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Economics of composting of poultry farm waste

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Abstract
Present study was conducted during the year 2016 (January-March for winter trail and May-July for summer trail) to assess the economics of composting of poultry farm waste under the agroclimatic conditions of Kashmir Valley in the Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry (SKUAST- Kashmir). Poultry farm waste in the form of poultry carcass and poultry litter was selected for this purpose. Four treatment recipes formulated for composting were: T_1: Poultry carcass + Poultry litter, T_2: Poultry carcass + Poultry litter + Paddy straw, T_3: Poultry carcass + Poultry litter + Effective Microbes and T_4: Poultry carcass + Poultry litter + Paddy straw + Effective Microbes. Each treatment was having four replicates. The sale rate of the end product was kept as Rs. 4.31/kg. The net profit of composting (winter + summer) was highest in T_3 (Rs. 614.87) and lowest in treatment group T_2 (Rs. 418.83). Similarly net profit per bin was also higher in treatment group T_3 (Rs. 204.95) and lowest in T_2 (Rs. 139.61). The total net profit obtained during both the seasons was Rs. 3550.3 during both the seasons. **Conclusion**: It was concluded that poultry farm waste was disposed of eco-friendly besides appreciable amount of economic returns were also attained.

Keywords: Economics, composting, poultry farm waste

1. Introduction
Poultry is one of the fast growing segments of agriculture in the world. The poultry industry in India now is the fastest growing segment of the livestock sector with 12.39% present annual growth rate [1]. India is the third largest egg producer and fifth largest chicken meat producer in the world with production estimates of 3.22 million tons of broiler meat and 73 billion numbers of eggs during the year 2014-2015 and is expected to reach 4 million tones and 80 billion respectively in the year 2016-17 [2]. Nearly 20 million people are employed in poultry industry with around 1,000 hatcheries operating across India [2]. With high levels of concentrated production, it involves generation of large volumes of waste. Poultry farm waste includes mixture of urinary and faecal excreta, bedding material or litter, waste feed, dead birds, broken eggs, packing material and feathers [3]. One of the major problems currently faced by the poultry industry is the accumulation of a large amount of waste especially manure and litter generated by intensive production which poses different environmental, social and economic problems, requiring prompt and regular removal and disposal of such waste for proper biosecurity [4].
Currently poultry farm waste is disposed of by burial, incineration, rendering, or landfilling [5]. Each of these processes however, has its unique flaws like cost involvement, labour intensiveness, production of environmental pollutants and obnoxious odour etc [6]. Therefore, developing a technically feasible and economically viable method for this purpose would benefit both large and small scale poultry farms and processing units. In this regard, early disposal of poultry farm wastes with efficient method is an important waste management tool for raising healthy and profitable poultry farming activity. Composting is an environmentally sound, inexpensive method of processing poultry farm waste into valuable manure [7]. Composting when properly operated, reduces the volume of the organic waste and destroys pathogens effectively [8]. The end product of compost resembles humus and can be used as soil amendment. Thus the use of composting processes for recycling and transformation of wastes may be a good way for further utilization of the disposed end product in future.
The objective of the study was to analyze the economic feasibility of composting of poultry farm waste during winter and summer seasons.

2. Materials and methods

The present study was carried out in the Division of Livestock Production and Management, Faculty of Veterinary Sciences and Animal Husbandry Shuhama Srinagar. Poultry farm waste (dead birds and poultry litter) was utilized to study the composting and fermentation experiments in two separate trails during summer and winter seasons. Composting of poultry litter was done in wooden bins (Mini composter) with a specification of 3 feet length x 3 feet width x 3 feet height designed as per the method of Donald *et al.,* [9]. The floor of the compost bin was made impervious to prevent seepage of leachiates and subsequent moisture and nutrient loss. The sidewalls of the compost bins were made up of country wooden planks of 4 to 5 inches wide and one inch thick. An air space of 1-2 inch was provided between wooden planks to aid sufficient aeration to the compost piles. Dead birds for the present study were collected from local poultry farms and stored at – 5ºC till sufficient carcasses were made available to fill all the compost bins in a single day. Similarly, poultry litter was collected from poultry farm of LPM. Paddy straw (*Oryza sativa*) was used as a carbonaceous as well as bulking agent wherever it was required. Paddy straw was purchased from farmer's field and stored in advance. Four compost recipe treatments (with three replicates in each treatment) were formulated with addition of effective microbial culture (*Lactobacillus plantarum, Lactobacillus casei, Saccharomyces cerevisiae and Rhodopseudomonas palustris*) in two treatments as shown in Table. 1.

The cost of production of dead bird compost was worked out with following assumptions:

1. The cost of wooden compost bin was Rs. 250.00 per bin and the life of the wooden bin was two years.
2. The cost of effective microbes was kept as Rs. 50/treatment.
3. The cost polythene bags kept at the base of the bins was Rs. 10.00 per bin.
4. The cost for loading, remixing, unloading and transportation of poultry carcass per bin was worked out as Rs. 8.00 per bin per composting.
5. The rate of depreciation of polythene bags kept at base of bins was 100% during one trial.
6. Dead birds were received free of cost.
7. Poultry litter was also received free of cost.
8. The cost of carbon source (straw/hay) was Rs. 6.66 per Kg (1 Kg/ bin was used).
9. Value per kg of end product was Rs. 4.31/kg of compost [10].

