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Effect of Vermicompost on seed germination and vegetative growth in wheat crop (*Triticum aestivum)* in Malwa region of M.P.

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Abstract

The environmentally pure organic fertilizer vermicompost, made from earthworm activity, improves soil fertility and crop yield by providing balanced nutrients, humic compounds, and helpful bacteria. In this study,weed biomass from *Cassia tora, Cassia occidentalis, Alternanthera* spp., *Achyranthus aspera, Parthenium hysterophorus,* and *Lantana camara* was utilized to prepare vermicompost during the 2024–25 season in Shajapur, Madhya Pradesh. Its effects on seed germination and vegetative growth of wheat (Triticum aestivum var. WH-147) were evaluated in glass petri plates under controlledconditions. Results revealed significantly higher seed germination (80%) in vermicompost-treated soil compared to control (50%). Vegetative growth improved markedly, with average shoot and root lengths of 51 cm and 8 cm, respectively, versus 30 cm and 2 cm in control for 60 days treatment. Biomass accumulation was also enhanced, with fresh weight (2.3 g/plant) and dry weight (0.5 g/plant) exceeding control values (0.6 g and 0.25 g/plant) for 30 days treatment. Thus, vermicompost prepared from invasive weeds effectively promotes wheat growth and productivity.

Keywords: vermicompost, weed biomass, seed germination, vegetative growth, Biomass accumulation

Introduction

Vermicompost is an ecologically pure organic fertilizer, the product of processing manure with assistance of technological earthworm startle (Walia & Kaur, 2024). This concentrated fertilizer contains the whole balanced complex of essential nutrient and micro-elements, enzymes, soil antibiotics, vitamins, growth promoting hormones (Ma et al., 2022). It also contains a lot of humic substances. Vermicompost is a unique microbiological fertilizer with the community of useful soil microorganism improving soil fertility. Vermicompost does not contain pathogenic microflora, helminth eggs, weed seeds and heavy metals (Tian et al., 2024; Wu et al., 2023).

Vermicompost improves agro chemical characteristics, increases quality and yield of agricultural crops. Vermicompost quickly restores natural soil fertility, improves its structure and health. It is highly effective, plants and seeds immediately response to it. It reduces seed germination period, promotes plant growth and blossom, fruits ripen 2-3 weeks earlier (Çirka et al., 2022). Vermicompost provides plants with durable immunity, increasing their resistance to stress, unfavourable environmental conditions, bacterial and putrefactive diseases (Ahmad et al., 2024; Sivasabari et al., 2023). It also provides high seedlings survival, optimum growth of flower and full blossom. Vermicompost considerably increases yield capacity and improves taste of the product grown. Vermicompost is in fact the castings or coprolites of earth worm. It is a black crumby soil like matter smelling pleasant and looking like black earth.

Vermicompost contains a great amount (up to 32% per dry weight) of humic substances humic and fulvic acid, humates (Keskin et al., 2025). The organic fertilizer is provided with high agrochemical and growth stimulant characteristics. All nutrients are balanced and biologically available compounds for plants. Move over it contains a unique community of useful soil and plant microorganism. When vermicompost is applied they inhibit soil, excrete phytohormons antibiotics, fungicides and antibacterial compounds that help control pathogenic microflora (Nonthapa et al., 2024). Eventually soil is improved and many wide spread plant diseases are eliminated. From earlier studies also it is evident that vermicompost provides all nutrients in readily available form and also enhances uptake of nutrients by plants.

The production of degradable organic waste and its safe disposal becomes the current global problem. Mean while the rejuvenation of degraded soils by protecting top soil and sustainability of productive soils is major concern at the international level. Provision of a sustainable environment in the soil by amending with good quality organic soil additions enhances the water holding capacity and nutrient supplying capacity of soil and also the development of resistance in plants to pests and diseases(Al-Maamori et al., 2023).They serve as “Nature’s ploughman” and from nature’s gift to produce good humus, which is the most precious material to fulfil the nutritional needs of crops (Kumar et al., 2023). We can increase the diversity and growth of microbes by preparing vermicompost by utilizing some weed species (Pradhan et al., 2025) like *Casia tora, Casia oxidentalis, Alternanthera* spp., *Achyranthus aspera, Parthenium hysterophorous, Lantana camara*. It has been attributed to the additional availability of N, P, and K nutrients in the soil due to the application of organic manures and also the conversion of unavailable forms of nutrients into available forms (Kumar et al., 2024).

