# Effect of compost of *Parthenium hysterophorus* on growth and yield of wheat (*Triticum aestivum*): A comparative study

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**Abstract:** In last few decades, our planet Earth is facing an extreme pressure due to ever increasing population and resulting in a higher food demand. On the other side, weeds are adding to this problem. *Parthenium hysterophorus* is also such a weed that should be managed properly to maintain the balance of the ecosystem. In present days, a newer ecofriendly approach is used for managing *Parthenium* weed by preparing its compost. The compost of *Parthenium hysterophorus* weed was prepared using the **Vishishta** composting method. The effect of the compost of *Parthenium* weed and inorganic fertilizer was seen on yield of wheat crop (*Triticum aestivum*). Productivity of wheat has been seen and a comparative study was made under three different conditions. These are (i) An area, where the *Parthenium* compost was used as an external nutrient source, (ii) An area, where an inorganic fertilizer was used as an external nutrient source and (iii) An area, which is unfertilized i.e. no external nutrient source was used. It was observed that the compost of *Parthenium hysterophorus* weed gave good results in yield of wheat (*Triticum aestivum*).

[Satish Kumar Ameta, Paras Tak, Rakshit Ameta, Suresh C. Ameta. **Effect of compost of *Parthenium hysterophorus* on growth and yield of wheat (*Triticum aestivum*): A comparative study.** *J Am Sci* 2016;12(10):34-37]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). http://www.jofamericanscience.org. 5. doi:10.7537/marsjas121016.05.

**Key Words:** Allelochemicals, compost, environment, food, health, nutrients, *Parthenium*, seed, weed, wheat

## 1. Introduction

Weed problems have become more noticeable and prominent with the increase in the use of inputs like seeds of high yielding varieties, fertilizer and irrigation. These inputs help in good growth of weeds, in cropped areas; thereby, causing severe competition between crops and weeds. It is known that weeds compete with crop plants for light, air, moisture and nutrients. But the full extent of harm caused by them and their direct effects on crop fields, are not generally realised in economic sense. Of the total annual loss of agricultural produce from various pests in India, weeds roughly account for 37%, insects for 29%, diseases for 22% and other pests for 12% (Yaduraju, 2006).

Invasive plant species i. e. *Parthenium* weed has the potential to damage our crops, industries, environment and public health and hence, scientists, academics, leaders of industry and land managers are realizing that such invasive species are serious environmental threats for the 21st century (Masum et. al, 2013). *Parthenium* is one of the most problematic, obnoxious and toxic weed, which not only menace to agriculture but also cause human and animal health hazards (Kohli and Rani, 1994). It is an annual herb, erect with up to 1 m in height. The plant was accidentally introduced in India along with food grain imported under PL-480 (Public Law 480 passed in 1954 to give food, grains to developing countries). *Parthenium hysterophorus* has got a position among the list of top ten worst weeds of the world and has been listed in the global invasive species database (Callaway and Ridenour, 2004).

The non-nutritional secondary metabolites produced by an organism of one species affect the growth and population biology of individuals of other species are known as allelochemicals (Minorsky, 2002; Callaway and Ridenour, 2004). These allelochemicals impose environmental stress on other plants growing in their vicinity. The allelopathic nature of this weed has been well documented and water soluble phenolics and sesquiterpene lactones have been reported from the roots, stems, leaves, inflorescences, pollens and seeds (Evans, 1997). The sesquiterpene lactones namely parthenin and coronopilin present in the trichomes of leaves and stems of *Parthenium*, are responsible for causing various allergies like contact dermatitis, hay fever, asthma and bronchitis in human beings (Wiesner et al., 2007; Kapoor, 2012). *Parthenium,* is a prolific seed producer and a fully grown plant, which can produce more than 15,000 seeds in its lifetime (Dhileepan and Strathie, 2009).

*Parthenium* has the ability to germinate and establish at any time of the year with good rainfall and warm temperature (Navie et al., 1996; Tamado et al., 2002). The germination rate of *Parthenium* weed seeds was also significantly faster than that of all other species present (Prasad, 2007). Management of *Parthenium* weed is also possible by its utilization.

Some of the potential uses of *Parthenium* are as a potential source of herbicide (Tefera, 2002), antimalarial action (Anonymous, 2003), Antibacterial activity (Fazal et al., 2011), anticancer activity (Pandey et al., 2012) and in fuel production (Swati et al., 2012).

It is necessary to control the problematic weed *P. hysterophorus* in time before spreading, because of its adverse impacts on natural and agro ecosystem. There are several methods available for controlling the *Parthenium* weed such as mechanical and cultural control, chemical and biological control and managing the weed by proper utilization. The available chemical or mechanical control measures are neither feasible nor economical. The biological methods have also some limitations and therefore, the weed management strategy needs to be shifted towards certain effective non-chemical methods. An eco-friendly and economically sustainable management of *P. hysterophorus* is thus necessary to protect and conserve our environment. Composting might be a useful alternative to convert biomass from this species to a useful material that could be used as soil conditioner (Anbalagan and Manivannan, 2012; Jelin and Dhanarajan, 2013).

