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Research Article

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Utilization of three obnoxious weeds (*Parthenium hysterophorus, Lantana camara* and *Eichhornia crassipes)* through vermicomposting and their response on vegetative growth of Soybean crop.

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Abstract

In the present study, three major obnoxious weed species of this area *viz- Parthenium hysterophorus, Lantana camara* and *Eichhornia crassipes* were selected for vermicomposting. Vermicomposting was performed in shadow area at botanical garden of govt. Madhav Science P.G. College, Ujjain (M P). After preparation of all three types of vermicomposts, the effects of these composts on vegetative growth of Soybean (*Glycin max* var. JS-9560) were studied in its particular seasons. Studied parameters of vegetative growth were increased significantly in all the three vermicomposts in comparison to control.

Keywords: Vermicomposting, *Parthenium hysterophorus*, Soybean, *Lantana camara*, weeds, *Eichhornia crassipes.*

Introduction

Several weed species have been introduced in to country in the past, many as contaminants in food or grain imports. Some of them have found the condition favorable and have spread far and wide with serious consequences. Invasive alien species have many negative impacts on human economic interests. Weeds reduce crop yields, increase control costs, and decrease water supply by degrading water catchments areas and freshwater ecosystems (Mooney *et al.*, 2005). Major weed invasions change the natural diversity and balance of ecological communities (Ricciardi *et al.*, 2000).

These weeds affect biodiversity and some seriously impair health and productivity. Some of the major alien invasive weeds include *Lantana camara, Parthenium hysterophorus and Eichhornia cresipes, Prosopis juliflora, Cyperus rotundus and Cynadon dactylon* etc. In India, there are huge amount of unwanted plants, which have shown their alarming growth and are spreading very fast in the cultivated lands, pastures, grasslands and forests. Lantana and congress grass are the most problematic, obnoxious, poisonous weeds, which not only menace to agriculture but also cause human and animal health hazards (Gujral and Vasudeven, 1983; Kohli and Rani, 1994).

Vermicomposting is one of the fastest and effective ways to recycle organic material into vermicompost high quality manure with the aid of earthworms. Vermicompost is a valuable soil amendment, which replaces the chemical fertilizers, stimulates plant growth and prevents plant diseases, besides increasing the quality of the produce (Singh and Rai, 1998).

It has been well established that epigeic forms of earthworms can hasten the composting process to a significant extent depending on the starting material, with production of better quality of compost as compared with those prepared through traditional methods of composting (Kale, 1992; Chowdappa *et al.*, 1999).

Photoplate 1. *Parthenium hysterophorus* obnoxious weed species highly growing on- wastelands, grasslands and road sides (Ujjain – Dewas road).

All toxic weeds like *Eichhornia*, *Parthenium* and *Lantana* are creating serious problem and health hazard for human being and our environment. Hence the control of these toxic weeds is most necessary for healthy environment. The control at present is mainly done by mechanical removal and herbicides are effective but these are not favorable as it has many negative implications. Herbicides are dangerous chemicals for all organisms and our environment. The residual effects of different herbicides have been bioassay. The herbicides have detrimental effects on soil, crop, earthworms and human being. The complete eradication of weeds is very difficult and costly without further use of their biomass. The green matters of these weeds have tremendous potential for being used as organic manures. The direct incorporation of their green matter in soil causes poor germination of seed and reduction in crop yield. However, the recycling of these weeds as composted manures is the only way to avoid their allelopethic, toxic, poisonous pollution effect leading to their optimum use (Sharma *et al.*, 2008).

In Madhya Pradesh, Parthenium & *Lantana* grow as weeds in wasteland, grassland & forests. Aquatic weed *Eichhornia* grows luxuriantly in many fresh water bodies as weed. Although *Parthenium* is a toxic weed it can be used for many purposes such as compost and green leaf manure (Biradar *et al.*, 2006). *Chromolaena ordorata* is an obnoxious weed fastly spreading in western ghat region is also useful in composting (Angadi *et al.*, 1977). Therefore the use of these weeds for preparation of vermicompost through vermicomposting is suitable method of their control and utilization.

