

Extent of Adoption of Vermicompost by the Farmers of Bathiaghata Upazila under Khulna District of Bangladesh

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Abstract—The main objectives of this study were to determine the farmers' extent of adoption of vermicompost and to explore the relationship between selected characteristics of the farmers and their extent of adoption of vermicompost. Data were collected from randomly selected 80 respondents of five villages such as Raingamari, Sachibunia, Dorgatola, Jhorvanga and Mathavanga of Bathiaghata upazila under Khulna district through personal interview method by the researcher himself using an interview schedule during 04 March to 06 April, 2018. Farmers extent of adoption of vermicompost was the dependent variable and the twelve selected characteristics of the respondents considered as the independent variables of the study. Majority (68.8%) of the respondents had low adoption followed by medium (26.3%) and high adoption (5%). Among twelve selected characteristics of the respondents educational qualification, extension media contact, cosmopolitaness, knowledge on vermicompost and training experience on vermicompost of the respondents showed a significant positive relationship with their extent of adoption while age, family size and farming experience showed a significant negative relationship with their extent of adoption of vermicompost. Most (96.25%) of the respondents belong to medium problem confrontation category followed by low problem confrontation (3.75%). Out of 10 identified problems, respondents indicate "Lack of training in adoption of vermicompost" as the highly severe problem followed by "Lack of knowledge on vermicompost." The least severe problem was "an unpleasant odor comes from the bin."

Keywords: Extent of adoption, Vermicompost, Farmers.

1. INTRODUCTION

Vermicompost is the product of the composting process using various species of earthworms. Usually red wigglers, white worms, and other earthworms are used to create vermicompost. It is a heterogeneous mixture of decomposing vegetable or food waste, bedding materials and vermicast, also called worm castings, worm humus or worm manure. It is the end-product of the breakdown of organic matter by an earthworm (Allen, 2016). These castings have been shown to

contain reduced levels of contaminants and a higher saturation of nutrients than do organic materials before vermicomposting. Containing water-soluble nutrients, vermicompost is an excellent, nutrient-rich organic fertilizer and soil conditioner (Sherman, 2003). The process of producing vermicompost is called vermicomposting (Ndegwa et al., 1998; Ndegwa and Thompson, 2001). Vermicomposting is the biological degradation and stabilization of organic waste by earthworms and microorganisms to form vermicompost. This is an essential part in organic farming today. It can be easily prepared, has excellent properties, and is harmless to plants. The earthworms fragment the organic waste substrates, stimulate microbial activity greatly and increase rates of mineralization (Aira et al., 2007). These rapidly convert the waste into humus-like substances with finer structure than thermophilic composts but possessing a greater and more diverse microbial activity. Vermicompost being a stable fine granular organic matter, when added to clay soil loosens the soil and improves the passage for the entry of air. The mucus associated with the cast being hygroscopic absorbs water and prevents water logging and improves water holding capacity. The organic carbon in vermicompost releases the nutrients slowly and steadily into the system and enables the plant to absorb these nutrients. The soil enriched with vermicompost provides additional substances that are not found in chemical fertilizers (Kale, 1998).

According to Sinha *et al.*, (2010) vermicomposting is "economically viable" (affordable by all nations), "environmentally sustainable" (friendly to the environment-flora, fauna, soil, air and water, with no adverse effect on them) and "socially acceptable" (beneficial to the society with no adverse effect on human health) technology.

Vegetable and fruit in our market are not always safe for health due to excessive use of agrochemicals. Farmers can produce safe foods by using vermicompost. It can play a great

role to our economy. On the basis of our extension visit experience, we found that the farmers' of rural area of Bangladesh are eager to use vermicompost. Farmer of all ages can start this work at their farm. Mahmud et al., (2016) found that combination of vermicompost and chemical fertilizers increased the organic matter, P, K and S status of post harvest soil significantly. Hasanuzzaman et al., (2010) showed that wetland rice productivity could be increased through the application of vermicompost instead of other conventional manures. All these are the views of the researchers regarding the performance of vermicompost. Besides, the practical field situation is revealing that the availability of suitable earthworm species for vermicomposting and large scale production of vermicompost are still challenges for the rural farmers. It can be said that vermicompost is of huge potential to play an important role in our agriculture. Provided these beneficial effects of vermicompost but we don't know the adoption status of the technology at farmers level. Considering these points in view, the researchers intended to conduct this study.