The following weed species were used in this study to make vermicompost: *Cassia tora, Cassia occidentalis, Alternanthera spp., Achyranthus aspera, Parthenium hysterophorus,* and *Lantana camara*. This was done during summer and rainy seasons of the 2024-25 session.

We collected weed biomass by cutting wasteland, grassland, and the sides of roads in the local area of the city Shajapur Madhya Pradesh. A mixture of vermicompost and weed biomass from several species was made. These species include *Casia tora, Casia oxidentalis, Alternanthera spp., Achyranthus aspera, Parthenium hysterophorus,* and *Lantana camara*.

Wheat is common crop in Malwa reason so response of this vermicompost on this crop was observed comparatively. Thus these hazardous weeds species can be utilized in vermicomposting method for management of weed problem and significant observations were occurred by the application of prepared Vermicompost on selected crop during this investigation. The utilization of vermicompost has resulted in several benefits to farmers, industries, environments and over all national economy (Katiyar et al., 2023).

In present investigation we analysed the Effect of prepared Vermicompost on seed germination and vegetative growth in wheat crop (*Triticum aestivum)* in Malwa region of M.P.The Wheat variety **WH-147**is commonly grown in this area has been taken for bioassay.The following parameters were selected for bioassay –

1. Percentage Seed germination
2. Shoot and Root length
3. Fresh and Dry weight (Biomass)

Materials and Methods

The selected weed species were used in the preparation of Vermicompost: viz. *Cassia tora, Cassia occidentalis, Alternanthera spp., Achyranthus aspera, Parthenium hysterophorus,* and *Lantana camara*. This was done during summer and rainy seasons of the 2024-25 session. In this study we used the method developed by for vermicomposting (Rajkhowa, D.J.,et al.,2005).

We collected weed biomass by cutting wasteland, grassland, and the sides of roads in the local area of the city Shajapur Madhya Pradesh. A mixture of vermicompost and weed biomass from several species was made. These species include *Casia tora, Casia oxidentalis, Alternanthera* spp., *Achyranthus aspera, Parthenium hysterophorus,* and *Lantana camara*. **Selection of agronomic crops** –

(b) *Triticum aestivum var.*WH-147 (Wheat)-

Wheat is grown on more land area than any other commercial crop and is the most important staple food for humans. World trade in wheat is greater than for all other crops combine Globally, wheat is the leading source of vegetable protein in human food, having a higher protein content than either maize (corn) or rice, the other major cereals.

After preparation of vermicompost the effects of this compost on seed germination and vegetative growth ofWheat (***Triticum aestivum var.*WH-147**) as rabi crop was studied in its particular season . Wheat seed were purchased from local market of Shajapur and used in the experiment.

Determination of seed germination was observed in petriplates which were filled with mixture of soil and vermicompost along with control. Two petriplates were used to determine the germination percentage of seed in vermicompost treatment and control. Hence, a total of 10 petriplates were used for two treatments. Each petriplate was filled with treatment mixture. 10 seeds were sown in each petriplate at a depth of 1 cm and kept at 25 -28 °C in incubator. Percentage seed germination was observed by direct count method.

Study of agronomic effects-

Two plots were prepared in size of 1m², one plot for vermicompost treated soil and one plot for control. Seeds of Wheat Were sown in these plots and following observations were taken at the interval of 15 days.

Shoot Length, Root Length, Fresh weight and dry weight of plant –

Height of plant was reported as shoot and root length by standard scale and biomass calculation was done by fresh and dry weight method with the help of weighing machine. Five plants were randomly selected from each plot for observation of height and biomass of plant.

