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Present Status and Problem Confrontation of Floating Bed Vegetables Production in Tungipara Upazila under Gopalganj District of Bangladesh

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Abstract

Floating bed vegetables production (FBVP) is an age old practice in southern coastal areas especially in Gopalganj district of Bangladesh. The purpose of the study was to identify the present status of floating bed vegetables production and to determine the problem confrontation associated with FBVP. Data were collected through face-to-face interview during July to November, 2012 and analyzed by using SPSS software. Water hyacinth was main materials to prepare bed and practice during June to November in a year. The highest number (8.75%) of beds was prepared considering the sizes of 15.24m long × 1.83m wide × 1.83m thick. An amount of 1600 BDT is required for labor purpose to prepare a bed of 30m×1.83m×2.44m in size and other costs involve for purchasing seed/seedlings and pesticides if needed. The respondent farmers' are produced 12 crops as single and mixed crops. The average yields of okra, turmeric and red amaranth as single crop were 23.122, 20.664 and 17.222 tons/ha, respectively. The net income from same area of floating bed (1.0 ha) ranged from 40364.66 to 1062936.15 BDT with a mean 230798.63 BDT. The residues of floating bed applied as compost for further cultivation of vegetables in the winter season.

The respondent farmers confronted 18 problems to different extent. Rat's attack (98.96%) was the highly severe problem while unavailability of floating bed materials like water hyacinths (0.21%) was the least problem. Among 13 selected characteristics only training showed a negative relation while extension contact showed significant relation with their problem confrontation.

Key Words: Floating Bed Vegetables Production, Present status, Problem confrontation

Introduction

The southern, south-western, haor and the coastal areas of Bangladesh remain submerged for long periods every year, especially during the monsoon season. People in these areas have been coping with submerged conditions for generations. The people of these areas depend on agriculture. They have adopted a method of cultivation, locally referred to as "Vasoman Chash," meaning floating agriculture, since the time of their forefather's. Floating bed vegetables production (FBVP) is an age old practice in southern coastal areas especially in Gopalganj district of Bangladesh. It is an indigenous knowledge based practice which is environment friendly (Haq *et al*., 2002; lUCN, 2005; Islam and Atkins, 2007; Irfanullah, 2009; and Irfnaullah *et al*., 2011).

In Bangladesh when most of the lands become flooded during monsoon, farmers practice floating cultivation in their submerged lands. The procedures of making the floating bed is usually the same, however the size, shape and local materials vary from region to region (Islam and Atkins, 2007; APEIS & RIPSO, 2004). Various local materials are used to build the floating layers. The most commonly used material is water hyacinth (*Eichhornia crassipes*), but topapana (*Pista stratiotes*), son ghash (*Imperata cylindrica*), noll ghash (*Hamerthria protensa*), wood ash, and dissected coconut fibers are also used (Islam and Atkins, 2007). During the months of May to July, people collect the water hyacinth from the nearby river, khals and from others water bodies where it is available. After collecting the water hyacinth, a layer is made with it. After a week to ten days, for decompose the water hyacinth, people make a second layer on top of the first layer of the water hyacinth and left for decompose and then after, sowing the seeds or transplanting the seedlings on floating bed. Since the bed is floating in nature, people can easily transfer it to where they want to. The size and shape of the bed is not fixed.

In south western region around 200,000 hectares of land are wet lands comprising both natural and artificial. Of these around 20,000 hectares could partially be used for soil less agriculture. These are mostly in the districts of Gopalganj, Barisal, Pirojpur, Jhalakathi, Satkhira, Jashore and Khulna. Water logging is not new. It is caused by poor drainage of seasonal rain. The land remains under water for around 4-6 months (July-December). It was found in a survey of 2013, 68,197 ha is under water logged condition of which 15,700 ha in Jashore, 19,023 ha in Khulna and 33,470 ha in Satkhira. It was found of 2014 through remote sensing data that 32,830 ha of

land is water logged in Jashore (Kabir and Robson, 2015; Haq *et al*., 2004; Hasan and Syed, 2014).

