermicompost were further accessed for seed germination of *Vigna mungo*. Seed germination of plants treated with 3 kg soil - 30 mg vermicompost reported with high seed germination content compare to other concentrations and control. *Vigna mungo* plants were showed 100% seed germination when treating with 3kg soil + 30 mg vermicompost. The effect of vermicompost on the fresh weight and dry weight of root, stem and leaves of *Vigna mungo* were also analyzed by present study. Among the different concentrations, the plants treated with 3 kg soil + 300 mg vermicompost, reported with high fresh and dry weight content compared to control and other concentrations. Effect of the vermicompost on the relative growth parameters was analysed. The relative growth leaf rate, relative growth stem rate and relative growth root rate in the control is compared with of vermicompost treatment results showed that treatment with 3 kg soil + 300 mg vermicompost and 3 kg soil + 200 mg vermicompost greatest impact on plant relative growth parameters compared with other treatments. The effect of vermicompost on the biochemical constituents in selected pluses *Vigna mungo* plant reveals that in treatment 3 (T3 - 3 kg soil + 300 mg VC)\ found maximum biochemical constituents. The effect of vermicompost on the protein, starch, amino acid, phenol and nitrate reductase activity of selected pluses *Vigna mungo* plant were also analyzed among the different concentrations, the plants treated with 3kg soil + 300mg vermicompost, reported with high biochemical constutions content compared to control and other concentrations. It is concluded that vermicompost application for the selected concentration promote the growth, and biochemical parameters. So it continuously increased the yield of the crops. Vermicompost treatments promote the development of selected vegetable crops in different places.

In the present study, the application of vermicompost significantly increases the plant height, biomass and other growth parameters. It is established fact that vermicompost improves the physical and biological properties of soil including supply of almost all that essential plant nutrients for the growth and development of plants, ultimately increased the plant height and number of effective tillers per meter row length.

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