Research Article

Effect of coconut waste on bird excreta in organic manure formulation

S. Anbuselvi*, Guddu Kumar

ABSTRACT

Introduction: Biofertilizer can be obtained from agricultural waste, animal excreta, and plant decomposed sector. The poultry waste (bird excreta) had high C:N ratio when compared with other animal excreta. The composting of poultry waste in soil showed good manuring property. **Materials and Methods:** The different concentrations of manure mixed with soil yield better growth of plants. **Results:** Bird excreta manure helped for translocation of nutrients from manures to the root of plant . **Discussion:** Composting with poultry excreta also enhance the N, P, and K levels in the poultry coconut husk manure as compared to that in non-composted material. **Conclusion:** Composting with poultry excreta also enhanced the N, P and K levels in the poultry coconut husk manure as compared to that in non composted material.

KEY WORDS: Animal excreta, Carbon, Nitrogen, Poultry excreta

INTRODUCTION

Organic manures enhanced soil mixture into this inert mixture and promoted biological activities. The useful influence of organic matter on the physical-chemical and biological properties of the soil is widely changed the nutrients present in the soil. The recycling and reuse of organic wastes in the soil most effective methods of maintaining the concentrations of nitrogen phosphorus and potassium in soil and maximum yield are achieved through the shortest period. In India, the use of plant and animal waste is used as a source of organic manure with nutrient was the accepted practice.[1]

Continuous cultivation of crops in the soils leads to the deterioration of soil structure which leads to low crop yield. Dhar *et al*. (1962) reported that by adding large doses of N-fertilizers in modern agriculture always the danger of humus depletion and fall in crop production, which can be reduced only by adding additional amounts of organic residues and manures.[2,3]

Poultry manure is an excellent source of nutrients and minerals can be incorporated into fertilizer programs. The soil fertility management helps to prevent nutrient imbalance and associated contamination. The role of successful management of poultry manure is to match the nutritional requirement of soil varies not only with its nutrients available in the manure but also with management and handing costs.[4]

Poultry excreta contain all essential nutrients including micronutrients and it has been a best valuable source of plant nutrients,[5] especially for organic growers.[6] Addition of poultry manure to soils not only helps to overcome the waste management but also stimulates the physical, chemical, and biological fertility of soils.[7-9]

Poultry excreta have maximum amount of nitrogen, phosphorus, and potassium. The variability in composition is due to dietary, physiological status, and age of excreta.[10] Organic residues of poultry excreta are piled up, moistened, turned occasionally to aerate, and allowed to decompose partially and bring down the carbon-nitrogen ratio to about 30:1. In general, composting is carried out in open pit by filling alternate layers of organic wastes and other materials rock phosphate and other amendments. If the organic wastes are largely high-carbohydrate materials, some fertilizer nitrogen is needed.

The preparation of poultry waste and coconut husk mixture is composting to speed up decomposition and helps to improve the texture of the product. Aeration in the compost pile is essential. It is good to mix succulent organic materials with the mixture.[11] This study deals with composting of coconut husk and poultry waste in different proportions and its efficiency was analyzed.

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Department of Industrial Biotechnology, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India

***Corresponding author:** S. Anbuselvi, Department of Industrial Biotechnology, Bharath Institute of Higher Education and Research, Chennai, Tamil Nadu, India. E-mail: anbuselvichennai@yahoo.com

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MATERIALS AND METHODS

Poultry excreta were taken from chicken farms and dried. The dried poultry wasteder of poultry excreta mixed with dried form of coconut husk in different properties. The compost wells were created with a depth of 3 m × 6 m × 3 m size. The coconut husk and poultry waste were mixed with different proportion (1 kg:100 g, 1 kg:150 g, 1 kg:200 g, and 1 kg:250 g). The slight aeration and water sprinkling were done at regular intervals for there for 3 months.

The fertile nature of soil and manure helped to determine the growth of plant. The nature of natural and slightly alkaline soils was suitable for plantation. The physical parameters of pH, moisture, bulk density, water holding capacity, and specific gravity of soil were analyzed. The nitrogen content of soil and manure was determined by Kjeldahl method. The available phosphorus was determined by micro-vanadate-molybdate method. The potassium content was analyzed using ammonium acetate method.

RESULTS AND DISCUSSION

Poultry waste contains many essential nutrients needed for the growth of plants. The poultry excreta poultry wasteder mixed with different proportions for composting to make organic manure formulations. The physical and chemical constituents of soil and poultry excreta are summarized in Table 1.