Materials and Methods

Vermicomposting was done according to the method proposed by Rajkhowa *et al.*, (2005). It was performed in shadow area at botanical garden of Madhav Science P.G. College, Ujjain (M. P.).

Weed biomass of *Lantana camara*, *Parthenium hysterophorus* was collected from wasteland, grassland and road side of local area of city by cutting. Biomass of *Eichhornia crassipes* was collected from various local ponds of the city. Three types of vermicomposts were prepared separately by utilizing these selected weeds *in* all three seasons (summer, rainy and winter). Three standard concrete tanks (with breadth 3 ft. and height 1.5-2.0 ft. of appropriate Length) were used for preparation of composts. 60:40 ratio was taken of weed biomass and cow dung respectively in the process.

Eisenia foetida (red wigglers) was used for vermicomposting. The earthworm was obtained from department of Microbiology at Govt. Madhav Sciences College, Ujjain (M.P.). Collected and heaped

the weeds biomass under sun for about 7- 10 days. Chopped the biomass required.

Cow dung slurry Sprinkled on the heap. Thin layer of surface soil (1-2 inch) at the bottom of the tank and fine bedding material such as partially decomposed cow dung and dried leaves over the soil was placed. Placed the chopped bio-waste and partially decomposed cow dung layer-wise in the tank up to a depth of 1.5-2.0 ft. The bio waste: cow dung ratio was 60:40 on dry weight basis. Released about 2-3 kg earthworms over the mixture. Covered the compost mixture with dry straw. Sprinkled water as and when necessary to maintain 70-80% moisture content. Provided shade over the composts mixture to protect from rain water and direct sunshine. Stopped sprinkling of water when 80-98 % bio wastes was decomposed. Maturity could be judged visually by observing the formation of granular structure of the compost at the surface of the tank. Collected the vermicomposts by scrapping layer-wise from the top of the each tank and kept these under shade (Rajkhowa *et al.*, 2005).

After preparation of all three types of vermicomposts, the effects of these composts on vegetative growth of Soybean were studied in its particular seasons. Soybean seeds were purchased from local market of Ujjain and used in the experiment. Four plots were prepared in size of 1m², three plots for three types of vermicompost (Lantana vermicompost, Eichhornia vermicompost and Parthenium vermicompost) and one plot for control. Seeds of Soybean were sown in all the four plots and following observations were taken at the interval of 15 days.

1. Shoot Length of plant
2. Root Length of plant
3. Fresh weight of plant
4. 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. Data were statistically analyzed by Mean ± Standard Error (SE) using Microsoft Office Excel 2007.

Results and Discussion

Effects of vermicomposts on vegetative growth of Soybean crop

In all the three vermicomposts, studied parameters of vegetative growth were increased considerably. Highest Mean ± SE value of shoot length (43±0.450 cm) and root length (18±0.251 cm) of 60 days old soybean plants was recorded in *Lantana* vermicompost treated soil while lowest Mean ± SE value of shoot length (29±0.450 cm) and root length (10±0.208 cm) of 60 days old soybean plants was recorded in control (Table 1&2).

Table- 1. Effect of Vermicomposts on Shoot length of Soybean.

S. No.	No.of Days	Shoot length (cm.)			
		Control	Eichhornia Vermicompost	Parthenium Vermicompost	Lantana Vermicompost
1	15	10.16±0.528	12.7±0.650	12.2±0.519	17.7±0.493
2	30	18.4±0.750	20±0.493	25.3±0.753	25±0.450
3	45	26±0.493	35±0.500	38±0.416	39±0.378
4	60	29±0.450	38±0.472	41±0.450	43±0.450
5	75	32±0.351	41±0.450	44±0.483	48±0.351

Data are given in Mean ± SE of three replicates.