Followings are the specific objectives of the study:

1. To analyze the selected characteristics of the vermicompost users.
2. To determine the extent of adoption of vermicompost by the vermicompost users.
3. To explore the relationships between selected characteristics of the vermicompost users and their extent of adoption of vermicompost.
4. To identify the problems confronted by the vermicompost users in adoption of vermicompost.

2. METHODOLOGY

Research Design and Sources of Data: The study was designed to determine the extent of adoption of vermicompost by the farmers and their problems related to use of vermicompost. It was conducted at five villages namely Raingamari, Shacibunia, Mathavanga, Dorgatola and Jhorvanga of Bathiaghata upazila under Khulna district of Bangladesh. Data were collected from randomly selected 80 farmers out of 160 vermicompost users during 04 March to 06 April, 2018 using a pretested interview schedule through face-to-face interview.

Selection and Measurement of Variables: Data were collected on socioeconomic characteristics of the respondents which were treated as independent variable viz., age, educational qualification, family size, farming experience, innovativeness, farm size, annual family income, extension media contact, organizational participation, cosmopolitanism, knowledge on vermicompost, and training experience. The innovativeness of the respondents was determined on the basis of time (months) required to adopt vermicompost from first hearing to final adoption of it. Then, the required time was categorized following the adopter categories suggested by Rogers (1983).

The extent of adoption of vermicompost was measured by percentage of area coverage by vermicompost using the following formula:

$$\text{Extent of Adoption} = \frac{A_a}{P_a} \times 100$$

Where,

A_a = Actual area of adoption of vermicompost

P_a = Potential area for adoption of vermicompost

To determine the problem confrontation score of the respondents a 4-point scale such as highly severe, moderately severe, negligible, not at all was employed against each of the problem and a score of 3, 2, 1 and 0 was assigned against the rating scales respectively. Each of the respondents was asked to rate the extent of problem confrontation against each of the 10 problems. Thus, the problem confrontation score of a respondent could range from '0' to '30' where '0' indicate no problem confrontation and '30' indicate high problem confrontation.

The extent/severity of the problems about using of vermicompost was determined by the following formula:

$$\% \text{Severity} = \frac{\text{Observed PCI score}}{\text{Possible PCI score}} \times 100$$

PCI score was calculated by using the following formula:

$$\text{PCI} = N_1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0$$

Where, PCI = Problem Confrontation Index

N_1 = No. of respondents rated the problems as highly severe

N_2 = No. of respondents rated the problems as moderately severe

N_3 = No. of respondents rated the problems as negligible

N_4 = No. of respondents rated the problems as not at all

The PCI score of the respondents could range from '0' to '240' where '0' indicate no problem while '240' indicate the high problem confrontation.

Statistical treatments such as number, percent, rank order, range, mean and standard deviation were used to interpret data. To **explore relationship** between any two variables Pearson's Product Moment correlation coefficient 'r', Spearman rank correlation and functional relationship were employed. Data were analyzed using Microsoft Excel and Statistical Package for Social Science (SPSS).

3. RESULTS AND DISCUSSION

Selected socioeconomic characteristics

About half (48.8%) of the respondents were young as compared to 45% being middle aged and 6.3% old. It means that young and middle aged people of that locality were more interested to use vermicompost in their field. Highest

proportion (46.3%) of the respondents had secondary level of education followed by illiterate (37.5%), primary (7.5%), graduate or above (5%) and a few (3.8%) belonged to higher secondary category. The respondents those who had higher level of education they are most interested to adopt vermicompost. Majority (63.8 %) of the respondents belonged to the small sized family while 27.5% and 8.8% of them belonged to medium sized family and large sized family respectively. Highest proportion (47.5%) of the respondents were medium experienced in farming followed by high experience (27.5%) and one-fourth (25%) of them had low experience. The findings also indicate that three-fourth of the respondents (75%) has medium to high experience. The respondents showed almost similar adoption behavior as Rogers (1983) findings i.e. in this study the percentage of early adopter, early majority and late majority were 13.8%, 37.5% and 38.8% respectively while Rogers (1983) found (13.5%), (34%) and (34%) respectively for the same. The percentage of laggards decreased to 10 instead of Rogers findings. None of the respondents were innovator. Majority (65%) of the respondents possessed small farm compared to

