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SUITABILITY OF GOAT DUNG AND *CALOTROPIS GIGANTEA* LEAVES FOR COMPOSTING

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ABSTRACT

Composting of goat dung and leaves of *Calotropis gigantea* was performed for 90 days. Changes in pH, electrical conductivity, calcium, magnesium, chloride, total organic carbon, total nitrogen, C : N ratio, available phosphorus and available potassium were recorded during composting at different composting period of 30, 60 and 90 days. Results show that contents of all the parameters fluctuates with composting time. Contents of calcium, magnesium, total nitrogen, available phosphorus and available potassium were increased during composting compared to their values in goat dung before composting whereas organic carbon and C : N ratio decreased.

Key words: Aerobic decomposition, Microbial mineralization, Nutrients transformation.

INTRODUCTION

With industrialization and increase in agricultural production amount of waste generated is continuously increasing. The big problem today is how and where to store these wastes ? Further, what should be done to manage these wastes in an eco-friendly manner because all the wastes are not being degraded completely and their presence causes pollution. Landfill (ordinary, sanitary and secured landfill), incineration, gasification, aerobic and anaerobic degradation etc. are common techniques used for waste management[1] but each has distinct advantages and limitations. Degradable organic wastes are decomposed during composting and stable product is obtained[2]. Composting is a process in which different groups of aerobic microorganisms acts on wastes and causes mineralization. Due to

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microbial activities complex groups present in waste materials degrades and releases simpler forms, which can be assimilated by microbial cells for their growth.

Animals are being used by man with the human civilization for various purposes like milk, meat, leather, fertilizer, agricultural work etc. Goat is a ruminant animal commonly found in many parts of world and in India. As per the census the Goat population in India is 135.17 million in 2012.

Goat is generally reared for milk, meat and wool purposes. Goat eats almost every material and produces manure about 5 percent of their body weight daily. *Calotropis gigantea* is a plant grown freely in any type of waste land and not utilized by animals due to its toxic contents in leaf and stem. Present study is an attempt to find out a possible way to utilize leaves of *Calotropis gigantea* for composting with goat manure.

EXPERIMENTAL

Materials used

Goat dung and leaves of *Calotropis gigantea* were used in study. They were collected locally from Sadara village. For composting above ground pit was prepared in protected shed with bricks. The size of pit was 2 x 2 feet. In chemical analysis AR grade chemicals were used.

Composting

Goat dung (10 Kg) and fresh *Calotropis gigantea* leaves (2 Kg) were added in pit and mixed well manually. The mixture was moistened with water and turnings were given at every 15 days. During turning the heap was opened, mixed well and watered to maintained moisture. Turning is essential process in composting to avoid temperature rise[3,4].

Analysis of composting material

To find out the changes in various chemical properties at different time interval of composting process the samples were withdrawn of composting material at 30, 60 and 90 days after composting (DAC) and analysed for pH (pH meter), electrical conductivity (conductivity meter), calcium, magnesium and chloride[5], total organic carbon[6], total nitrogen[7], available phosphorus[8] and available potassium[9]. Before composting the goat dung used was also analysed and results show that it has pH (7.60), electrical conductivity (0.26 mS/cm), Ca^{2+} (0.029%), Mg^{2+} (0.62%), Cl^{1-} (0.05%), total organic carbon (6.33%), total nitrogen (1.03%), available phosphorus (106.4 Kg/ha) and available potassium (425.6 Kg/ha).

RESULTS AND DISCUSSION

pH, electrical conductivity, calcium, magnesium and chloride contents

Data of Table 1 show that the pH of composting material increases slightly from 7.61 to 7.86 with time. Content of electrical conductivity of composting material increased from 0.26 (before composting) to 0.39 (at 30DAC), 0.62 (at 60 DAC) and 0.86 (at 90 DAC) (Table 1). Compared to the value of electrical conductivity of goat dung before composting this increase was 50.0, 138.46 and 230.77% at 30, 60 and 90 DAC, respectively. Contents of calcium, magnesium and chloride ions also fluctuate with composting time due to mineralization action of microorganisms present in dung. The increase in electrical conductivity may be due to liberation of ions during microbial action on many complex molecules of substrate. Electrical conductivity depends mainly on concentration of Ca and Mg ions[10]. Increase in electrical conductivity with composting time was also reported previously[11,12] for different compost mixtures.

Table 1: Chemical characteristics of composting material at different days of composting

Days of composting	pH	EC (mS/cm)	Ca^{2+} (%)	Mg^{2+} (%)	Cl^{-} (%)
30	7.61	0.39	0.024	0.033	0.02
60	7.81	0.62	0.028	0.052	0.05
90	7.86	0.86	0.033	0.047	0.03

Available phosphorus and potassium

Data presented in Table 2 reveal that 31.58, 105.26 and 263.16% increase in available phosphorus and 10.53, 15.79 and 36.84% increase in available potassium was observed at 30, 60 and 90 DAC compared to their contents in goat dung before composting. Production of heat and various acids during microbial decomposition causes solubilizing effect on adsorbed forms of phosphorus and potassium[13-15].

Table 2: Available nutrients at different days of composting (Kg/ha)

Days of composting	Phosphorus (P_2O_5)	Potassium (K_2O)
30	140.0	470.4
60	218.4	492.8
90	386.4	582.4

Total organic carbon, nitrogen and C:N ratio

Goat dung contains 6.33% organic carbon, which reaches to 11.77% during first month but decreased thereafter in second and third month of composting and at the end of composting its value was 10.10% (Table 3). Total nitrogen content of goat dung before composting was 1.03%, which increases continuously with composting time and reaches to 1.11, 1.15 and 1.17% after 30, 60 and 90 days of composting (Table 3). At zero days of composting, when goat dung was mixed with leaves of *Calotropis gigantea*, the ratio of organic carbon to total nitrogen was 10.66, which decreased continuously and reaches at 10.60, 10.00 and 8.63% after 30, 60 and 90 days of composting (Table 4). This decrease in C:N ratio was 0.56, 6.19 and 19.04% at 30, 60 and 90 days after composting compared to that of zero days. During decomposition process microorganisms use organic carbon of substrate as energy source and convert a part of it to carbon dioxide and remaining part is assimilated[16-18]. Loss in organic carbon content during composting is also reported by a number of workers[19-21]. Decreased ratio of organic carbon to total nitrogen may be due to either increased total nitrogen content or activities of nitrogen-fixing bacteria[22,23].

Table 3: Total organic carbon, total nitrogen and their ratio in composting material at different days of composting

Days of composting	TOC (%)	Total N (%)	C:N
30	11.77	1.11	10.60
60	11.50	1.15	10.00
90	10.10	1.17	8.63

Table 4: Changes in C:N ratio with composting time

Days of composting	C : N	Difference of C:N between compost and initial mixture	% Decrease over initial content
0 (Initial)	10.66	-	-
30	10.60	0.06	0.57
60	10.00	0.66	6.19
90	8.63	2.03	19.04

CONCLUSION

The study concludes that goat dung and leaves of *Calotropis gigantea* can be composted successfully and produces nutrient rich compost.

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