Table- 2. Effect of Vermicomposts on Root length of Soybean.

S. No.	No.of Days	Root length (cm.)			
		Control	Eichhornia Vermicompost	Parthenium Vermicompost	Lantana Vermicompost
1	15	2±0.378	3±0.435	5±0.208	6±0.416
2	30	4±0.208	5±0.208	6±0.416	8±0.400
3	45	6±0.408	8±0.408	10±0.208	12±0.838
4	60	10±0.208	15±0.351	17±0.305	18±0.251
5	75	12±0.378	16±0.351	18±0.305	20±0.351

Data are given in Mean ± SE of three replicates.

Maximum average shoot length and root length of 60 days old soybean plants was reported in *Lantana* vermicompost treated soil in comparison to other two treatments. However in all three composts, plant length was increased significantly in comparison to control (Fig. 1 & 2). Maximam fresh weight (8.76 gm / plant) and dry weight (1.7 gm /plant) of soybean plants was observed in *Lantana* vermicompost (Table 3&4).

Photo plate 2. Vegetative growth of 30 days old - Soybean plants in Lantana Vermicompost (LVC).

Photo plate 3. Vegetative growth of 30 days old - Soybean plants in Parthenium Vermicompost (PVC).

Photo plate 4. Vegetative growth of 30 days old - Soybean plants in Eichhornia Vermicompost (EVC).

Photo plate 5. Vegetative growth of 30 days old - Soybean plants in control.

Mean ± SE value of shoot length, root length, fresh weight and dry weight of 60 days old soybean plants was reported as 41±0.450, 17±0.305, 9.5±0.0141 and 1.8±0.044 respectively in Parthenium vermicompost treated soil. While mean ± SE value of shoot length, root length, fresh weight and dry weight of 60 days old soybean plants was reported as 38±0.472, 15±0.351, 8.4±0.151 and 0.92±0.034 respectively in Eichhornia vermicompost treated soil.

Results of studied parameters indicate that Lantana vermicompost and Parthenium vermicompost are more beneficial vermicomposts in comperision to *Eichhornia* vermicompost for increase the vegetative growth of soybean plants (Fig. 1, 2, 3 & 4). However vegetative growth of soybean plants significantly increased in all three vermicomposts over the control. Similar positive effects of vermicompost from various sources on general plant growth, fruit setting and root formation were observed by Subler *et al*., 1998; Atiyeh *et al.*, 2002; Arancon *et al.*, 2005. A number of field experiments have reported positive effects of quite low application rates of vermicomposts to field crops. When cabbage was grown in compressed

blocks made from pig waste vermicompost, after transplanting to the field they were larger and more mature at harvest compared to those grown in commercial blocking material (Edwards and Burrows, 1988).

Table- 3. Effect of Vermicomposts on Fresh weight of Soybean.

S. No.	No.of Days	Fresh weight in gm/plant.			
		Control	Eichhornia Vermicompost	Parthenium Vermicompost	Lantana Vermicompost
1	15	1.8±0.152	4.9±0.230	6.85±0.141	8.16±0.378
2	30	2.1±0.144	5.3±0.351	7.23±0.416	378 ±0.208
3	45	2.6±0.321	6.4±0.360	8.6±0.305	9.8±0.321
4	60	4.6±0.230	8.4±0.151	9.5±0.0141	11.6±0.144
5	75	6.2±0.251	9.7±0.341	11.2±0.351	14.8±0.400

Data are given in Mean ± SE of three replicates.

Table- 4. Effect of Vermicomposts on Dry weight of Soybean.

S. No.	No.of Days	Dry weight in gm/plant.			
		Control	Eichhornia Vermicompost	Parthenium Vermicompost	Lantana Vermicompost
1	15	0.32±0.015	0.85±0.037	0.91±0.035	1.3±0.020
2	30	0.41±0.020	0.92±0.034	1.2±0.023	1.7±0.045
3	45	0.49±0.036	0.98±0.032	1.6±0.045	1.9±0.040
4	60	0.51±0.030	1.3±0.026	1.8±0.044	2.3±0.014
5	75	0.86±0.043	1.8±0.025	2.2±0.041	2.9±0.026

Data are given in Mean ± SE of three replicates.