Results and Discussion

Effect of Vermicompost on Wheat crop –

Percentage Seed germination -

Table-1. Effect of Vermicompost on Seed germination of Wheat.

S.No.	Treatment	Percentage germination / day									
		1	2	3	4	5	6	7	8	9	10
1	Control	0	20	20	20	30	40	40	40	40	50
2	Vermicompost	0	50	50	60	60	70	80	80	80	80

Prepared vermicompost enhances percentage seed germination in selected crop. Comparatively high percentage of seed germination (80%) occurred in vermicompost treated soil as compared to control (50%) as showed in fig.1. Thus percentage seed germination significantly increased in vermicompost treated soil in comparison to control.

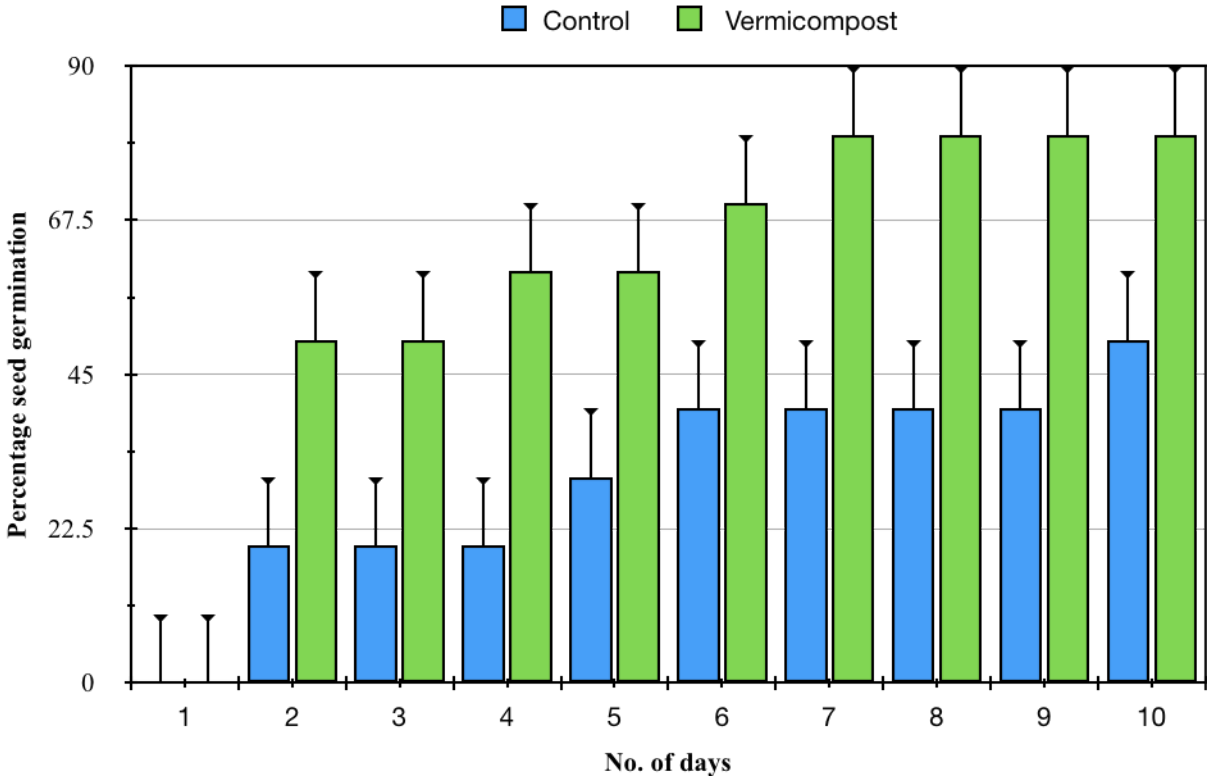

Figure 1. Effect of Vermicompost on Seed germination of Wheat.

Table-2 Effect of Vermicompost on Shoot length of wheat.

