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Mean score based opinion mining of dairy farmers regarding sustainable management of organic waste

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Abstract

Opinion is one of the vital discernible of cognitive domain of an individual which forms the basis of expression of human behaviour. In the current investigation, opinion mining was done based on mean scores using statements pertaining to organic (agriculture, household and livestock) waste. An *ex-post facto* research design was used along with multistage random sampling to select a total of 80 dairy farmers (40 each large and small) from District Ludhiana of Punjab based on livestock holding. The mean scores for all the opinion statements were calculated and it was found that among agriculture, household and livestock waste, the farmers were highly regarding 'Crop residue burning is most economical of all the methods for their management but cause environmental pollution and diseases', 'Kitchen waste should not be littered as littering increases the menace of rodents, insects and birds which may lead to diseases; Food waste can be reduced by adopting well measured and balanced cooking plan' and 'Utilization of dung manure leads to organic way of farming which is beneficial for human health', respectively. The study was concluded with the impression that farmers had positive opinion for management of organic waste but needs to be motivated and trained for sustainable management of the same.

Keywords: Crop residue, dairy, dung, opinion, organic waste

1. Introduction

The productivity of the agriculture and allied sectors have increased significantly over the years [28]. The animal genetic resources have also contributed immensely to the unique germplasm of the country targeting the increased production [16, 17, 18, 23, 33]. Along with increase in productivity, the waste production has also increased [1, 38]. The crop residue production has surged to 350 million tonnes (MT) per year whereas the current dung production from bovines is estimated to be 550.66 MT [2, 3, 4]. This mammoth biomass disturbs the lifecycle of various nutrients until managed sustainably [5, 6, 24, 25]. The sustainable management of wastes depends on the behavioural attributes of the farmers [20, 21]. Opinion is a major subset which forms the overall behavioural expression of an individual. Adoption of the suggested behaviors and interventions necessary at a specific period is influenced by an agreeable and acceptable [7, 19, 22]. Studies have elicited that behaviour can be influenced by the use of various techniques and technologies [29, 30, 32, 35, 36, 37]. Given how much organic waste is produced in rural areas, it was crucial to investigate farmers' perspectives on how to manage this waste in a sustainable and environmentally beneficial manner. Therefore, it was necessary to assess the farmers' opinions regarding the management of organic waste in order to provide a full image of waste disposal at the field level.

2. Materials and Methods

The study was conducted purposively in the state of Punjab because the contribution of agriculture and allied sectors in the Net State Domestic Product (NSDP) is one of the highest in India. Moreover, the bovine productivity is the highest in the state along with highest per capita milk availability [8, 9, 26, 27]. An *ex-post facto* research design was used along with multistage random sampling for selecting the dairy farmers [34].

For the present study, dairy farmer was operationally defined as a farmer who practices dairy farming as a business venture and rears at least 5 dairy animals with at least 2 acres of agricultural land. A total of 80 respondents, 40 from each group of dairy farmers were selected for the study. The state of Punjab and district Ludhiana was purposively selected based on their organic waste production attributes. District Ludhiana comprises of 13 blocks, out of which two blocks i.e. Ludhiana-I and Sidhwan Bet were randomly selected for the study. From each selected block, randomly four villages were selected. Further, from each village, 10 dairy farmers were selected, thus making a sample size of 80. Mean Scores (MS) for the opinion statements were calculated using the formula given in Equation 1.

$$\text{Mean Score} = \frac{\text{Total Obtained Score}}{\text{Maximum Obtainable Score}} \quad (1)$$

The Mann-Whitney U Test statistic was used to compare the means between the groups which is provided as Equation 2.

$$\text{Mann - Whitney U Test} = \sum_{i=1}^n \sum_{j=1}^m S(X_i, Y_j) \quad (2)$$

Where, X_i , X_n were supposed to be independent and identically distributed sample from X , and Y_i , Y_n were supposed to be independent and identically distributed sample from Y with

$$S(X, Y) = \begin{cases} 1, & \text{if } X > Y \\ \frac{1}{2}, & \text{if } X = Y \\ 0, & \text{if } X < Y \end{cases}$$

