A comparative analysis of an invasive alien weed *Parthenium hysterophorus* compost on growth and Yield of *Triticum aestivum*

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Abstract: Over the past few decades, our planet Earth has been facing immense pressure due to ever-increasing population and resulting increase in the demand for food. On the other hand, weeds are increasing this problem further. *Parthenium hysterophorus* is also a weed that must be properly managed to maintain the balance of the ecosystem. At present, a new eco-friendly approach is used for the management of Parthenium weed by composting it. The effect of *Parthenium hysterophorus* compost and inorganic fertilizer was observed on the yield of *Triticum aestivum*. *Triticum aestivum* productivity was observed and a comparative study was conducted under three different conditions. These are (i) one field, where parthenium manure was used as an external nutrient source, (ii) one field, where an inorganic fertilizer was used as an external nutrient source and (iii) one field, where no external nutrient source is used. It was observed that compost of *Parthenium hysterophorus* gave good results in the yield of *Triticum aestivum.*

Key Words: Allelochemicals, Parthenium, weed, compost, environment, food grain, nutrients, *Triticum aestivum*

1. INTRODUCTION

India is an agricultural country. Agriculture provides the principal means of livelihood for the majority of the Indian population. Out of the country's 328.72 million hectares geographical area, about 130 million hectares are cultivated. Desired crop production requires a healthy soil environment, which means it must contain all the necessary nutrients. Nutrients are used in significant quantities by growing plants and hence, they must be replaced periodically to maintain productivity and for this purpose, fertilizers are used in the fields. Plants require at least 16 elements for normal growth and to complete their life cycles. The elements used in greatest quantity are carbon, hydrogen and oxygen. These are non-mineral elements supplied by air and water. The other 13 elements are taken by plants from the soil in the form of minerals, otherwise they are definitely mixed in the form of fertilizers. But with the increase in the use of inputs such as high-yielding varieties of seeds, fertilizers and irrigation, weed problems have become more noticeable and prominent. These inputs help in good growth of weeds in crop fields; Thus, serious competition arises between crops and weeds. It is known that weeds compete with crop plants for light, moisture, air and nutrients. But the full extent of harm caused by them and their direct impact on crop fields, are usually not realised in economic sense. Invasive plant species such as *Parthenium hysterophorus* is an aggressive dominating weed in many parts of the world due to its allelopathic properties, which pose not only a threat to agriculture but also to human and animal health (Masum S. M *et al.*,2013; Bajwa *et al*., 2019). This plant was accidentally introduced in India along with food grains imported under PL-480 (Public Law 480 passed in 1954 to provide food grains to developing countries).

P. 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 (Callaway and Ridenour, 2004; Chitale, 2020). These allelochemicals impose environmental stress on other plants growing in their vicinity. Management of Parthenium is also possible by its utilization.

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

problematic weed *P. hysterophorus* in time before spreading, because of its adverse impacts on natural as well on agroecosystem. The parthenium weed can be managed using a variety of techniques, including mechanical and biological control, cultural and chemical control and appropriate weed management. The mechanical or chemical control methods currently in use are neither feasible nor economical. Since the biological methods have some drawbacks as well, the weed management strategy must be adjusted to include some efficient non-chemical methods. An eco-friendly and economically sustainable management of *P. hysterophorus* is thus necessary to protect and conserve our environment (Rai A., 2020).

Composting is an organic method of recycling used in the solid waste management process. In addition to stable organic compounds (such as humic compounds) and labile organic matter, compost also contains macro and micronutrients and a variety of microorganisms. The latter is an important source of food and energy for the soil food web. (Anbalagan and Manivannan, 2012; Jelin and Dhanarajan, 2013). Earlier research was carried out on use of different manures prepared from different weeds for increasing yield and quality of maize (Naikwade and Jadhav, 2011). Ameta et al (2016) proved that no Parthenium plant was germinated after application of compost, which may also encourage end users about its composting.

Parthenium compost is a good source of nitrogen as it consists three times more nitrogen than simple FYM (Muche, M. et al., 2022). 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; Chitale, R. D., 2020).

2. MATERIALS AND METHOD

2.1 Material Require

Parthenium compost, inorganic fertilizer, *Triticum aestivum* (wheat) seeds, etc.

2.2 Methodology

To conduct a comparative study, a total of thirty (210 x 210 cm^2) field plots were prepared for the purpose of growing wheat seeds. In ten replicates no external nutrients were applied considered as control. In ten replicates an inorganic fertilizer was applied, and in ten replicates parthenium compost was applied which made by the composting technique described by Chitale, R. D., & Mali, B. S (2020). After that, wheat seeds were sown there, and the growth and yield of the crop were regularly monitored.