Being an overpopulated country, Bangladesh can ill afford to remain dependent on its ever-shrinking areas of arable land to feed the population. Floating cultivation can help to mitigate this situation and reduce the pressure on arable lands by turning the flooded and waterlogged areas into productive ones (Haq *et al.,* 2004). It could be also one such measure in those areas that avoid salt-water intrusion, because it offers new opportunities using indigenous knowledge's and techniques that are well adapted to local environmental conditions (Chowdhury, 2004).

Farmers cultivate in Dhap method traditionally and do not follow any Scientific method. In fact, in Floating Bed Vegetables Production, the farmers face various production related problems. From this point of view, the researchers were very interested to undertake the research program entitled "Present Status and Problem Confrontation of Floating Bed Vegetables Production in Tungipara Upazila under Gopalganj District of Bangladesh". In order to proper direction to the research, the following specific objectives were formulated:

1. To determine the present status of floating bed vegetables production (FBVP) in the study area;

2. To identify the problems of floating bed vegetables production confronted by the farmers;

3. To explore the relationship between the selected characteristics of the respondents and problems confronted in floating bed vegetables production.

METHODOLOGY

The study was conducted at four unions **(**Bonnabari, Mitradanga, Joaria and Patharghata**)** of Tungipara upzila under Gopalganj district of Bangladesh. The total number of floating bed vegetables producers in the selected villages was 160 during the study. As the population is small in size so the whole population was considered as sample for the study. Data were collected during July to November 2012 from all the sampled (160) through personal interview using a pretested interview schedule by the researcher himself. Data were collected on socio-economic characteristics of the respondents which were treated as independent variable and problem confrontation in floating bed vegetables production was considered as dependent variable in this

study. Collected data were analyzed by using SPSS soft ware for different statistical techniques and for obtaining results and subsequent interpretation for satisfying the mentioned purpose of the study. For categorizing the findings, mean and standard deviation were calculated and categorized as follows: (i) low (ii) medium and (iii) high/large .

A number of 18 usually faced problems were identified and listed in the interview schedule. A 4-point rating scale such as highly severe, moderately severe, less severe and not at all was assigned against each of the problems to indicate the severity, and a score of 3, 2, 1, and 0 was assigned against each of the scales, respectively. The problem confrontation score of a respondent was determined by summing up all the scores obtained by the respondent against the all problems. The problem confrontation score of respondents could range from '0' to '54' where '0' indicated no problem confrontation while '54' indicated high problem confrontation.

To determine the severity of a problem, Problem Confrontation Index (PCI) was calculated using the following formula:

$$\mathbf{PCI= N_{hs}\times 3+ N_{ms}\times 2+ N_{ls}\times 1+ N_{naa}\times 0}$$

Where, PCI= Problem Confrontation Index

N_{hs}= No. of respondents indicated the problem as highly severe

N_{ms}= No. of respondents indicated the problem as moderately severe

N_{ls}= No. of respondents indicated the problem as less severe

N_{naa}= No. of respondents indicated that the problem was not at all a problem.

The PCI score of the respondents could range from '0' to '480' where '0' indicated not at all a problem and '480' indicate the highly severe problem. 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' was employed. Data were analyzed using the Microsoft Excel and Statistical Package for Social Science (SPSS).

Results and Discussion

Present Status of Floating Bed Vegetables Production (FBVP) in the Study Area

The present status of Floating Bed Vegetables Production (FBVP) in the study area was studied on following parameters:-

Size of the Floating Bed

160 respondents farmer prepared 61 sizes of floating beds with a wide variation in length, width and thickness. The highest number (8.75%) of beds were prepared considering the sizes of 15.24m long × 1.83m wide × 1.83m thick followed by 30.48m × 1.83m × 1.52m (8.125%), 30.49m × 1.83m × 1.83m (5.00%) and so on by the respondents of the study area. Irfanullah *et al.* (2011) implemented a project on floating bed agriculture in Kishoreganj and Sunamganj districts. The size of the floating bed was 4.5m long X 2m wide X 1 m high (Thick). None of the beds of the study area had similarity to the size as recommended by Irfanullah *et al.* (2011) especially in case of its length. But in some cases the width has little bit approximation to that of Irfanullah *et al.* (2011).

