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KNOWLEDGE OF TRIBAL WOMEN ON BIOCHAR PROMOTION FOR HOMESTEAD GARDENING

M.R. Karim*, T. Fardaus, M.R. Khan, M.R.F. Noman and S. Huda

Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University Dinajpur 5200, Bangladesh

ABSTRACT

The purpose of the study was to determine the knowledge of the tribal women on biochar promotion for homestead gardening. The research study was conducted in Nawabgang Upazila under Dinajpur district. A pretested and structured interview schedule was used to collect data from the tribal women during the period 16 August to 17 September, 2017. Co-efficient of correlation (r) was computed in order to explore the relationship between the ten selected characteristics of the tribal women and their knowledge on biochar. Findings indicated that majority of the tribal women (36.30%) had high knowledge followed by low knowledge (34.30%) and medium knowledge (29.40%) on biochar promotion for homestead gardening. Correlation analyses indicated that five selected characteristics such as level of education, farm size, annual family income, training received and extension media contact of the tribal women had positive significant relationship with their knowledge on biochar for homestead gardening. However, the selected characteristics such as age, family size, decision making ability, organizational participation and fatalism had no significant relationships with their knowledge on biochar for homestead gardening. The major problem faced by the tribal women on biochar promotion was found on 'lack of woody fuel' (Problem Faced Index value = 223). The lowest problem of tribal women faced on 'complexity on storage' (Problem Faced Index value = 50).

Key words: Knowledge, tribal women, biochar promotion, homestead gardening

INTRODUCTION

Bangladesh is mainly an agricultural based country. The improvement in agricultural sector means the development of the country. About 48.4% of the total populations of this country are directly involved in agricultural activities. Agriculture sectors contribute 17.5% to the Gross Domestic Product (GDP) of the country (FAO 2020). The country has 162.7 million people with a high population density (Bangladesh Statistics 2018.). The government predicts that with a high growth rate 1.59%, the total population will rise to approximately 265 million by 2050, putting increasing pressure on scarce resources (land and forest) for additional demand of food and energy (BBS 2017). Green revolution in Bangladesh was started in 1960 to feed its huge population through the adoption of modern variety, deep irrigation, synthetic fertilizers and pesticides (Savary *et al.* 2012 and Roy *et al.* 2013). Bangladesh has achieved success in agriculture due to increased yield of cereal crops over the last few decades. But the country is facing land degradation challenges due to excess use of ground water, chemical fertilizers and pesticides (Roy *et al.* 2013). In addition, the country has been suffering frequent natural disaster because of climatic change (Karim and Thiel 2017).

Women constitute about half of the humanity. Among total 152.51 million population of Bangladesh, women constitute 75.13 million (BBS 2017). Hence, women constitute about fifty percent of population, performing two-thirds of the work and produce fifty percent of food commodities. They

*Corresponding author: Email: rezaulaex@hstu.ac.bd, Cell phone: +8801717222702

earn one thirds of remuneration and own ten percent of the property or wealth of the country. Women are regarded as the "better half" of the society and at par with the men. But in reality, our society isstill male dominated and women are not treated as equal partners both inside and outside the four walls of the house. In fact, they are treated as weak and dependent on men. Moreover, women enjoy an unfavorable status in the society of Bangladesh (Amin *et al*. 2016). But, women empowerment is very important for the socio-economic development of the country.

Biochar is charcoal made from organic residues that are carbonized at temperature between 450-750°C in the absence of oxygen (pyrolysis) or with restricted oxygen (gasification). People have known for millennia that the ash and charcoal are good for plant growth (BBI 2015). Biochar is produced in an environmentally friendly manner by recycling plant waste into fertilizer (Cui 2015, McLaughlin *et al*. 2009 and Lehmann 2009). The existence of these 'dark earths' with high levels of soil fertility is often used to support modern research on biochar as a soil amendment (Leach *et al*. 2010). Moreover, the development of biochar producing stoves, which provides energy efficient and healthy cooking resulting biochar used for soil improvement and greenhouse gas (GHG) reduction (Barrow 2012).

In 2013, Bangladesh Biochar Initiative (BBI) was formulated to foster the use of biochar producing stove and its end product biochar for environment friendly cooking mechanism and sustainable agricultural development. Canadian scientist Professor Dr. Julian Winter and CCDB (Christian Commission for Development in Bangladesh) Policy Advisor Md. Mahbubul Islam recently invented low cost Natural Draft-Top-Lit-Up-Draft (ND-TLUD) gasifier stove (local name *Akha Chula*) which is environment and agriculture friendly and can be used for cooking and heating with locally available biomass (Karim 2018_a). The basic operating principle of an ND-TLUD is quite simple and compatible to the women's cooking habits of Bangladesh. The resulting end product after cooking process is called biochar that can be used as soil amendment (BBI 2015).