21.3% and 13.8% of them having marginal and medium farm respectively. None of the respondents belong to landless and large farm categories. Majority (68.8%) of the respondents had medium income while 18.8% had high income. Only 12.5% of the respondents had low income. Most (86.3%) of the respondents had medium extension media contact followed by low extension media contact (12.5%) and high extension media contact (1.3%). Majority (55.1%) of the respondents had low to medium level of organizational participation. On the other hand, two-fifths (40%) of the respondents had no organizational participation and only a few (5%) respondents having high organizational participation. About three-fourth (73.2%) of the respondents had low cosmopolitaness compared to 28.8% had medium cosmopolitaness. Most (88.75%) of the respondents had medium knowledge followed by high knowledge (10%) and only one (1.25%) respondent had low level of knowledge. About one-third (33.75%) of the respondents had no training on vermicompost. However, about two-third (66.25%) of the respondents had low training on vermicompost.

Table 1: Distrubtion of the respondents according to the socio-economic characteristics

Characteristics	Categories	Score	Respondent (N=80)		Min	Max	Mean	Sd (±)
			Number	Percentage (%)				
Age (Years)	Young Middle Old	≤ 35 36-50 >50	39 36 5	48.8 45 6.3	20	65	37.89	9.42
Educational qualification (Schooling year)	Illiterate Primary Secondary Higher Above secondary secondary higher	0 1-5 6-10 11-12 >12	30 6 37 3 4	37.5 7.5 46.3 3.8 5	0	18	5.63	4.9
Family size (Score)	Small Medium Large	Upto 4 5-7 >7	51 22 7	63.8 27.5 8.8	2	9	4.5	1.66
Farming experience (Year)	Low Medium High	≤10 11-20 >20	20 38 22	25 47.5 27.5	2	50	16.39	9.67
Innovativeness (Month)	Innovator (≤ \bar{X} -2Sd) Early Adopter (< \bar{X} -2Sd) to(\bar{X} -Sd) Early Majority(\bar{X} -Sd) to(\bar{X}) Late Majority (\bar{X}) to (\bar{X} +Sd) Laggard (> \bar{X} +2Sd)	≤0.8 0.8-6.5 6.6-12.2 12.3-18.7 >18.7	0 11 30 31 8	0 13.8 37.5 38.8 10	2	24	12.2	5.7
Farm size (ha)	Landless Marginal Small Medium Large	<0.02 0.02-.20 0.21-1.00 1.01-3.00 >3.00	0 17 52 11 0	0 21.3 65 13.8 0	0.03	2.69	0.57	0.55

Annual family income (Score)	Low	≤75000	10	12.5	51000	480000	125640	480000
	Medium	75001-150000	55	68.8				
	High	>150000	15	18.8				
Extension media contact (Score)	Low	1-8	10	12.5	3	18	11.63	2.48
	Medium	9-16	69	86.3				
	High	17-24	1	1.3				
Organizational participation (Score)	No	0	32	40	0	8	1.75	2.1
	Low	1-3	31	38.8				
	Medium	4-6	13	16.3				
	High	>6	4	5				
Cosmopolitaness (Score)	Low	≥5	57	71.2	2	8	4.35	1.54
	Medium	6-10	23	28.8				
	High	>10	0	0				
Knowledge on vermicompost	Low	1-7	1	1.25	7	16	11.85	1.93
	Medium	8-14	71	88.75				
	High	>14	8	10				
Training exposure (Score)	No	0	27	33.75	0	2	0.75	0.60
	Low	1-3	53	66.25				
	Medium	4-6	0	0				
	High	>6	0	0				

Table 2: Distribution of respondents according to their extent of adoption vermicompost

Categories	Score	Respondent (N=80)		Mean	Sd	Range	
		Number	Percentage (%)			Min	Max
Low adoption	Upto 30	55	68.8	23.46	18.63	2.50	87.86
Medium adoption	31-60	21	26.3				
High adoption	>60	4	5				
Total		80	100.00				

Table 3: Computed coefficient of correlation (r) and spearman rank correlation between the selected characteristics of the respondents and their extent of adoption