Thickness of the Floating Bed

Among 160 beds, the most dominant one was 1.828m (39.375%) followed by 1.523m (38.750%), 1.219m (14.375%), 1.370m (3.750%) and so on (Table 1).

Table 1. Thickness of the floating bed in the study area

Sl#	Thickness	Bed	
	(in m)	Number	Percent
1.	2.438	01	0.625
2.	2.133	03	1.875
3.	1.828	63	39.375
4.	1.523	62	38.750
5.	1.370	06	3.750
6.	1.219	23	14.375
7.	0.914	02	1.250
Total		160	100.00

From these findings it could be concluded that the thickness of beds may be a researchable problem i.e. whether the thickness of bed has any effect on yield performance of the grown vegetables.

Area of the Floating Bed

The area of the bed was calculated by multiplying length and width excluding thickness and it was converted from sq.ft to m^2 and hectare. Based on area, the beds were grouped into 26 categories though there were 61 types of beds based on size. The highest proportion (5 bed i.e. 8.196%) of beds covered an area of 0.005574 ha/bed followed by 0.006689 ha/bed (6.557%), 0.004181 ha/bed (6.557%), 0.002787 ha/bed (6.557%) and so on (Appendix 1).

Materials and cost for floating bed preparation

The respondent farmers used water hyacinth as main materials for floating bed preparation. Besides, bamboo, knife and rope were also used as subsidiary materials for bed preparation. An amount of 1600 BDT is required for labor purpose to prepare a bed of 30m×1.83m×2.44m in size. Other costs involve for purchasing seed/seedlings and pesticides if needed.

Season and types of vegetables grown of floating bed

The respondent farmers practice floating bed vegetables production during June to November of same year when the area is submerged by water. The respondent farmers of the study area produced 12 crops (includes 11vegetables and one spice crop) such as okra, Indian spinach, ribbed gourd, water taro, cucumber, red amaranth, pumpkin, bitter gourd, yard long bean, string Bean, bottle gourd and turmeric (spice) on floating bed. All of the twelve crops were grown as mixed crops. But turmeric, okra and red amaranth were also grown as single crop.

Fertilizer application and other intercultural operations

None of the respondents used any manure or fertilizer in their floating bed for vegetables production**.** Weeding (100%) and dhap/bed side cutting (95%) were some of the most commonly practiced intercultural operations. The respondent farmers were more aware about insect infestation (50%) than disease infestation (30%) in vegetables grown on floating bed.

Yield and income from floating bed vegetables production

The yield of all vegetables grown on floating bed is promising than that of vegetables commercially grown in field. The average yields of okra, turmeric and red amaranth as single crops were 23.122, 20.664 and 17.222 tons/ha, respectively. The average yield as mixed crops viz. Okra, Indian spinach and turmeric were 26.89952, 30.01825, 41.60952 tons/ha, respectively and so on (Table 2). The farmers of the study area grew vegetables on 61 sizes of bed which covered an area of 0.254966 ha (of bed) and 16.841tons of vegetables produced from that area. Based on findings, it is calculated that 66.05194 tons of vegetables were produced from one hectare of floating bed in the study area without considering the types of vegetables. The floating bed vegetables production was profitable in terms of income and expenditure. The net income

from same area of floating bed (1.0 ha) for vegetables production ranged from 40364.66 to 1062936.15 BDT with a mean 230798.63 BDT.