In the present study the bins were used for both the seasons of composting. But, in field conditions, the bins will be useful for 2-3 years of composting. The cost involved in composting of poultry farm waste (dead bird and litter) was worked out with variable cost alone excluding cost of manure and dead birds because they were collected at free of cost.

The economics was worked out as follows:

I. Fixed cost

a) Cost of wooden bins
b) Depreciation for wooden bin

II. Variable cost

a) Cost of manure
b) Cost of loading, remixing, unloading and transportation of poultry carcass and poultry litter and labour etc.
c) Cost of carbon source

III. Total cost involved: II + I

IV. Gross profit

a) The gross revenue was worked out based on fertilizer value of compost kept as Rs. 4.31/kg of compost [9].

VII. Net profit: VI – III

Table 1: Different treatments combinations for Composting

Treatments	Description
Treatment 1	Dead birds + Poultry litter (Control)
Treatment 2	Dead birds + Poultry litter + Paddy Straw
Treatment 3	Dead birds + Poultry litter + Effective Microbes
Treatment 4	Dead birds + Poultry litter +Paddy straw + Effective Microbes

2.1 Statistical analysis

The data was analyzed as per the method suggested by Snedecor and Cochran (1994) [11] using the software SPSS-20.

3. Results

The economic analysis of composting is presented in Table. 2. The fixed cost estimated was Rs. 187.5 during winter and summer season in all treatments. The variable cost ranged between Rs. 54.0 in treatment group T_1 (control group) and Rs. 122.0 in treatment group T_4 (containing paddy straw and effective microbes) during both the seasons. The total cost involved varied between 241.5 in T_1 and Rs. 310 in treatment group T_4 during both the seasons. The net profit of composting during winter and summer season was highest in T_3treatment group (Rs. 964.87) and lowest in T_4 (Rs. 824.51). The profit per kg of end product was highest and lowest in treatment group T_2 (Rs. 3.13) and in T_4 (Rs. 2.40) respectively.

4. Discussion

The fixed cost estimated was Rs. 187.5 during winter and summer season in all treatments. The variable cost ranged between Rs. 54.0 in treatment group T_1 (control group) and Rs. 122.0 in treatment group T_4 (containing paddy straw and effective microbes) during both the seasons. The total cost involved varied between Rs. 241.5 in T_1 and Rs. 310 in treatment group T_4 during both the seasons. The net profit of composting during winter and summer season was highest in T_3 treatment group (Rs. 964.87) and lowest in T_4 (Rs. 824.51). The profit per kg of end product was highest and lowest in treatment group T_2 (Rs. 3.1) and in T_4 (Rs. 2.40) respectively. However, with the continuity of the composting process round the year more economic benefits would be attained [12]. In contrast to present study Wineland [13] observed that composting cost was 2 percent greater than incineration but due to end product utility composting was more beneficial. Composting method is unique from other methods because the resulted product is valuable and can be used as a fertilizer and soil amendment [14]. Different disposal methods like burial, large bin composting and incineration with emerging methods like small-bin compost, fermentation and refrigeration were compared and observed that small bin compost was an economic way of disposal followed by fermentation and refrigeration [15].

The total profit, net profit and profit/kg end product was highest in T_2 group having paddy straw as an additional source of carbon. The additional carbon source enhances the composting process due to more microbial growth [16]. Similar types of results were also recorded by Sivakumar *et al* [17]. However in the treatment group T_4 (having paddy straw and effective microbes) the profits obtained were comparatively lesser because of the additional cost of the effective microbial culture. Das *et al*. [18] observed no significant effect of incorporation of additional source of carbon and effective microbial culture on the economic benefits of compost making. The initial microbial load in the poultry farm waste is sufficient enough for composting to complete successfully. Although additional microbial culture boosts the composting process but adds no extra advantage in terms of economic benefit due to extra input cost of culture [19].

5. Conclusion

The net profit of composting during winter and summer season was highest in T_3 treatment group and lowest in T_4. The profit per kg of end product was highest and lowest in treatment group T_3 and in T_4 respectively. Net profit/bin was more due to composting. Net profit per kg of product of composting was Rs. 2.75. It was concluded that besides the primary objective of environment friendly and safe disposal of dead birds and poultry litter, a secondary valuable end product in the form organic manure was also procured.

6. Acknowledgement

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Table 2: Economics of composting

Treatment	Fixed cost (Rs)		Variable cost (Rs)		Total cost (Rs)		End product obtained (Kg)		Cost involved /kg of end product (Rs)		Profit (Rs)*		Total Profit (Rs)	Net profit (Rs)	Profit/Kg end product (Rs)
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer			
T_1	188	188	54	54	242	242	145	174	1.7	1.4	625.1	750	1375.1	892.1	2.8
T_2 (Paddy Straw)	188	188	72	72	260	260	152.4	169.6	0.8	1.5	657	730.8	1387.8	868.8	3.1
T_3 (Effective Microbes)	188	188	104	104	292	292	152.7	206.4	1.9	1.4	658.3	889.6	1547.9	964.9	2.7
T_4 (Paddy Straw+ Effective Microbes)	188	188	122	122	310	310	130.4	204.9	2.3	1.5	562.1	883	1444.5	824.5	2.4

- Sale rate of end product was Rs. 4.31/kg

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