Characteristics (Independent variable)	Dependent variable	Correlation coefficient	Remark
Age	Extent of adoption	-0.335**	PPCC
Educational qualification		0.267*	PPCC
Family size		-0.262*	PPCC
Farming experience		-0.275*	PPCC
Innovativeness		-0.87	PPCC
Farm size		0.095	PPCC
Annual family income		0.075	PPCC
Extension media contact		0.348**	PPCC
Organizational participation		0.162	SRCC
Cosmopolitaness		0.233*	SRCC
Knowledge on vermicompost		0.365**	PPCC
Training on vermicompost		0.374**	SRCC

NS= Non-significant **, Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed). PPCC = Pearson's Product Moment co-efficient of correlation. SRCC = Spearman Rank Correlation Coefficient

Table 4: Distribution of respondents according to problem confrontation

Categories	Score	Respondent (N=80)		Mean	Sd	Range	
		Number	Percentage (%)			Min	Max
Low problem confrontation	1-10	3	3.75	14.46	2.6	9	20
Medium problem confrontation	11-20	77	96.25				
High problem confrontation	21-30	0	0				
Total		80	100.00				

Table 5: Relative position (rank order) of the statements related to problem regarding using of vermicompost

Sl. no	Statement	PCI		Rank Order
		Score	(%)	
1	An unpleasant odor comes from the bin	30	12.5	10 th
2	It requires high maintenance than that of traditional compost process	103	42.9	6 th
3	High price of worm	97	40.4	7 th
4	Dying of worm	132	55	3 rd
5	Lack of knowledge on vermicompost	188	78.3	2 nd
6	Unavailability of worm	88	36.6	9 th
7	Scarcity of vermicompost supply in time	94	39.16	8 th
8	Lack of training in adoption of vermicompost	205	85.4	1 st
9	Non availability of printed materials about vermicompost	120	50	4 th
10	Unavailability of food for worm	110	45.8	5 th

*PCI= Problem Confrontation Index

Extent of adoption of vermicompost

The extent of adoption score of the respondent varied from 2.5% to 87.86% with a mean and standard deviation of 23.46 and 18.63, respectively. On the basis of extent of adoption score the respondents were classified into three categories which is presented in Table 2. It was revealed from the study that majority (68.8%) of the respondents had low adoption followed by medium (26.3%) and high adoption (5%). The findings of the study also indicate that most (95.1%) of the respondents had low to medium level of adoption. This might be due to that vermicompost is introduced very recently in the study area. The findings of the study have almost harmony with the findings of Islam (2007). He found that most (91%) of the respondent had low to medium adoption and only a few (9%) respondents having high adoption. The present findings quite similar to the findings of Islam (2007) adoption of mixed cropping.

Relationship between the selected characteristics of the respondents and their extent of adoption of vermicompost

This section deals with the relationship between twelve selected characteristics of the vermicompost users (farmers') and their extent of adoption of vermicompost. To explore the relationships between the selected characteristics of the respondents and their extent of adoption Pearson's product Moment co-efficient of correlation (r) as well as Spearman rank correlation Coefficient were used. The relationship of the selected characteristics of the respondents with their extent of adoption appears in Table 3.

Problem Confrontation

Problem confrontation score of the respondents ranged from 9 to 20 with a mean of 14.46 and standard deviation of 2.6. The distribution of respondents according to their problem confrontation score is shown in Table 4. Data presented in Table 4. indicate that most (96.25%) of the respondents had medium problem confrontation followed by low (3.75%) problem confrontation. None of respondents belonged to high problem confrontation categories.

Comparative problem confrontaion of farmers regarding individual statement related to problem of vermicompost

Based on the Problem Confrontation Index (PCI) score, the statements were also arranged in rank order as shown in the Table 5. Data presented in Table 5. indicate that the farmers' had high problem confrontation regarding 'Lack of training in adoption of vermicompost' followed by 'Lack of knowledge on vermicompost', 'Dying of worm' etc. The farmers' also expressed their least severe problem confrontation regarding 'an unpleasant odor comes from the bin'.

4. CONCLUSION

Majority of the respondents had low adoption followed by medium and high adoption of vermicompost. Among 12 selected characteristics of the respondent's educational qualification, extension contact, cosmopoliteness, knowledge on vermicompost and training experience of the respondents showed a significant positive relationship with their extent of adoption while age, family size and farming experience showed a significant negative relationship with their extent of adoption. The rest characteristics did not show any significant relationships with adoption.

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