S.No.	No. of Days	Average length of shoot (cm.)	
		Control	Vermicompost
1	15	8	16
2	30	10	20
3	45	18	31
4	60	30	51
5	75	47	72

Table-3 Effect of Vermicompost on Root length of Wheat

S.No.	No. of Days	Average length of Root (cm.)	
		Control	Vermicompost
1	15	1	3
2	30	1.5	4
3	45	2	6
4	60	2	8
5	75	3.5	9

There is also a large variation in the effects of vermicompost depending on the plant species or even the variety considered. This was observed in tomato plants where the replacement of a fertilized commercial potting media with vermicompost had different effects on germination, seedling elongation, biomass allocation, fruit morphology and chemical properties of three tomato varieties (Jankauskienė et al., 2022; Yıldırım & Yılmaz, 2023).

Vegetative growth –

The vegetative growth of selected crop significantly increased after the treatment of soil by prepared vermicompost. Highest average shoot length (51 cm) and root length (8 cm) of 60 days old Wheat plant was recorded in vermicompost treated soil (1 m^2 plot) incomparison to control (30 cm and 2 cm)respectively as showed in fig.2&3. Thus vermicompost promotes the shoot and root length in wheat plants over the control.

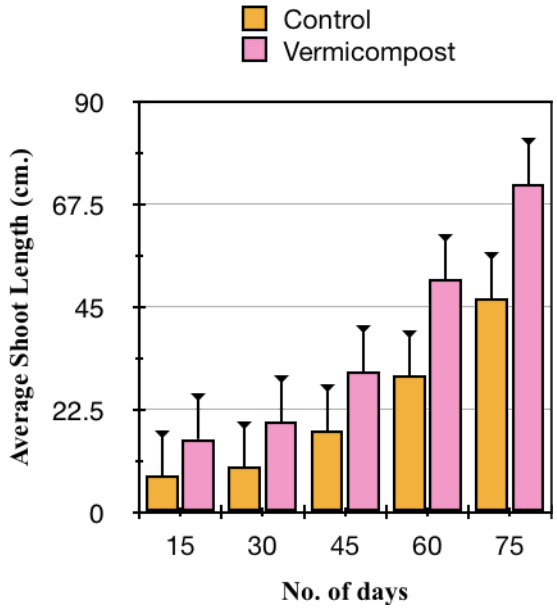

Fig. 2

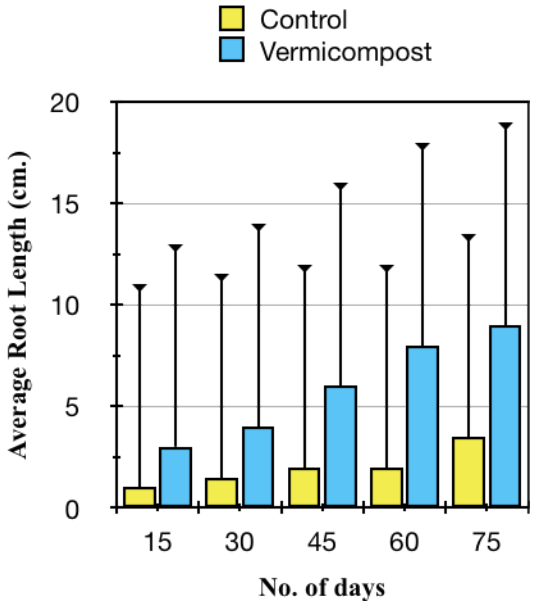

Fig. 3

Figures- 2 & 3 showed the average shoot and root lengths in c.m.