Biochar is an emerging multi-purpose innovation which is rapidly attracting the attention of researchers. An ideal use of biochar is natural or organic waste management. Transforming biomass into biochar through *Akha Chula* may prevent emissions of carbon dioxide and other greenhouse gases to the atmosphere (Scholz *et al*. 2014). Biochar has many agricultural benefits. It increases crop yields, sometimes substantially if the soil is in poor condition. The opportunities of biochar promotion using *Akha Chula* could be written as: a) *Akha Chula*, which produces high heat or renewable energy without smoking and black spots while consuming less time for cooking food materials; and b) both *Akha Chula* and biochar are environmentally friendly, ensuring long term soil fertility and better crop yield (Karim 2018_a).

In the salt affected regions along the south coast, biochar could be used to increase food production on the higher ground where homesteads are located (BBI 2015). It is hard to make a farm family self-sufficient only with the production of field crops. Using the biochar as organic materials in homestead gardens will have an immediate impact on household nutrition and income. The benefits of organic farming seemed to be environmentally friendly and helpful for climate change mitigation (Karim 2018_b).

Bangladesh is an agrarian country and about 65 percent of its population lives in rural area (Karim and Muhammad 2018). Homestead vegetable production can play a vital role in poverty alleviation by increasing food production as well as raising the nutritional status of the people. A homestead refers to home and adjoining land occupied by a family for a purpose, such as small scale agricultural production, health and nutrition (Kundu *et al.* 2010).

Since 2013, CCDB (Christian Commission for Development in Bangladesh) has been fostering the Bangladesh Biochar Initiative program that will help the energy issue with efficient cook stoves and simultaneously producing biochar applicable to small scale homestead farmin gas environment friendly agriculture. From that point of view, the researchers attempted the research study with the objectives: a) to describe the selected characteristics of the tribal women; b) to determine the extent of knowledge of tribal women on biochar; c) to explore the relationship between selected characteristics of the tribal women and their knowledge on biochar promotion; and d) to assess the problems faced by the tribal women in biochar promotion activities.

MATERIALS AND METHODS

Locale of the study and sampling: The study was conducted in two unions, Dawadpur and Mohammudpur of Nawabganj Upazila under Dinajpur district where biochar initiative activities have been implementing by CCDB. Bangladesh Biochar Initiatives with the support of Christian Commission for Development in Bangladesh (CCDB) has been implementing in the study area for the socio-economic development of the tribal women such *Santal* and *Orau*. An updated list of 276 tribal women was collected from CCDB office record. Among them a sample of 102 tribal women was selected by random sampling method.

Measurement of selected characteristics and focus issue: The selected characteristics of the tribal women such as age, level of education, family size, farm size, annual income, decision making ability, organizational participation, training received, fatalism and extension media contact were measured by following appropriate techniques and standard scales. Knowledge on biochar promotion for homestead gardening was the focus issue of the study. The knowledge level of a respondent women was measured by asking 18 questions related to biochar production and its application in homestead gardening. Different scores such as 2, 3, 4 and 5 were assigned for the questions based on the nature of each question (Karim *et al.* 2011). For correct response, the respondents were given full of the assigned scores. Thus, the possible knowledge on biochar of the respondents could be ranged from 0 to 66. Where, 0 indicated no knowledge and 66 indicated very high level of knowledge on biochar promotion for homestead gardening.

Measurements of problems faced by the tribal women in biochar promotion: Eight problems were selected faced by tribal women in promoting biochar. The respondents were asked to response on four alternatives responses as ‘not at all’, ‘low’, ‘medium’ and ‘high’for each of 8 selected problems. Scores were assigned to those alternative responses as 0, 1, 2 and 3, respectively. To ascertain the comparison among the problems, Problem Faced Index (PFI) was computed by using the following formula which was adopted from Rahman *et al.* (2014):

$$PFI = Pn\times 0 + Pl\times 1 + Pm\times 2 + Ph\times 3$$

Where,

PFI = Problem Faced Index
Pn = Number of respondents influenced ‘not at all’
Pl= Number of respondents influenced ‘low’
Pm = Number of respondents influenced ‘medium’
Ph = Number of respondents influenced ‘high’

Thus FPI for a particular factor could range from '0’ to '306', while ‘0' indicating no problem faced and ‘306’ indicating highest problem faced.