Table 2. Yield of different vegetables/crops grown on floating bed as single and mixed crop in the study area

Name of crops	Type of cropping	Yield (ton/ha)			
		Minimum	Maximum	Average	Standard Deviation
Lady's finger	Single (3)	21.52782	23.91980	23.12247	1.38101035
	Mixed (90)	5.74075	71.75940	26.89952	11.51794454
Indian spinach	Mixed (13)	13.45489	80.37053	30.01825	18.21084757
Turmeric	Single (26)	13.45489	29.89975	20.66423	4.17585259
	Mixed (62)	2.98998	107.63910	41.60952	17.08166475
Ribbed gourd	Mixed (27)	3.73747	38.75008	15.81385	7.82870557
Water taro	Mixed (83)	2.15200	53.81955	22.57980	9.97902670
Cucumber	Mixed (25)	6.72700	49.67959	24.97291	11.42118329
Red amaranth	Single (4)	11.95990	25.83339	17.22225	6.00461649
	Mixed (38)	9.71742	38.75008	22.46192	7.36157622
Pumpkin	Mixed (2)	23.91980	161.45866	92.68922	97.25465731
Bitter gourd	Mixed (1)	23.91980	23.91980	23.91980	----
Bean	Mixed (2)	5.38196	14.35188	9.86691	6.34269504
String Bean	Mixed (1)	5.38196	5.38196	5.38196	----
Bottle Gourd	Mixed (1)	86.11128	86.11128	86.11128	----

After-Use of floating bed/ dhap residues

The respondent farmers of the study area usually applied the residues of floating bed as compost for further cultivation of vegetables in the winter season and they were grown different types of vegetables viz. red amaranth, brinjal, bitter gourd, potato, chili, etc.

Personal socioeconomic characteristics

Highest proportion (47.5%) of the respondents was middle aged as compared to young (30%) and old (22.5%). Thus an overwhelming majority (77.5%) are young to middle aged farmers. It means that the young and middle aged farmers are interested in floating bed vegetables production as they are conscious about climate change. Highest proportion (43.75%) of the respondents possessed primary level of education followed by secondary education (36.25%). It is clear from the study four-fifth (80%) of the respondents are primary and had secondary level of education who are encouraged in floating bed vegetables production to produce vegetables in water logging condition to meet their vegetables demand and regular income source as they are some aware about climate change adaptation techniques (Table 3).

Majority (48.1%) of the respondent farmers had medium experience in farming as compared to low experience (26.3%) and high experience (25.6%). Majority (43.1%) of the respondents had medium experience followed by low experience (34.4%) and high experience (22.5%) in floating bed vegetables cultivation (Table 3). From the findings it could be concluded that respondent farmers are same experienced in farming as well as floating bed vegetables cultivation. Floating bed vegetables cultivation is an already established adaptation technique of alternate vegetables production in water logged area in south and south-west region of Bangladesh.

The average family size of the respondents was 4.98, while 59.4% of them had the family size from 5 to 6. Majority of the respondent farmers of the study area had small (53.8%) farm size of 0.41 – 1.0 hectare as compared to medium (38.1 %) and marginal (5.6%) farm holders. Only a few (2.5%) were large farm holders. The average family annual income of the farmers was 117,880 BDT, while the average income of the respondents from floating bed vegetables was 2660 BDT per bed of 30m×1.83m×2.44m size (Table 3).

The respondent farmers of the study area had low to medium (80.6%) organizational participation and majority (65.6 %) of the respondent farmers had medium cosmopolite as compared to low (23.1%) and high cosmopolite (11.3 %). Majority (56.9%) of the respondent farmers did not receive any training on agricultural related issues. Majority (57.5 %) of the respondent farmers had low contact while 37.5% and 5% respondent farmers had no and medium contact with extension media respectively. Most (92.5%) of the floating bed vegetables producers' borrowed low amount of loan while only a few 5 and 1.25 percent of respondents borrowed medium to high amount of loan (Table 3). From the findings it could be concluded that respondent farmers who are cultivated vegetables on floating bed borrowed low amount of loan as they had regular income from floating bed vegetables in water logged situation when traditional vegetables cultivation is not possible because most of the arable land are submerged.