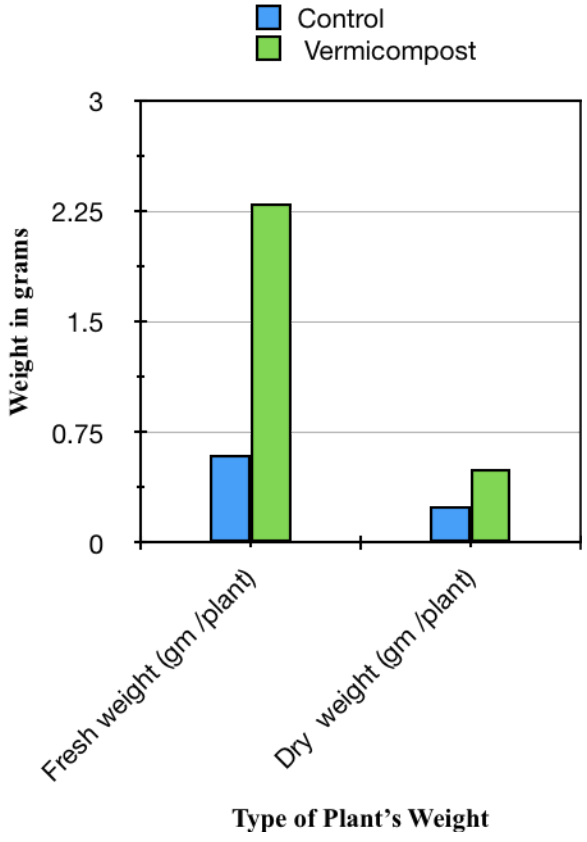

Fig. 4

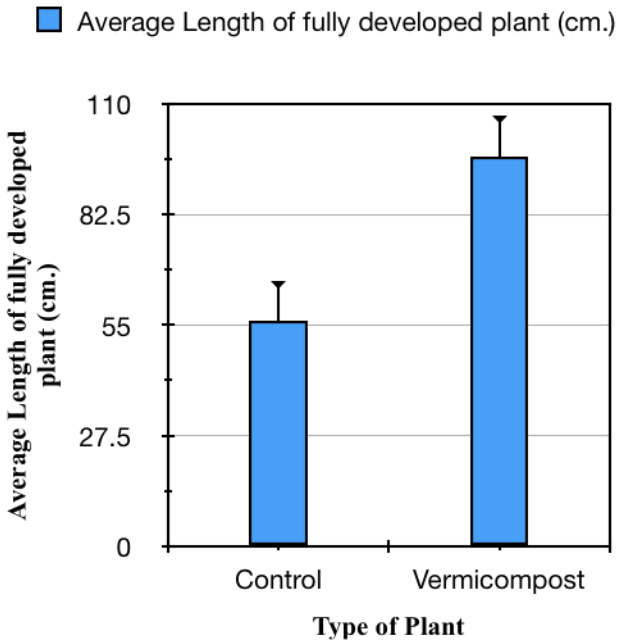

Fig. 5

Figure- 4 showed the comparative fresh and dry weight of control and vermicompost treated soil plants and Fig. 5 showed the average length of fully developed plant

According to the findings showed in figures 4 & 5 the maximum biomass as fresh (2.3 gm /plant) and dry weight (0.5 gm /plant) of 30 days old plants of wheat was observed in vermicompost treated soil and minimum was in control (0.6 gm/plant and 0.25 gm per plant). The results were shown in table 2-5 also. Thus, plant biomass is also significantly increased in vermicompost treated soil in comparison to control (Hassan et al., 2022; Yıldırım & Yılmaz, 2023).

Conclusion

In the present study we selected obnoxious weeds of this area for preparing vermicompost and investigated its effect on seed germination and vegetative growth of wheat crop in Malwa region of Madhya Pradesh. The green biomass of the weeds can be recycled by the method of vermicomposting which will avoid their allelopathic, toxic, poisonous effect and render the soil fertile. By the process of vermicomposting the vermicompost produced is nutrient rich natural fertilizer.

Thus it is clear that the vermicompost of local weeds enhance the quality of soil by increasing microbial activity and microbial biomass. By the vermicomposting process there is a safe disposal of waste biomass in to highly rich manure and is a step towards sustainable development by utilizing weed waste in to black gold. This clearly indicates that the vermicompost of local weeds, enhances the vegetative growth and seed germination of Wheat crop in the Malwa region of Madhya Pradesh.

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