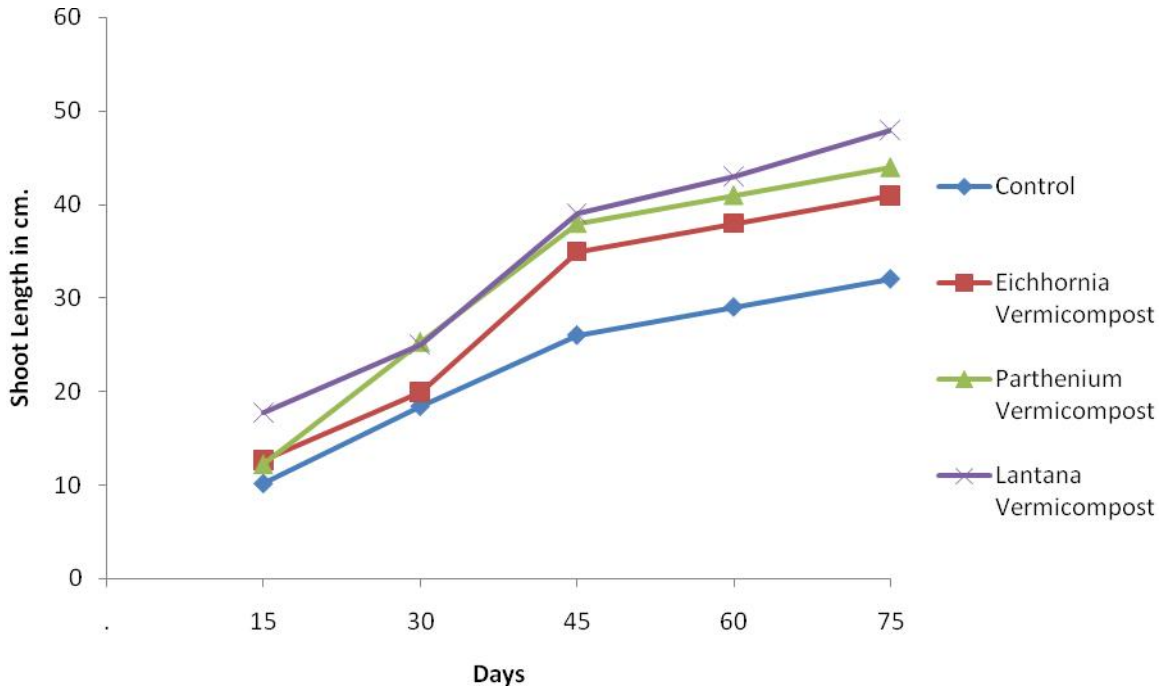

Figure- 1. Effect of Vermicomposts on Shoot Length of Soybean.

