Changes in nutrients content during composting of weed plants

Bijal Chauhan[1] & Shilpkar Prateek[1]*

Department of Biogas Research and Microbiology, Gujarat Vidyapith, At and Po: Sadra, Dist: Gandhinagar, Gujarat, India

*Corresponding Author: pshilpkar@yahoo.com, Tel: +91-9427408880

ABSTRACT

Soil health become poor day by day due to excessive usage of chemical fertilizer and ultimately it affects to all living things at globally. Many researchers are working for sustainable environment for health. In this study three toxic weed plants were used for composting. Nutrients content were analysed before and after composting by standard methods. The experiment was carried out at Biogas Research Centre and Department of Microbiology, Gujarat Vidyapith, Sadra Campus. Compost nutrient analysis suggest it will help in improve soil fertility and increased soil microbial diversity.

Key words: *Weed plants, composting, microbes, soil fertility.*

1. INTRODUCTION

Sustainability goals for a better future world are required at the global level. It can be done in many ways to create a healthy environment for all living things. The composting of organic waste is one of them.

Composting is the degradation of the organic materials by mesophilic, thermophilic, and psychrophilic microorganisms. Food waste, agricultural waste, manure, dung, etc. are all used for composting. Biochar blends well with compost because it provides a home for microbes, boots microbial activity, and improves soil and crop yield.

Datura stramonium belongs to Solanaceae family and order Solanales. Their all species are highly toxic. Scopolamine and atropine like poisonous compounds are identified from *Datura stramonium*. *Lantana camara* plant is belongs to Verbenaceae family. It is growing in tropical and subtropical environment and it is mostly shown in America, Asia and Africa. There were 150 species of *Lantana camara* properly estimated because it shows very high hybridization and unsalability in nature. Euphorbiaceae family plant *Jatropha curcas* is known for optional fuel production. It is toxic to humans and animal and may cause death if high doses of seeds are eaten. Seed and leaves are extracted in different solvents and used as insecticide and fungicide. 1500-2000kg per hectare seed cultivated from plant and used for oil extraction.

The objective of this experiment was to find out the change at the initial and maturation levels during composting.

2. MATERIALS AND METHOD

2.1 Composting experiment

In this experiment, three different plants (*Lantana camara, Datura stramonium, and Jatropha curcas*) were used. Plant samples were collected in a nearby area of the Department of Biogas Research and Microbiology, Gujarat Vidyapith, Sadra. 19 different treatments were selected for the composition experiment. Buffalo dung and three plants (*Lantana camara, Datura stramonium, and Jatropha curcas*) were planted in the following 19 treatments, each with two replications: 10 kg of total raw materials for one compost pit have been prepared, and the whole experiment was carried out on the college campus.

T_1-*Datura stramonium* (100%), T_2-*Lantana camara* (100%), T_3-*Jatropha curcas*(100%), T_4-Dung (100%), T_5-*Datura stramonium*+ *Lantana camara* (50%+50%), T_6- *Datura stramonium*+ *Jatropha curcas* (50%+50%), T_7-*Lantana camara*+ *Jatropha curcas* (50%+50%), T_8- *Datura stramonium*+ Dung (50%+50%), T_9- *Jatropha curcas*+ Dung (50%+50%), T_{10}- *Lantana camara*+ Dung (50%+50%), T_{11}-*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* (33.33%+33.33%+33.33%), T_{12}- *Datura stramonium*+ *Lantana camara*+ Dung (33.33%+33.33%+33.33%), T_{13}-*Lantana camara*+ *Jatropha curcas*+ Dung (33.33%+33.33%+33.33%), T_{14}- *Datura stramonium*+ *Jatropha curcas* (33.33%+33.33%+33.33%) + Dung, T_{15}- *Datura stramonium*+ *Lantana camara*+ *Jatropha curcas*+ Dung (25%+25%+25%+25%), T_{16}- *Datura stramonium*+ *Datura stramonium* biochar (50%+50%), T_{17}-*Lantana camara* + *Lantana camara* biochar (50%+50%), T_{18}-*Jatropha curcas*+ *Jatropha curcas* biochar (50%+50%), and T_{19}- *Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar (33.33%+33.33%+33.33%).

