

## Effect of different ratios of Vermicompost & soil on Mung bean (*Vigna radiata*) seed germination and growth

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### Abstract

Vermicompost, a nutrient-rich organic material produced through the decomposition of organic waste by earthworms, has been widely recognized as a beneficial soil amendment for plant growth. This study aims to investigate the effect of different ratios of vermicompost soil on mung bean (*Vigna radiata*) seed germination.

The experiment was carried out in pots kept in plant physiology laboratory of Bareilly College, Bareilly.

The seeds of *Vigna radiata* were purchased from local seed shopkeeper at collectorate region of Bareilly Uttar- Pradesh. The variety SML668, Chetak was taken to conduct the experiments. Vermicompost was purchased from IVRI (Indian Veterinary Research Institute) located at Izzatnagar, Bareilly in Uttar Pradesh state.

A randomized controlled experiment was conducted, utilizing three different ratios of vermicompost soil mixed with regular potting soil 0% vermicompost (control group), 25% vermicompost, 50% vermicompost, and 75% vermicompost. Each treatment was replicated one time, resulting in a total of six experimental units. Mung bean seeds were sown in each unit, and the germination process was monitored after a period of 24, 48 and 72 hrs.

The results revealed a significant effect of the vermicompost soil ratio on mung bean seed germination. The control group, consisting of 0% vermicompost, exhibited an average germination rate of 65%, while the 25% vermicompost ratio showed an average germination rate of 72%. The 50% and 75% vermicompost ratios exhibited average germination rates of 78 % and 88 %, respectively.

Furthermore, the seedling growth parameters, such as shoot length, root length were also measured. The plants grown in the 50% and 75% vermicompost ratios demonstrated significantly higher shoot and root lengths as compared to the control and 25% vermicompost groups.

**Keywords:** Earth worms, Vermicompost, Mung bean, Germination %, Growth parameters

### Introduction

Mung beans, also known as green gram or mung beans, are a staple in Indian cuisine and hold great importance in the Indian diet. It is a good source of essential nutrients, including protein, dietary fiber, vitamins such as B vitamins and vitamin K, and minerals such as potassium, magnesium, and iron. Mung beans provide an excellent vegetarian source of protein, making them a valuable part of the Indian diet, especially for vegetarians and vegans. Mung beans have a relatively low glycemic index, which means they can help regulate blood sugar levels. This is particularly beneficial for individuals with diabetes or those at risk of developing diabetes.

### Nutritional value of 100 gm mung seeds

- Calories: 347 kcal
- Protein: 24.6 grams
- Carbohydrates: 63.4 grams
- Dietary Fiber: 16.3 grams
- Sugars: 6.6 grams

### Fat: 1.2 grams

- Saturated Fat: 0.4 grams
- Monounsaturated Fat: 0.2 grams
- Polyunsaturated Fat: 0.4 grams

### Vitamins

- Vitamin A: 0 IU
- Vitamin C: 2.8 mg (4% DV)
- Vitamin K: 0.2 mcg (0% DV)

- Thiamin (Vitamin B1): 0.3 mg (20% DV)
- Riboflavin (Vitamin B2): 0.1 mg (6% DV)
- Niacin (Vitamin B3): 1.7 mg (9% DV)
- Vitamin B6: 0.2 mg (9% DV)
- Folate (Vitamin B9): 205 mcg (51% DV)
- Pantothenic Acid (Vitamin B5): 0.4 mg (4% DV)

### Minerals

- Calcium: 132 mg (13% DV)
- Iron: 6.7 mg (37% DV)
- Magnesium: 189 mg (47% DV)
- Phosphorus: 367 mg (37% DV)
- Potassium: 1246 mg (36% DV)
- Zinc: 2.8 mg (19% DV)
- Copper: 0.8 mg (40% DV)
- Manganese: 0.8 mg (41% DV)
- Selenium: 2.5 mcg (4% DV)

### (Values can vary according to variety and area)

It is necessary to increase the production and yield of crops to fulfill the requirements of the huge population of India. Organic fertilizers can be helpful for the same.