Table 3. Distribution of the respondents on the basis of selected socioeconomic characteristics

Characteristics	Categories	Score	Respondent (N=160)		Range	Mean	SD (±)
			Number	Percent			
Age (Year)	Young	<36	48	30.0	17-80	42.88	11.49
	Middle	36-50	76	47.5			
	Old	>50	36	22.5			
Education (Year of schooling)	Illiterate	0	32	20.00	0-14	5.13	3.65
	Primary	1-5	70	43.75			
	Secondary and above	>6	58	36.25			
Farming experience (Year)	Low	<16	42	26.3	2-60	24.23	11.61
	Medium	16-30	77	48.1			
	High	>30	41	25.6			
Experience in floating bed vegetables production (Year)	Low	<14	55	34.4	1-45	18.94	10.69
	Medium	14-26	69	43.1			
	High	>26	36	22.5			
Family size (Number)	Small	1-4	56	35.0	3-8	4.98	0.999
	Medium	5-6	95	59.4			
	Large	>6	9	5.6			
Farm size (ha)	Marginal	0.20-0.40	09	5.6	0.21-4.45	1.03	0.585
	Small	0.41-1.0	86	53.8			
	Medium	1.01-3.03	61	38.1			
	Large	>3.03	04	2.5			
Annual Income (‘000’BDT)	Low	Up to 100	78	48.75	41-350	117.88	55.21
	Medium	101-250	78	48.75			
	High	>250	04	2.50			
Income from floating bed (‘000’BDT)	Low	Up to 2	45	28.125	1.05-7.70	2.66	0.935
	Medium	2.01-4	105	65.625			
	High	>4	10	6.250			
Organizational Participation (Score)	No	0	16	10.0	0-8	1.93	1.31
	Low	1-2	90	56.2			
	Medium	3	39	24.4			
	High	>3	15	9.4			
Cosmopoliteness (Score)	Low	3-5	37	23.1	3-13	6.72	1.52
	Medium	6-8	105	65.6			
	High	>8	18	11.3			
Training (Score)	No	0	91	56.9	0-3	0.562	0.741
	Low	1	51	31.8			
	Medium	2	15	9.4			
	High	3	03	1.9			
Extension Contact (Score)	No	4-9	60	37.5	4-24	10.69	3.06
	Low	10-15	92	57.5			
	Medium	>15	8	5.0			

Loan Borrowed (‘000’BDT)	No	0	2	1.25	0-80	10.66	13.27
	Low	<26	148	92.5			
	Medium	26-50	8	5.0			
	High	>50	2	1.25			

Source: Field Survey

Problem Confrontation

The problem confrontation scores of respondents varied from ‘0’ to ‘54’ with a mean and standard deviation of 32.27and 3.03 respectively. Based on possible problem confrontation scores, the respondents have been classified into three categories viz. low, medium and high. Most (93.8 %) of the respondent farmers had medium to high problem confrontation while a few (6.2%) of the respondent had low problem confrontation. There are lots of unsolved issues regarding floating bed vegetables production which are the outcomes of the prevalence of existing problems. Proper research and extension measures should be undertaken to help the farmers to overcome those problems so that floating bed vegetables production gets more popularity and higher production could be obtained in terms of both quality and quantity.

Rank order of problems as confronted by floating bed vegetables producers

The respondent farmers of the study area confronted 18 problems to different extent. Rat’s attack (98.96%) was the highly severe problem while unavailability of floating bed materials like water hyacinths (0.21%) was the least severe problem. The severe problems should be taken under consideration of priority basis for immediate solution. The other major problems were lack of good quality seeds (95.42%), lack of preservation facilities of vegetables (92.29%), lack of technical knowledge (79.38%) and so on. Most (93.8 %) of the farmers had medium and high problem confrontation while 6.2% of the farmers had low problem confrontation (Table 4).