2.2 Physico-chemical analysis

Plant pH, total organic carbon, nitrogen, and phosphorus were analysed with standard methods. Samples from all the treatment combinations were collected in zip-lock plastic bag for further analysis. The pH of compost at initial and Mature stages was measured using Digital pH meter MK-6. Analysis of compost nutrients has been done at the initial level and at the end of the experiment (the maturation stage of compost). pH (Digital pH meter MK6), Available Phosphorus (%) by Olsen *et al*., (1954), Available Potassium (%) by Jackson, (1967), Available Nitrogen (%) by Subbiah and Asija, (1956).

3. RESULTS AND DISCUSSION

In the present experiment, the evaluations of most important parameters of compost i.e. pH, Nitrogen, Phosphorus and Potassium have been carried out. These physico-chemical parameters were measure in all the treatment combinations at the beginning (0days) of composting. Results show significant changes in all nutrients.

3.1

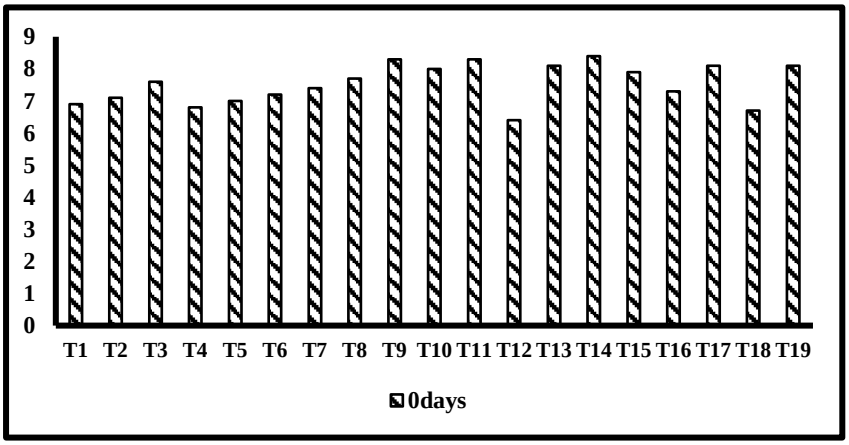

Fig.1 Change in pH at initial level (0 days) of composting

The highest pH values at 0 days were 8.4 in T_{14} (*Datura stramonium*+ *Jatropha curcas* + Dung) and lowest pH values noted 6.4 in treatment T_{12} (*Datura stramonium*+ *Lantana camara*+ Dung).

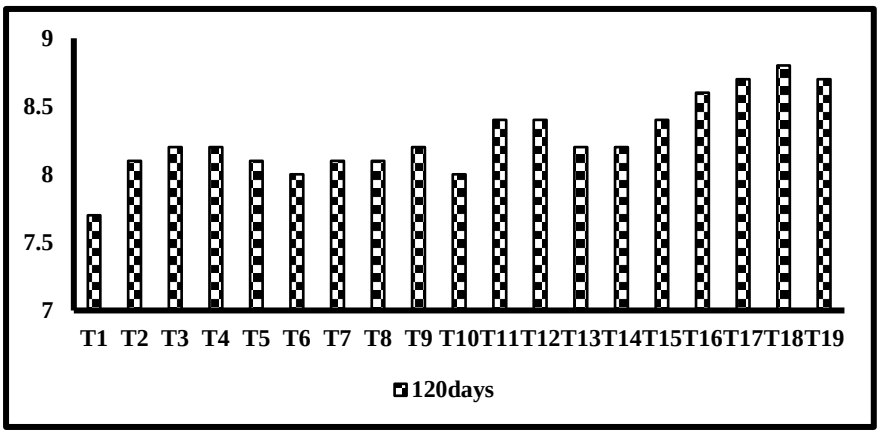

Fig.2 Change in pH at maturation level (120 days) of composting.