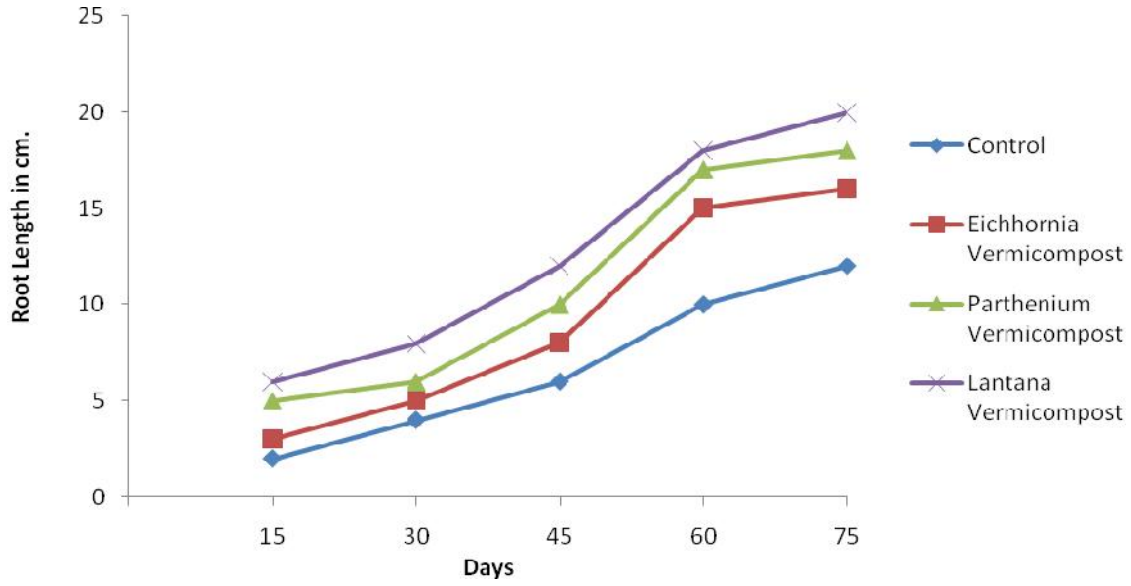

Figure- 2. Effect of Vermicomposts on Root Length of Soybean.

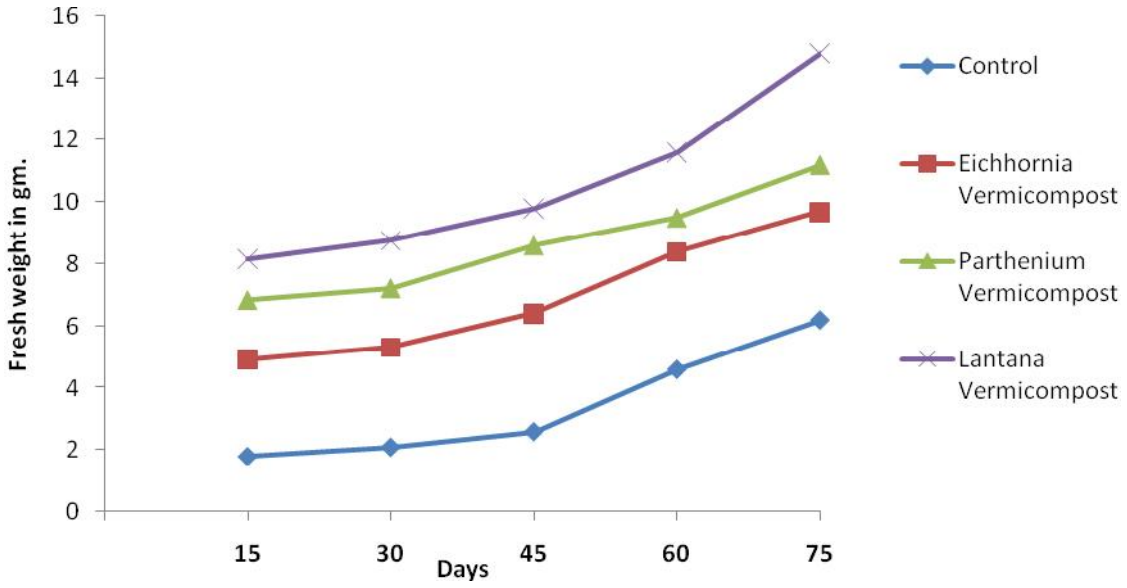

Figure- 3. Effect of Vermicomposts on Fresh weight per plant of Soybean.