Table 1: Ranking of opinion statements regarding agriculture waste

S. No	Statement	MSs	Rank	MSL	Rank	MSP	Rank	MWU Value
1.	Agriculture waste can be managed easily by composting.	0.58	VII	0.39	VII	0.48	VII	584.00*
2.	Mulching of crop residues entails easy management with increase in organic content of the soil.	0.61	VI	0.51	VI	0.56	VI	660.00 ^{NS}
3.	Composting the crop residues can reduce the cost of fertilizers and enhance soil health.	0.59	VI	0.54	V	0.56	VI	747.50 ^{NS}
4.	By enhancing the nutritional value of agriculture residues, it serves as excellent fodder for livestock.	0.78	IV	0.63	IV	0.70	V	638.00 ^{NS}
5.	Crop residue burning is most economical of all the methods for their management but cause environmental pollution and diseases.	0.93	I	0.93	I	0.93	I	800.00 ^{NS}
6.	Burning of crop refuse can be stopped if government provides financial aid in the form of subsidies and honorariums to individual farmers.	0.91	II	0.93	I	0.92	II	780.00 ^{NS}
7.	Agriculture machinery for managing crop residues should be provided at village level by the government.	0.91	II	0.84	II	0.88	III	680.00 ^{NS}
8.	Awareness among the farmers related to crop residue management can reduce the extent of burning.	0.85	III	0.80	III	0.83	IV	734.00 ^{NS}

MSs: Small farmers' mean score; MSL: Large farmers' mean score; MSP: Pooled mean score; MWU: Mann-Whitney U Test; NS: Non-significant; * significant at $p < 0.05$

3.2 Opinion mining for household waste

Table 2 elucidates the ranking of opinion of farmers regarding management of household waste, the opinion statements viz. kitchen waste should not be littered as littering increases the menace of rodents, insects and birds which may lead to diseases and food waste can be reduced by adopting well measured and balanced cooking plan were ranked I with mean

3. Results and Discussion

3.1 Opinion mining for agriculture waste

The ranking of opinion of farmers regarding management of agriculture waste is given in Table 1. For the pooled sample, farmers opined that crop residue burning is most economical of all the methods for their management but cause environmental pollution and diseases which was ranked I with mean score 0.93, followed by burning of crop refuse can be stopped if government provides financial aid in the form of subsidies and honorariums to individual farmers (Rank II, MS 0.92), agriculture machinery for managing crop residues should be provided at village level by the government (Rank III, MS 0.88), awareness among the farmers related to crop residue management can reduce the extent of burning (Rank IV, MS 0.83), enhancing the nutritional value of agriculture residues serves as excellent fodder for livestock (Rank V, MS 0.70), mulching of crop residues entails easy management with increase in organic content of the soil and composting the crop residues can reduce the cost of fertilizers and enhance soil health both ranked VI with mean score 0.56 and agriculture waste can be managed easily by composting (Rank VII, MS 0.48). There was a significant difference ($p < 0.05$) in the opinion elicited by small and large farmers over the opinion statement 'agriculture waste can be managed easily by composting'. Small farmers were found to have more scores as compared to large farmers regarding opinion on agriculture waste management. The results of the present study are in line with those reported by Satyendra *et al.* (2013) [10] and Roy *et al.* (2018) [11] in which the farmers opined that crop residues or biomass burning are cheap and easiest method to dispose the leftover crop residues (wheat, rice, sugarcane etc.) after harvesting, for land clearing and pest control.

score 0.89, followed by safe way to manage foods of animal origin, spoiled fruits, vegetables and grains is composting (Rank II, MS 0.82), garden sweepings and paper waste can be easily managed by composting (Rank III, MS 0.78), kitchen waste composting machine is the best way for managing kitchen waste (Rank IV, MS 0.74) and feeding fresh vegetable and fruit peels to livestock is a good practice (Rank

V, MS 0.57). Singh *et al.* (2016) ^[12] and Singh & Rashid (2017) ^[13] provided an insight that household waste can easily

be managed by composting which was also opined by the farmers in the present investigation.

Table 2: Ranking of opinion statements regarding household waste

S. No.	Statement	MSs	Rank	MSL	Rank	MSp	Rank	MWU Value
1.	Garden sweepings and paper waste can be easily managed by composting	0.76	IV	0.79	IV	0.78	III	760.00 ^{NS}
2.	Feeding fresh vegetable and fruit peels to livestock is a good practice.	0.63	VI	0.51	VI	0.57	V	689.00 ^{NS}
3.	The safe way to manage foods of animal origin, spoiled fruits, vegetables and grains is composting	0.81	III	0.83	III	0.82	II	767.00 ^{NS}
4.	Kitchen waste composting machine is the best way for managing kitchen waste	0.75	V	0.73	V	0.74	IV	790.00 ^{NS}
5.	Food waste can be reduced by adopting well measured and balanced cooking plan	0.88	II	0.90	I	0.89	I	760.00 ^{NS}
6.	Kitchen waste should not be littered as littering increases the menace of rodents, insects and birds which may lead to diseases	0.90	I	0.88	II	0.89	I	760.00 ^{NS}