At 120 days of composting all parameter were analysed by standard methods. In treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar) noted Highest pH values and lowest pH was reported in T_1 (*Datura stramonium*) 8.8 and 7.7 respectively.
Similar 8.8 pH values reported by the Awasthi *et al*., (2017) in their studies on effect of biochar and co-composting. Significant changes after addition of biochar was also reported.
Awasthi *et al*., (2017) during investigating the effects of biochar and co-composting, reported similar 8.8 pH values and found significant changes after the addition of the biochar.
Highest difference in pH Value during composting is shown in treatment T_{12}. At 0 days pH was 6.4 and after 120 days of compost pH was 8.4 noted.

3.2

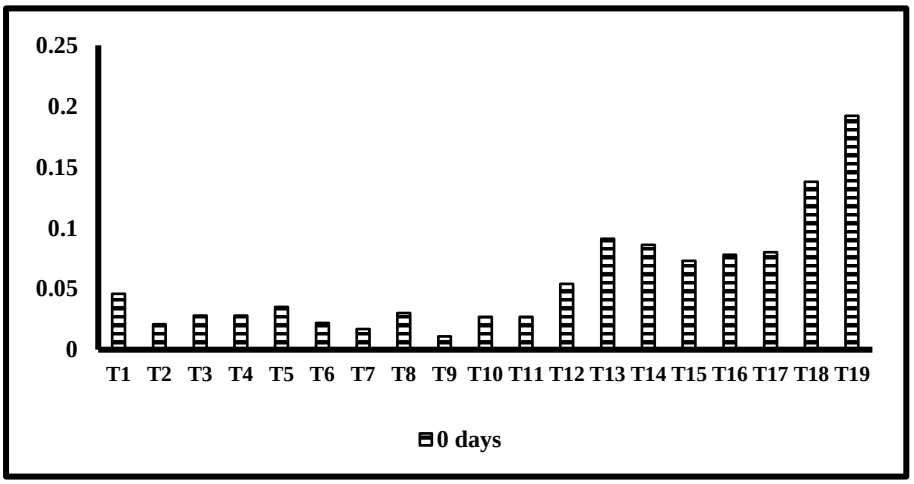

Fig.3 Change in Available Nitrogen (%) at initial level (0 days) of composting.

At initial level of composting available nitrogen was reported extremely low. As per analysis results highest available nitrogen content was noted in treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar) (0.192%) and lowest available nitrogen content was (0.011%).

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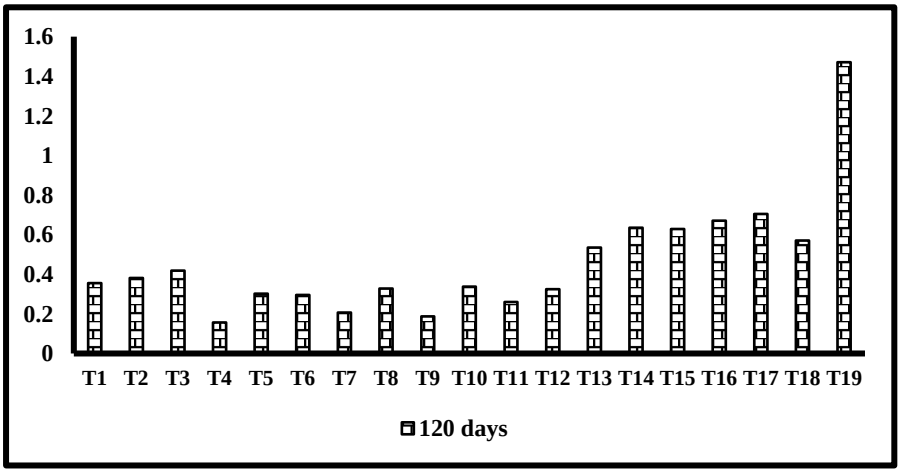

Fig.4 Change in Available Nitrogen (%) at maturation level (120 days) of composting

At maturation level of composting Treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar) has been shown highest nitrogen value compared to other treatment. Whereas other treatment lost their nitrogen content due to nitrification, ammonia volatilization and immobilization by different types of microbes. Contrary to it addition of biochar helps porous characteristics made habitat for microorganisms in treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar), so in that case biochar absorbent capacity play a significant role in reduction of nitrogen content during composting.