3. RESULTS AND DISCUSSION

The effect of compost of *Parthenium hysterophorus* on seed germination and survival of *Triticum aestivum* was observed and compare with previous works. The previous researchers Wakjira M. *et al.* (2009) on lettuce, Ameta S. K. *et al.* (2015) on radish and Bajwa, A. A. *et al.* (2019) on rice etc shows some positive things associated with invasive weed *P. hysterophorus* compost while using it in cropping. Effect of compost of Parthenium on *Triticum aestivum* crop also gave some worthwhile results, which encourage its composting.

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. Productivity of the *Triticum aestivum* crop was almost same in two types of plots; first in the plots, in which an inorganic fertilizer was used as an external nutrient source as well as in the plots, in which Parthenium compost was used. But there is a significant difference in the production of *Triticum aestivum* in fertilized and unfertilized field. Whereas there is not a significant difference was observed between the production of inorganic fertilizer and parthenium compost crop field production. Productivity of wheat in all 30 plots is reported in Table 1 and Graph 1. Percent of difference in wheat productivity between (A) in compare to control condition (unfertilized) and (B) in compare to inorganic fertilized replicates can be calculated as-

$$\text{Percent of difference in wheat productivity (A)} = \frac{Parthenium\ compost - Control}{Control} \times 100$$

$$= \frac{2.124 - 1.671}{1.671} \times 100$$

$$= 27.11\%$$

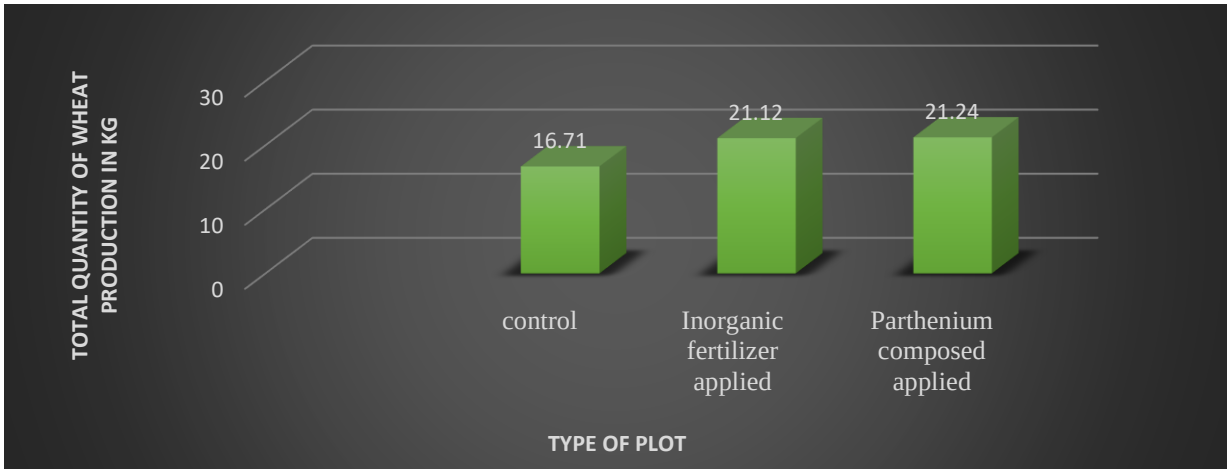
$$\text{Percent of difference in wheat productivity (B)} = \frac{Parthenium\ compost - Inorganic\ Fertilizer}{Inorganic\ Fertilizer} \times 100$$

$$= \frac{2.124 - 2.112}{2.112} \times 100$$

=0.56%

Table 1: Productivity of wheat in different nutrients

Type of plot	Total quantity of wheat production in Kg	Average production (Total quantity of wheat production/10) in Kg
Control	16.71	1.671
Inorganic fertilizer applied field	21.12	2.112
Parthenium composed applied field	21.24	2.124



Graph 1: Productivity of wheat in different nutrients

4. CONCLUSION

The environmental effects of frequently applying pesticides to eradicate weeds are widely recognized, but not enough has been done to address these effects. Thus, it is important to embrace the use of environmentally friendly weed-controlling technologies, such as composting, in order to find a solution to this issue. These results support the use of *P. hysterophorus* compost because wheat productivity was approximately 27% higher than in the replicate when no external nutrient source was used and 0.56% higher in compare to inorganic fertilizers. The wheat plants not only grew well, but their intense green colour also indicates that the compost had a beneficial effect on the crop's growth.

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