Vermicompost, also known as worm castings or worm compost, is a nutrient-rich organic fertilizer produced through the digestion of organic matter by earthworms. It is known for its positive effects on plant growth and soil health. When applied to mung bean (*Vigna radiata*), vermicompost can have several beneficial effects. Vermicompost helps improve soil structure by increasing its porosity and water-holding capacity.

This allows better root development and enhances nutrient uptake by mung bean plants. Vermicompost is rich in essential plant nutrients such as nitrogen, phosphorus, potassium, calcium, and micronutrients. These nutrients are released slowly, providing a sustained supply to mung bean plants throughout their growth stages.

Vermicomposts have large particulate surface areas that provide many microsites for microbial activity and for the strong retention of nutrients Shi-wei and Fu-zhen (1991) [1].

Vermicomposting is a process of composting organic waste using worms. In this process, earthworms are added to organic waste, which helps break down the waste into a nutrient-rich fertilizer called vermicompost.

Vermicomposting is an environmentally friendly way to recycle organic waste, as it helps to reduce the amount of waste going to landfills and also provides a natural fertilizer that can be used in gardening and agriculture. Vermicomposting is particularly popular for use in home gardens, community gardens, and small-scale agriculture.

During the vermicomposting process, the worms eat the organic material and break it down into smaller particles. The worms then excrete nutrient-rich castings or vermicompost that can be harvested and used as a natural fertilizer. Abbas *et al.* (2011) [2] studied the effect of organic and inorganic fertilizers on mung beans. Vermicompost is a great soil amendment that improves soil structure, retains moisture, and increases soil fertility. Since ancient times, farmyard manure has been used as a nutritional supplement and to enhance the physical qualities of the soils Kilic *et al.* (2021) [3], Verma *et al.* (2021) [4].

Vermicomposting has many benefits, including reducing waste, producing a natural fertilizer, improving soil health, and promoting sustainable gardening practices. Edwards and Arancon (2004) [5]. The increased amount of humus in soil through application of vermicompost by earthworms would certainly help favorable change in physical, chemical and biological properties of soil, and in enhancing the water-holding capacity Singh *et al.* (2011) [6]. It is also a great way to engage in a fun and educational activity that teaches about the importance of recycling and sustainability.

### Vermicompost chemical composition

Vermicompost is a nutrient-rich fertilizer that is produced through the process of vermicomposting, which involves the use of worms to break down organic waste. The chemical composition of vermicompost can vary depending on the type of organic waste used and the type of worms involved in the process. However, in general, vermicompost contains the following nutrients:

**Nitrogen (N):** Vermicompost is a good source of nitrogen, which is an essential nutrient for plant growth. Nitrogen is present in the form of ammonia, nitrate, and amino acids.

**Phosphorus (P):** Vermicompost also contains phosphorus, which is important for root development and overall plant growth. Phosphorus is present in the form of organic phosphates.

**Potassium (K):** Vermicompost contains potassium, which is important for plant growth and stress resistance. Potassium is present in the form of potassium ions.

**Calcium (Ca):** Vermicompost contains calcium, which is important for plant growth and cell development. Calcium is present in the form of calcium ions.

**Magnesium (Mg):** Vermicompost contains magnesium, which is important for photosynthesis and overall plant growth. Magnesium is present in the form of magnesium ions.

In addition to these essential nutrients, vermicompost also contains other micronutrients and trace elements that are important for plant growth and development, such as iron, zinc, copper, and manganese. Vermicompost also contains organic matter, which improves soil structure and helps to retain moisture in the soil. Overall, the chemical composition of vermicompost makes it a valuable fertilizer for organic gardening and farming.

**Table 1:** All the values have shown in the

Sr. No.	Test Parameters	Results
1.	Organic Matter	13.50
2.	Nitrogen %	1.6
3.	Phosphorus %	1.03
4.	Potassium %	0.56
5.	Calcium mg/100g	80.45
6.	Magnesium mg/100g	430.99
7.	Iron mg/kg	538.58
8.	Copper mg/kg	5.14
9.	Sulphate %	0.09
10.	Boron %	0.002

### Material and Methods

#### Collection of seed

Seeds of *Vigna radiata* Linn. were purchased from a local seed shopkeeper at the collectorate region of Bareilly Uttar - Pradesh.

#### Variety of mung bean

The variety SML668, Chetak was taken to conduct the experiments.