3.3

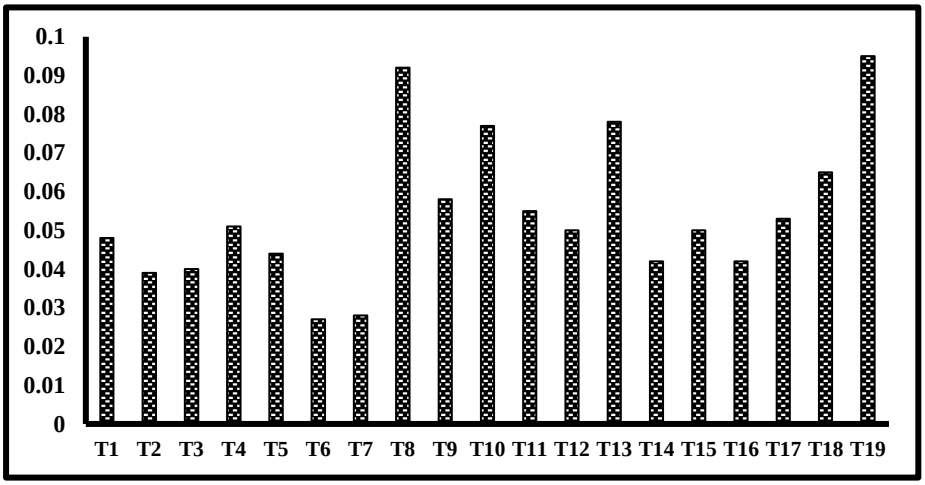

Fig.5 Change in Available Phosphorus (%) at initial level (0 days) of composting.

The phosphorus is one the important parameter of composting. At 0 days of composting phosphorus value noted low in all the treatment. Lowest value 0.158% in treatment T_9 and highest value 0.486% in treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar). Changes in phosphorus during composting may be its dependent on the microbial and enzymatic activity.

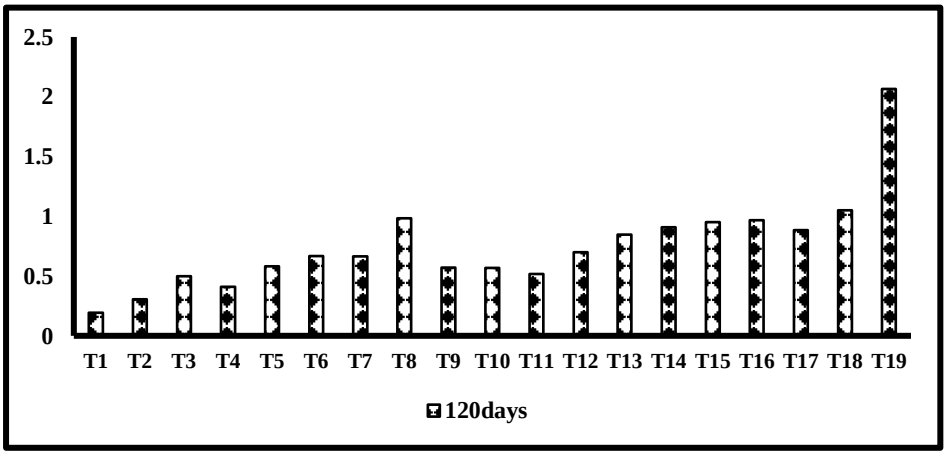

Fig.6 Change in Available phosphorus (%) at maturation level (120 days) of composting.

At 120 days of composting highest content of phosphorus viz. 2.0158% was reported in treatment T_8 (*Datura stramonium*+ Dung) and lowest 0.588% in treatment T_1 (*Datura stramonium*). Higher phosphorus value indicates the higher microbial activity in compost. Available phosphorus content of 0.36% was reported by Alvarenga *et al*., (2015) who worked compost as agricultural soil amendments.