Data processing and analysis: After data collection, the collected data were coded, compiled, tabulated and analyzed. The analysis was performed by using the Statistical Package for Social Science (SPSS 22.0) package. Descriptive statistical measures such as frequency, number, percentage, mean, standard deviation and rank order was used for categorization and describing the variables. Pearson's Product Moment Correlation Coefficient (r) was used for testing the relationships between the concerned variables.

RESULTS AND DISCUSSION

Knowledge of tribal women on biochar: The observed scores of the tribal women knowledge ranged from 1 to 24 with the mean and Standard Deviation (SD) were 33.04 and 18.70, respectively. Based on the possible scores, tribal women were classified into three categories such as low (up to 22), medium (23-44) and high knowledge (above 44) shown in Table 1. A similar category was followed by Azad (2013).

Finding showed that majority (36.30%) of the tribal women had high knowledge followed by 34.3% had low knowledge and 29.40% had medium knowledge on biochar. It could be said that more than half (63.70%) of the tribal women had low to medium knowledge on biochar promotion for homestead gardening (Table 1).

Selected characteristics of the tribal women: Majority (81.40%) tribal women were young followed by 14.70% were middle aged and only 3.90% were old. Around half (49.00%) of the tribal women could sign their name only followed by 28.40% of the tribal women had secondary level of education compared to 15.70% primary level education and 4.90% had above secondary level of education and only 2.00% tribal women were illiterate in the study. Highest proportion 70.60% of the tribal women had medium family size, while 20.60% of belonged to small family size and only 8.80% of them had large family size. It could be said that two-third of the tribal women had medium family size. Highest proportion (44.10%) of the tribal women had small farm compared to 30.40% marginal, 12.70% medium farm, 11.80% landless and only 1.00% had large farm size. Majority proportion (88.20%) of the tribal women had medium family income compared to 10.80% had high income and only 1.00% had low income. Highest proportion (86.30%) of the tribal women had medium decision making ability, while 10.80% had low and 2.90% had high decision making ability (Table 2).

Majority (91.20%) of the tribal women had low organizational participation followed by 4.90% medium, 2.90% high and 1.00 % had no participation in organization. Around 61.80% of the tribal women had received medium training followed by 34.30% had no received training. Majority (54.90%) of the tribal women had medium fatalism, while 28.40% had low and 16.70% had high fatalism. A major proportion (81.40%) of the tribal women had low extension media contact compared to 17.60% of them having medium extension media contact (Table 2).

Relationship between the selected characteristics and knowledge on biochar promotion: Pearson's Product Moment co-efficient of correlation (r) was used to test a null hypothesis concerning the relation between any two variables. Results of co-efficient of correlation between each of the selected characteristics of the tribal women and their knowledge on biochar promotion have shown in Table 3. Among 10 selected characteristics of tribal women such as level of education, farm size, annual income, training received and extension media contact showed significant relationship with knowledge on biochar promotion in homestead gardening. On the other hand, age, family size, decision making ability, organizational participation and fatalism did not show significant relationship with tribal women knowledge on biochar for homestead gardening (Table 3).

Table 1. Categorisation of the tribal women based on their knowledge on biochar

Range		Categories	Respondents		Mean	SD
Possible	Observed		No.	%		
0-66	2-63	Low (up to 22)	35	34.30	33.04	18.70
		Medium (23-44)	30	29.40		
		High (above 44)	37	36.30		