Depletion of non-renewable sources of energy, escalating cost of fertilizers and environment quality aspects made it mandatory to the review various approaches focusing on the use of available renewable sources of plant nutrition for sustainable agricultural production. Composting effectively reduces the viability of the weeds and allows for the safe reuse of the nutrients and organic matter contained in the weed material, if managed properly i.e., by controlling them through utilization as green manure and composting indirectly (Balasubramanian et al., 1972, Gaur et al. 1973). Ambasta and Kumari (2013) used a method for preparing compost from *Parthenium* weed by using a pit of size 3 × 6 × 10 feet (depth × width × length). *Parthenium* weed was spread on the bed of pit with some addition of *Trichoderma viride* (fungi cultured powder), phosphate rock, water etc. The process is repeated as level rises to 1 meter height. Well decomposed *Parthenium* compost was obtained within 4 to 5 months. Many other scientists prepared compost of *Parthenium* as well using composting, vermicomposting and other methods (Ameta et al., 2016; Anbalagan et al., 2012; Sivakumar et al., 2009; Senthilkumari et al., 2013; Apurva et al., 2010; ).

*Parthenium* compost is a good source of nitrogen as it consist 3 times more nitrogen than simple farm yard manure (Ameta et al., 2016a). Therefore, farmers with limited resources and others could also make use of the high nutrient contents of *Parthenium* compost and could control this weed by composting (Wakjira et al., 2009).

## 2. Materials and Method

### 2.1 Materials

*Parthenium* compost, wheat seeds, inorganic fertilizer, etc.

### 2.2 Methodology

A total of 30 plots of size 210 x 270 $cm^2$ were prepared in the field for growing wheat seeds for making a comparative study. *Parthenium* compost prepared by Vishishta composting method (Ameta et al., 2016b) was applied in the 10 replicates, an inorganic fertilizer was applied in 10 replicates and remaining 10 replicates were left unfertilized i.e. means no external nutrient source was used in them (Fig. 1). Then wheat seeds were sown in it and growth and productivity of wheat crop was seen.

**Fig. 1:** *Parthenium* compost applied in the plot

## 3. Results and Discussion

**Fig. 2:** Wheat plants in unfertilized plot

An experiment for observing the effect of compost of *Parthenium hysterophorus* on seed germination and survival of radish (*Raphanus sativus*) had already been carried out by Ameta et al. (2015). They discussed and observed some positive things associated with *Parthenium* compost while using it in cropping. Effect of compost of *Parthenium* weed on wheat crop also gave some worthwhile results, which encourage its composting.

**Fig. 3:** Wheat plants in presence of inorganic fertilizer

**Fig. 4:** Wheat plants in presence of *Parthenium* compost

These are-

(i) Growth of wheat juveniles as well as plants was good enough as it was in the plot in which inorganic fertilizer was used.

(ii) Wheat plants in the plot, where no external nutrient source was provided were slightly yellowish, while in remaining two types of plots, they were intense green and looked healthy (Fig. 2-4).

Productivity of the wheat crop was almost same in two types of plots; first in the plots, in which *Parthenium* compost was used as an external nutrient source as well as in the plots, in which an inorganic fertilizer was used. But there is a significant difference (lowering in production) in the wheat productivity in the plot, which was left unfertilized.

Productivity of wheat in all 30 plots is reported in Table 1.

Percent of difference in wheat productivity between fertilized and unfertilized replicates can be calculated as-

$$\frac{(\text{Maximum} - \text{Minimum})}{\text{Minimum}} \times 100 \quad \ldots (1)$$

= 0.380 / 1.441 x 100

= 26.37%

**Table 1:** Productivity of wheat in all 30 plots

| Type of plot | Total quantity of wheat in all the 10 plots of a particular type | Average production of the wheat in one plot |
|---|---|---|
| *Parthenium* compost was used | 18.21 kg | 1.821 kg |
| Inorganic fertilizer was used | 18.20 kg | 1.820 kg |
| No fertilizer was used | 14.41 kg | 1.441 kg |

## 4. Conclusion

Although disadvantages of regular and repeated use of pesticides on ecosphere for destroying weeds are well known; however, the necessary steps have not been taken to the required extent. Therefore, use of environmentally friendly technologies for controlling weeds must be welcomed such as its composting for sorting out the solution to this problem. These findings encourage about using the compost of the weed as the productivity of wheat was about 125% as compared to the replicate, when no external nutrient source was used. Not only growth of the wheat plants was well, but the intense green colour of the plants also shows a positive effect of the compost on the growth of the crop.

## Acknowledgements

The authors wish to thank Mr. Chenram Ghayri for his help in the field work and Dr. Priyanka Ashiya, Mr. Manohar Lohar, Mr. Mukesh Chandra Ameta, Mr. Pankaj Ameta, Mr. Dipak Lohar, Mr. Dilip Lohar, Mr. Jayesh Jain and Mr. Anil Panchal for their encouragement and support during experiments.

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10/14/2016