The poultry excreta showed slightly acidic range of 6.5; the control soil showed alkaline pH 8. The pH of soil was gradually attained neutral pH after the treatment of soil with composting manures. Organic manure helps to maintain the pH which suitable for plantation. The turbidity was observed in coconut husk of 68.5 Nephelometric Turbidity Units (NTU). The soil showed very little turbidity of 0.55 NTU. The maximum turbidity was observed in 250 g of coconut husk treated samples. The high moisture was found to be higher in coconut husk (86%) when compared with other samples. This was due to the presence of water holding capability of coconut husk. The minimum moisture content was found to be in control (10%), 500 g treated sample (19%), and 150 g treated sample (18.3%).

The poultry waste showed specific gravity (1.20). The specific gravity of normal soil and coconut husk was 9.28 mg/m^3 and 9.529.28 mg/m^3. The coconut husk treated poultry waste was rapidly decreased its specific gravity from the range of 9–0.018 mg/m^3 up to 150 g treated samples. However, the specific gravity of sample was gradually increased in 250 g and 500 g treated samples. The bulk density of normal fertile soil was about 1.0 g/cm^3. The raw coconut husk and poultry excreta showed high amount of specific gravity in terms of 0.62 g/cm^3 and 0.45 g/cm^3. During organic manure formulation and interaction with soil specific gravity of coconut husk and poultry excreta were gradually declined to 0.10 g/cm^3 and slightly raised to 1.02 g/cm^3. The poultry excreta showed only 10% of water holding capacity even when compared with normal soil (54%). The coconut husk is a good water adsorbent and found to be 93% of water holding capacity. The water holding capacity of combined waste formulations was found to be gradually increased from 27% to 65%. This physical features of coconut husk showed high moisture content, specific gravity, and water holding capacity properties.[12] This helps to translocated the growth of plants. In olden days, cow dung, goat excreta, and poultry waste were used as for the growth of plants by farmers [Figure 1].

The coconut husk and poultry excreta contain high amount of nitrogen (0.19 and 0.28 mg). The level of nitrogen is gradually increased from 0.18 to 0.36 mg

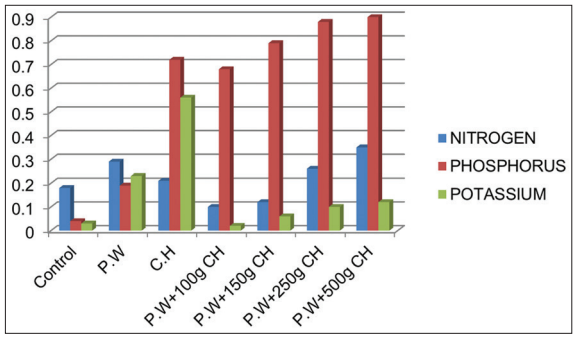

Figure 1: Nitrogen phosphorus and potassium levels in combination of coconut husk and poultry waste

Table 1: Physical changes in composting of coconut husk and poultry waste

Samples	pH	Turbidity (NTU)	Moisture content (%)	Bulk density(g/cm^3)	Specific gravity(mg/m^3)	Water holding capacity (%)
Control soil	8.0	0.55	10	1.0	9.28	54
P.w	6.5	46.7	63	0.45	1.20	10
P.w+s	7.5	62.4	22	0.10	0.26	78
Ch	7.0	68.5	86	0.62	9.52	93
P.w+s + ch100 g	7.5	64.0	52	0.10	0.080	27
P.w+s + ch150 g	7.5	101	18	0.10	0.018	43
P.w+s + ch250 g	7.5	121.1	41	0.11	1.194	61
P.w+s + ch500 g	7.5	65.3	19	1.02	1.631	65

P.w: Poultry waste, S: Soil, Ch: Coconut husk

in 500 g treated sample. Hachicha *et al*. (2009) also represented that total N was increased between 1.8 and 2.2 mg/kg in initially composted raw poultry litter and vegetables waste.[13] Composting provides environmentally sustainable solution of waste recycling and control of NH_3 emissions.[14]

The normal soil contains 0.04 mg of phosphorus. The high concentration of phosphorus was found in coconut husk (0.73 mg). The phosphorus level of combined treatments was gradually increased from 0.68 mg to 0.90 mg in the range if 100–500 g samples. Composting resulted in to significantly higher in the level of phosphorus contents over uncomposting from 60 days. The findings in the current study are also similar to the results of Cooperband *et al.* (2002) who found higher *P* values in the poultry litter after composting process as compared to its mixtures with other wastes.[15]