MSs: Small farmers' mean score; MSL: Large farmers' mean score; MSp: Pooled mean score; MWU: Mann-Whitney U Test; NS: Non-significant

3.3 Opinion mining for livestock waste

Table 3 reflects the ranking of opinion of farmers regarding management of livestock waste. The opinion of utilization of dung manure leads to organic way of farming which is beneficial for human health was ranked I with mean score 0.96 followed by production of farmyard manure is the most economical method of livestock waste management (Rank II, MS 0.95), use of earthworms enhances the nutrient composition of the manure, therefore vermicomposting is better than traditional composting and biogas is safe, easy to produce and eco-friendly form of energy (both Rank III, MS 0.94), health risks related with handling of livestock waste can be overcome by proper handling and composting and higher percentage of subsidies should be given on biogas plants and stoves (both Rank IV, MS 0.91), dung from livestock is a resource and should not be burned in the form of dung cakes (Rank V, MS 0.85), livestock dung contains essential elements required by the soil and should be used as a

manure (Rank VI, MS 0.80), use of dung manure cut costs on fertilizer use, enhances soil health and boosts crop productivity (Rank VII, MS 0.66) and incorporating kitchen waste into dung for biogas production is good for its management (Rank VIII, MS 0.52). The results of the study are in accordance with those reported by Baliah (2017) ^[14] in which farmers opined that the organic manures play a key role in promoting growth and providing immunity to plant system. Mittal *et al.* (2018) ^[15] opined that biogas has emerged as a promising renewable technology to convert agricultural, animal, industrial and municipal wastes into energy. Singh *et al.* (2021b) ^[6] opined that vermiculture technology have the potential to generate self-employment opportunities for the unemployed as the returns are optimal and better than traditional composting. For bringing a positive change in the opinion of the dairy farmers, there is need to enhance their knowledge as their knowledge regarding scientific dairying is low ^[31].

Table 3: Ranking of opinion statements regarding livestock waste

S. No.	Statement	MSs	Rank	MSL	Rank	MSp	Rank	MWU Value
1.	Livestock dung contains essential elements required by the soil and should be used as a manure.	0.79	VI	0.81	VI	0.80	VI	760.00 ^{NS}
2.	Use of dung manure cut costs on fertilizer use, enhances soil health and boosts crop productivity.	0.69	VII	0.64	VII	0.66	VII	737.50 ^{NS}
3.	Dung from livestock is a resource and should not be burned in the form of dung cakes.	0.88	V	0.83	V	0.85	V	720.00 ^{NS}
4.	Production of farmyard manure is the most economical method of livestock waste management.	0.94	II	0.96	II	0.95	II	760.00 ^{NS}
5.	Utilization of dung manure leads to organic way of farming which is beneficial for human health.	0.95	I	0.96	I	0.96	I	780.00 ^{NS}
6.	The health risks related with handling of livestock waste can be overcome by proper handling and composting.	0.89	IV	0.93	III	0.91	IV	740.00 ^{NS}
7.	Use of earthworms enhances the nutrient composition of the manure; therefore vermicomposting is better than traditional composting.	0.94	II	0.95	II	0.94	III	780.00 ^{NS}
8.	Biogas is safe, easy to produce and eco-friendly form of energy.	0.93	III	0.95	II	0.94	III	760.00 ^{NS}
9.	Higher percentage of subsidies should be given on biogas plants and stoves.	0.93	III	0.90	IV	0.91	IV	760.00 ^{NS}
10.	Incorporating kitchen waste into dung for biogas production is good for its management	0.48	VIII	0.56	VIII	0.52	VIII	687.50 ^{NS}

MSs: Small farmers' mean score; MSL: Large farmers' mean score; MSp: Pooled mean score; MWU: Mann-Whitney U Test; NS: Non-significant

4. Conclusion

The study can be concluded with the impression that farmers had positive opinion regarding sustainable management of

organic waste. However, there is imminent need to build their capacities and provide them with incentives for the management of same. The opinions of the small farmers and

large farmers were same for most of opinion statements and no significant difference was there, which implies that the felt needs of both groups were same regarding management of organic waste and this needs to be catered by the policy makers while developing policies on waste management.

4.1 Conflict of interests statement

The authors declare no conflicts of interest.

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