Table 2. Categorisation of tribal women based on their selected characteristics

Characteristics	Scoring method	Range		Categories	Respondents		Mean	SD
		Possible	Observed		No.	%		
Age	No. of year	Unknown	18-60	Young (≤35)	83	81.40	31.97	7.704
				Middle (36-50)	15	14.70		
				Old aged (≥51)	4	3.90		
Education	Year of schooling	Unknown	0-13	Illiterate (0)	2	2.00	3.39	4.223
				Can sign only (0.5)	50	49.00		
				Primary (1-5)	16	15.70		
				Secondary (6-10)	29	28.40		
				Above SSC (≥11)	5	4.90		
Family size	No. of Member	Unknown	1-9	Small (≤ 3)	21	20.60	4.66	1.432
				Medium (4-6)	72	70.60		
				Large (≥7)	9	8.80		
Farm size	Hectare	Unknown	0.0-3.34	Landless (<0.02)	12	11.80	0.48	0.622
				Marginal (0.021-0.2)	31	30.40		
				Small (0.21-1.0)	45	44.10		
				Medium (1.01-3.0)	13	12.70		
				Large (>3.0)	1	1.00		
Annual income	('000' Tk.)	Unknown	35-585	Low (<33)	1	1.00	128.16	95.431
				Medium (33-223)	90	88.20		
				High (above 223)	11	10.80		
Decision making ability	Score	0-40	8-40	Low (<13)	11	10.80	17.92	4.242
				Medium (13-26)	88	86.30		
				High (above 26)	3	2.90		
Organization participation	Score	0-24	0-7	No (0)	1	1.00	1.51	1.032
				Low (1-2)	93	91.20		
				Medium (3-4)	5	4.90		
				High (above)	3	2.90		
Training received	Day	Unknown	0-7	No (0)	35	34.30	2.05	1.631
				Short term (≤ 2)	1	1.00		
				Medium (3-4)	63	61.80		
				Long-term (>4)	3	2.90		
Fatalism	Score	1-35	10-18	Low (≤12)	29	28.40	13.18	2.075
				Medium (13-24)	56	54.90		
				High (≥25)	17	16.70		
Extension media contact	Score	0-36	1-24	Low (≤12)	83	81.40	8.90	4.509
				Medium (13-24)	18	17.60		
				High (>24)	1	1.00		

Table 3. Relationship between selected characteristics and knowledge on biochar promotion

Focus Issue	Selected characteristics	Computed ' r' value	Tabulated 'r' value at	
			0.05 level	0.01 level
Knowledge on biochar promotion	Age	0.026	0.195	0.254
	Level of education	0.284**		
	Family size	-0.117		
	Farm size	0.259**		
	Annual income	0.246*		
	Decision making ability	0.152		
	Organization participation	0.058		
	Training received	0.739**		
	Fatalism	-0.066		
	Extension media contact	0.525**		

***Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).*

Problems faced by the tribal women in biochar promotion: Tribal women mentioned their problems faced in biochar promotion. The percent distributions of the respondents for each of the problems are presented in Table 4 along with Problem Faced Index (PFI) and the ranked order of the problems based on PFI. The PFI in implementing of CCDB program ranged from 50 to 223 against the possible range 0 to 306.

Table 4. Rank orders of the problems faced by the tribal women in biochar promotion

Sl. No.	Problems in biochar promotion	Extent of problems				PFI	Rank order
		Not at all	Low	Medium	High		
1.	Operating of *Akha* is difficult	27	49	23	3	104	6
2.	Unavailability of woody fuel	9	6	44	43	223	1
3.	Complexity in storage of biochar	53	48	1	0	50	7
4.	Comparatively high price of *Akha*	28	39	25	10	119	5
5.	Lack of training on *Akha* and biochar	3	16	47	36	218	2.5
6.	Lack of information on biochar	23	26	37	16	148	4
7.	Lack of knowledge on biochar use	19	33	34	16	149	3
8.	Insufficient information on biochar	3	16	47	36	218	2.5

The data from the research revealed that the highest problem faced by the tribal women was found on 'unavailability of woody fuel' (PFI = 223). The result might be due to that most of the beneficiaries are poor and use dry leaves and tree shell in traditional cooking purpose. The second important problem faced by the tribal women was found on 'insufficient of information on biochar use' and 'lack of training on *Akha* and biochar' (PFI = 218). The result might be due to that most of them are poor educated and they cannot get available information from different sources of extension. Complexity in storage of biochar' (PFI = 50) was found as lowest ranked problem faced by tribal women in biochar.

CONCLUSION

Around more than half of the tribal women had low to medium knowledge on biochar promotion for homestead gardening. Therefore, there should take necessary education and campaign programme to

increase the knowledge level on biochar. Care should be taken to increase tribal women participation in various government and non-government organizations. In addition, proper steps should be given to maximize individual, group and mass contact methods like farm and home visit, results and method demonstrations and television programs on biochar benefits and opportunities. The concern authorities should conduct more training programs on biochar promotion for homestead gardening. Furthermore, the highest problem faced by the tribal women was found on 'unavailability of woody fuel'. A suggestion is provided to use other raw materials such as leaves, straw, jute sticks, cowdung or bamboo for biochar production.

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