#### Collection of vermicompost (V.C.)

Vermicompost was purchased from IVRI (Indian Veterinary Research Institute) located at Izzatnagar, Bareilly in Uttar Pradesh state.

#### Preparation of soil- vermicompost mixture

Different mixtures were prepared for sowing with various ratios of soil and V.C. which are as follows-

**Table 2:** Percentage of vermicompost and soil.

Soil %	Vermicompost (V.C.) %	Ratio
100% (Control)	Nil	
75%	25%	3:1
50%	50%	2:2
25%	75%	1:3

**Preparation of Pots**

Pots were filled with different ratios of soil and vermicompost mixture. One pot was filled with 100 % soil used as control. The other three were filled with 75/25, 50/50, and 25/75 soil-V.C. mixture as mentioned in the above table.

A parallel replica of pots was also prepared for the accuracy of results.

**Selection and sowing of seeds**

Clean and healthy seeds were chosen for sowing. Hundred (100) seeds were sown in each pot. Pots were irrigated by hand shower at regular intervals to keep them moisturized.

**Result and Discussion**

Germination of seeds takes place after 12 hrs. But the first reading was noticed after 24, 48, and 72 hrs.

**Germination percentage at different intervals.**

It is clear from the tables that germination % increases with increasing the quantity of V.C. in the mixture. After 24 hrs. maximum germination occurred in a 75/25 V.C.-soil mixture. (Table 3).

This trend was found again after 48 and 72 hrs. It was 77 and 85 % after 48 and 72 hrs. respectively. (Table-4 and Table-5)

**Table 3:** After 24 Hours Treatments Germination %

<b>Control</b>	<b>06</b>
Vermicompost 25%	15
Vermicompost 50%	22
Vermicompost 75%	25

**Table 4:** After 48 Hours

<b>Control</b>	<b>58</b>
Vermicompost 25%	62
Vermicompost 50%	68
Vermicompost 75%	77

**Table 5:** After 72 Hour

Control	68
Vermicompost 25%	74
Vermicompost 50%	77
Vermicompost 75%	85

A study published in the journal "Scientific Reports" in 2021 found that mung bean seeds treated with vermicompost had a higher germination rate, larger seedlings, and increased biomass compared to seeds treated with conventional fertilizers or no fertilizer at all Sharma *et al.*, (2021) [7]. Vermicompost is rich in organic matter, nutrients, and beneficial microorganisms. When used as a seedbed or seedling substrate, it can improve the germination rate of mung bean seeds compared to traditional soil or other soil amendments. Atiyeh *et al.*, (2001) [8]. used this organic waste for growing marigold plants.