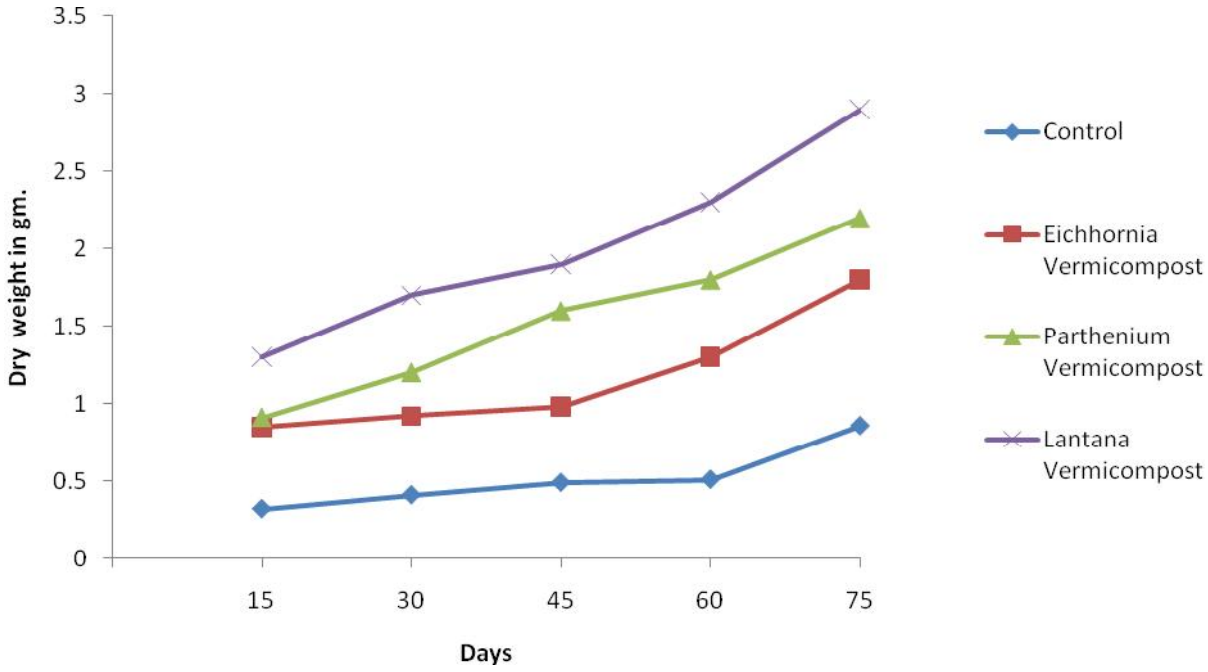

Figure- 4. Effect of Vermicomposts on Dry weight per plant of Soybean.

In a field experiment applying cassava peel mixed with guava leaves and vermicomposts from poultry droppings, Mba (1983) reported more shoot biomass and increased seed yields of cowpeas. Wormcasts are a resource that may be used in agriculture because of their effects on nutrient dynamic and the physical structure of soil may significantly enhance plant growth and conserve better soil status (Lee, 1985). Arancon *et al.* (2002) reported significantly increased growth and yields of field tomatoes (*Lycopersicon esculentum*) and peppers *(Capsicum anuum grossum*) when vermicomposts, produced commercially from cattle manure, food waste or recycled paper, were applied to field plots at rates of 20 t/ha and 10 t/ha in 1999 and at rates of 10 t/ha and 5 t/ha in 2000 compared with those receiving equivalent amounts of inorganic fertilizer. In present study highest vegetative growth of Soybean was reported in *Lantana* vermicompost in comparison to the *Parthenium* and *Eichhornia* vermicomposts. Although vegetative growth of Soybean was significantly increased in all three types of prepared vermicomposts in comparison to control.

Conclusion

The results of studied parameters clearly indicate that the vermicomposts of these weeds are beneficial and useful for the growth of Soybean crop. Thus it is clear that the vermicomposts of these three weeds enhance the quality of soil. It is a better option over composting as earthworms enhance the process of waste conversion and produce a better product. It improves the physico-chemical and biological properties of the soil. By this 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.

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