3.4

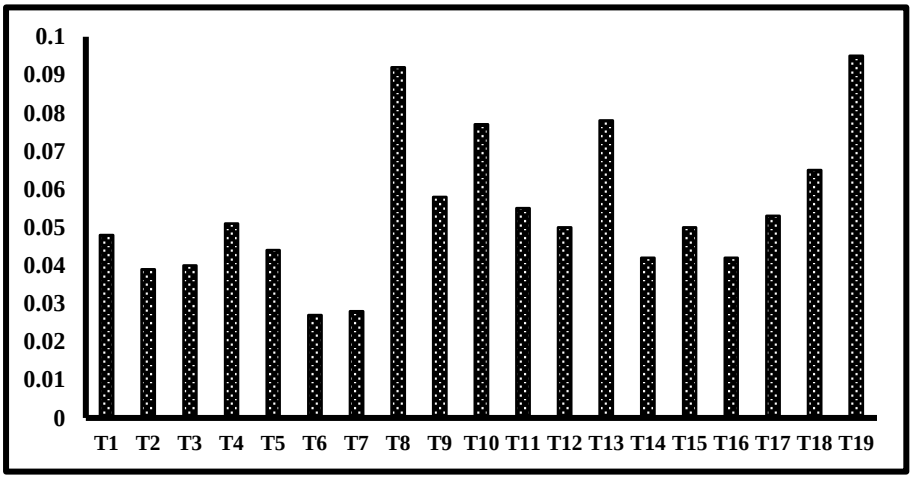

Fig.7 Change in Available Potassium (%) at initial level (0 days) of composting.

Available Potassium analysed by the flam-photometer at initial and maturation level. The results of 0 days shown low value of potassium. Lowest potassium viz. 0.027% was observed in treatment T_6 (*Datura stramonium*+ *Jatropha curcas*) and 0.092% in treatment T_8 (*Datura stramonium*+ Dung).

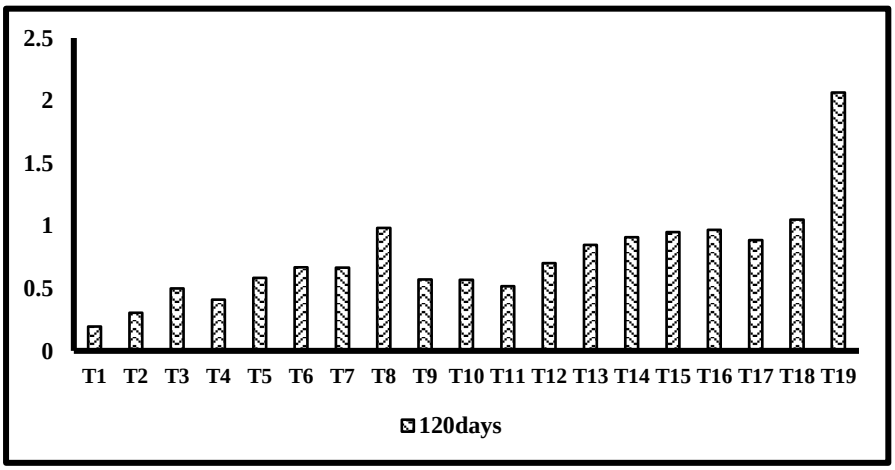

Fig.8 Change in Available potassium (%) at maturation level (120 days) of composting.

As per Fig.8 at 120 days of composting results show the increment of available potassium. Highest results 2.065% noted in treatment T_{19} and lowest 0.193% in treatment T_1 (*Datura stramonium*). Treatment T_{19} (*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix biochar) is combination of mix biochar, plant and dung. Naba *et al*., (2020) also worked on the nutrient effects on the various composting methods with or without biochar. They also found significant effect of biochar addition with 2.13% available potassium which was higher than compared to other treatments.

4. CONCLUSION

At the end of the experiment, it could be concluded pH, Available nitrogen (%), Available Phosphorus (%) and available potassium increased in all treatments. As per results and discussion treatment 19(*Datura stramonium*+ *Lantana camara*+ *Jatropha curcas* + mix

biochar) pH, Available Nitrogen, Available potassium value were significantly higher compare to other treatment. It may be caused by the biochar addition in composting. Biochar increased microbial diversity in compost and microbial activity enrich the compost with nutrients. Toxic weed plant converted into higharched compost. The compost can be used in agricultural soil.

5. ACKNOWLEDGMENT

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