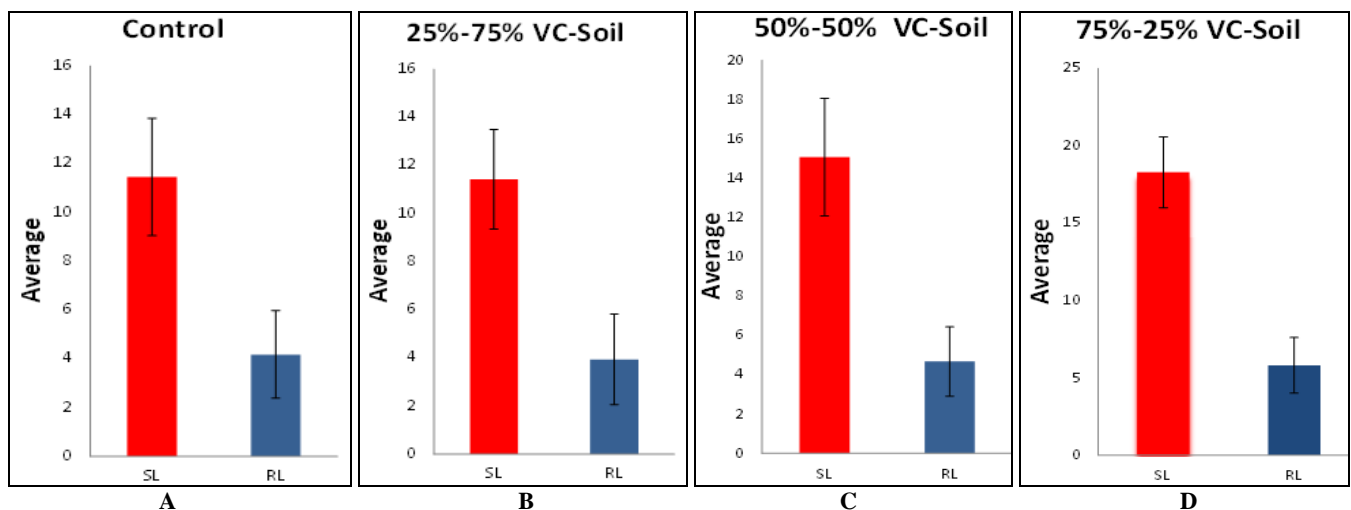
**Effect on Growth**

The growth of seedlings directly correlated with shoot and root length.

**Shoot and Root Length**

The shoot & root length of green gram have been recorded at 15 days seedlings, grown in pots with different ratios of soil and vermicompost. It was observed that shoot length was highest in 75/25 % treatment.

The columns in the graph indicate the average shoot and root length of mung bean seedlings germinated with different ratios of soil and vermicompost. It was observed that shoot and root length in all treatments deferred from the control. The mean shoot and root lengths of the mung bean seedlings in 25/75 VC-soil treatment (Graph B) was almost equal to that of control (Graph A) but values were higher in 50/50 (Graph-C) and 75/25 (Graph- D) vermicompost and soil treatment. These were (3.61 SL,0.5 RL) and (6.8 SL,1.6 RL cm.) respectively and differed from the control statistically that was 11.45 and 4.18 cm. The higher values show that high quality organic compost is useful for seedling growth. Nutrients present in organic compost have great positive effect on seedling growth of mung bean. It is recognized that adding organic matter to a growth medium improves soil functioning, with complex but generally positive effects on plant growth Murphy (2014) [9]. The increase in yield suggests that vermicompost is an efficient mean to increase crop yield in agriculture, confirming the results of former non-quantitative reviews Chaudhary *et al.*, (2004) [10], Lazcano and Domínguez (2011) [11]. Vermicompost contains a combination of macro- and micro-nutrients and the uptake of the nutrients has a positive effect on plant nutrition, growth, photosynthesis and chlorophyll content of the leaves Rekha *et al.*, (2018) [12].



## Conclusion

The study aims to determine the effect of vermicompost on the germination of mung bean seeds. Vermicompost is a type of organic fertilizer that is produced through the action of earthworms on organic waste materials. It is known to improve soil quality and plant growth due to its high nutrient content and beneficial microorganisms. Mung beans are a common crop used to study the effects of vermicompost on seed germination and plant growth. Vermicompost application improved mung bean seed germination by enhancing seedling growth and increasing the soil's nutrient content. The study also found that vermicompost improved the soil's microbial activity, which contributed to the enhanced plant growth.

Therefore, the researchers concluded that vermicompost greatly affects the growth of mung beans. The pure vermicompost offers an array of nutrients for the growing plants. Furthermore, it is recommended that vermicompost be used as an organic fertilizer to plants. Food waste could be seen as an opportunity to develop vermicomposting, since one quarter of the food produced each year is never consumed Kummu *et al.* (2012) [13].

Another study published in "The Journal of Plant Nutrition" in 2020 found that vermicompost application increased the number of branches, leaves, and pods of mung bean plants, as well as their nitrogen and phosphorus uptake Bhat *et al.* (2020) [14].

These findings suggest that vermicompost can be a valuable tool for improving the growth and yield of mung bean crops. However, it is important to note that the optimal dosage and application method of vermicompost may vary depending on the specific soil and environmental conditions of each farm or garden.

**Future Scope:** Research indicates that the use of vermicompost not only improves the growth parameters of mung beans but also enhances their yield. The organic matter and microorganisms present in vermicompost can stimulate growth and improve plant health. Vermicomposting has a promising future as a sustainable agricultural practice. It is not only effective in nutrient recycling but also reduces reliance on chemical fertilizers, making it a cornerstone for sustainable agricultural practices. With an increasing trend towards organic and sustainable farming, the demand for vermicompost could see significant growth in the Indian market. This presents opportunities for businesses and entrepreneurs to invest in vermicompost production.

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