Coconut husk showed higher amount of 0.54 mg of potassium when compared with raw poultry excreta (0.22 mg). The potassium concentration was rapidly declined at the initial mixing of coconut husk and poultry waste. During manure formulation, the potassium levels were gradually raised to 0.12 mg. The compost had less moisture content, improved handling properties, and less odor than raw manure. The composted product containing poultry litter was found to have higher levels of plant nutrients such as N, P, and K than the product without poultry litter.[16,17]

CONCLUSION

Composting of poultry wastes mixed with coconut husk leads to less in weight, less odor, high NPK, water holding capacity, and easier to transport for land application. Composting narrows down the C:N ratio earlier than in uncomposted poultry coconut manure, making it ready for soil application in shorter time. Thus, coconut husk mixed poultry manure helps to the agricultural farms and completely reduces the risk of pollution.

REFERENCES

1. Kelley CP, Mohtadi S, Cane MA, Seager R, Kushnir Y. Climate change in the fertile crescent and implications of the recent Syrian drought. Proc Natl Acad Sci U S A 2015;112:3241-6.
2. Dhar ML, Dhar MM, Dhawan BN, Mehrotra BN, Ray C. Screening of Indian plants for biological activity: I. Indian J Exp Biol 1968;6:232-47.
3. Blanchet G, Gavazov K, Bragazza L, Siraj S. Responses of soil properties and crop yields to different inorganic and organic amendments in swiss conventional farming system. Agric Ecosyst Environ 2016;230:116-26.
4. Chan KY, Zwieten LV, Meszaros I, Downie A, Joseph S. Using poultry litter biochar as soil amendments. Aust J Soil Res 2008;46:437-44.
5. Harmel RD, Smith DR, Haney RL, Dozier M. Nitrogen and phosphorus runoff from cropland and pasture fields fertilized with poultry litter. J Soil Water Conservation 2009;64:400-12.
6. Preusch PL, Adler PR, Sikora LJ, Tworkoski TJ. Nitrogen and phosphorus availability in composted and un composted poultry litter. J Environ Qual 2002;31:2051-77.
7. Nyamangara J, Bergstorm LF, Piha MI, Giller KE. Fertilizer use efficiency and nitrate leaching in tropical sandy soil. J Environ Qual 2003;32:599-606.
8. Friend AL, Roberts SD, Schoenholtz SH, Mobley JA, Gerard PD. Poultry litter application to Loblolly pine forests: Growth and nutrient containment. J Environ Qual 2006;35:837-48.
9. McGrath S, Maguire RO, Tacy BF, Kike JH. Improving soil nutrition with poultry litter application in low input forage systems. Agronomy J 2009;102:48-54.
10. Chaudhary AN, Naeem MA, Jhilani G, Rassaq A, Zhang D, Azeem M, *et al*. Influence of composting and poultry litter storage methods on mineralization and nutrient dynamics. J Anim Plant Sci 2013;23:500-6.
11. Anbuselvi S, Rebecca J. Study on the biodegradation of coir waste by three different species of marine *Cyanobacteria*. J Appl Sci Res 2009;5:2369-74.
12. Anbuselvi S. Growth of black gram by *Phormidium* treated coir waste and cow dung on drought stress. Int J Pharm Technol 2016;7:8832-6.
13. Hachicha R, Hachicha S, Trabelsi I, Woodward S, Mechichi T. Evolution of the fatty fraction during co-composting of olive industry wastes with animal manure: Maturity assessment of the end product. Chemosphere 2009;75:1382-6.
14. Ahmad R, Naveed M, Aslam M, Zahir ZA, Arshad M, Jilani G. Economizing the use of nitrogen fertilizer in wheat production through enriched compost. Renew Agric Food Syst 2008;23:243-9.
15. Cooperband L, Bollero G, Coale F. Effect of poultry litter and its compost on soil nitrogen and phosphorous availability and corn production. Nutr Cycl Agroecosyst 2002;6:185-94.
16. Das KC, Minkara MY, Melear ND, Tollner EW. Effect of poultry litter amendment onhatchery waste composting. J Appl Poult Res 2002;11:282-90.
17. Sharmila S, Rebecca LJ, Das MP. Production of biodiesel from *Chaetomorpha antennina* and *Gracilaria corticata*. J Chem Pharm Res 2012;4:4870-4.

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