Table 4. Rank order of problems based on problem confrontation index (PCI)

Sl#	Types of problem	Severity of the problems (N=160)					PCI		Rank order
		HS	MS	LS	NAA	Total	Score	Percent	
1	Unavailability of FB materials (like rice straw, water hyacinth)	0	0	1	159	160	1	0.208333	18th
2	Salinity reduce the productivity	0	1	159	0	160	161	33.54167	15th
3	Depth of water	0	2	151	7	160	155	32.29167	16th
4	Security of products	1	12	142	5	160	169	35.20833	14th

5	Rats' attack	156	3	1	0	160	475	98.95833	1st
6	Duck sometimes damage at seedling stage	7	97	56	0	160	271	56.45833	8th
7	Lack of technical knowledge	65	91	4	0	160	381	79.375	4th
8	Lack of knowledge for selecting appropriate vegetables	0	74	85	1	160	233	48.54167	11th
9	Lack of seed and seedling	22	107	31	0	160	311	64.79167	6th
10	Lack of good quality seeds	143	13	3	1	160	458	95.41667	2nd
11	Poor productivity	3	6	38	113	160	59	12.29167	17th
12	Lack of information	21	105	33	1	160	306	63.75	7th
13	Lack of marketing facilities	6	47	105	2	160	217	45.20833	12th
14	Lack of preservation facilities	141	2	16	1	160	443	92.29167	3rd
15	Diseases & insects infestation	25	43	89	3	160	250	52.08333	10th
16	Low market price	1	41	113	5	160	198	41.25	13th
17	Lack of loan facilities	2	87	71	0	160	251	52.29167	9th
18	Lack of quality pesticides	74	66	19	1	160	373	77.70833	5th

Here, HS= Highly severe, MS= Moderately severe, LS= Less severe, NAA= Not at all, PCI= Problem confrontation index
Source: Field Survey

Relationship between the Selected Characteristics and Problem Confrontation

The findings related to relationship of selected characteristics of the respondents and their problem confrontation appears in Table 5. Among the thirteen selected characteristics of the respondents, training showed a negative significant relationship with the problem confrontation at 5% level of significant. It means that the higher is the training; the lower is the problem confrontation of the respondents in floating bed vegetables production. On the other hand, the extension contact showed a positive significant relationship with the problem confrontation at 1% level of significant. It means that the higher is the extension contact, the higher is the ability of the farmers to identify the problems in floating bed cultivation. The rest characteristics of the respondents did not show any significant relationships with their problem confrontation in vegetables production.

Table 5. Relationship between the selected characteristics of farmers and their problem confrontation in floating bed vegetables production (FBVP)

Sl. No.	**Independent Variables** (Selected Characteristics)	**Dependent Variable**	**Coefficient of Correlation 'r' Value**
1	Age		-.015
2	Education		.061
3	Experience in farming		-.007
4	Experience in floating cultivation		-.033
5	Family size		.002
6	Farm size		.060

7	Annual income	Problem confrontation in floating bed vegetables production	.142
8	Income from floating bed		-.147
9	Organizational participation		.089
10	Cosmopoliteness		.150
11	Training		-.196*
12	Extension contact		.217**
13	Amount of loan borrowed		.056

* = significant at 5% level ** = significant at 1% level

CONCLUSION

Provided some problems, the farmers of the study area are still producing vegetables on the floating bed but they do not follow any fixed size of floating bed as there is no recommended size of the bed by the researchers. However the dominant size of floating bed practiced by respondent farmers was 15.24m long × 1.83m wide × 1.83m thick. The floating bed is profitable in terms of income and expenditure. Floating bed residue was used as compost for further cultivation of vegetables in the winter season.

The respondent farmers of the study area confronted 18 problems to different extent. Rat's attack was the highly severe problem while unavailability of floating bed materials like water hyacinths was the least severe problem. Among 13 selected characteristics only training showed a negative relation while the extension media contact showed a positive significant relationship with the problem confrontation.

References

Asia-Pacific Environmental Innovation Strategies (APEIS) and Research on Innovative and Strategic Policy Options (RIPSO). 2004. Floating Agriculture in the flood-prone or submerged areas in Bangladesh (Southern regions of Bangladesh). http://www.iges.or.jp/contents/APEIS/RISPO/inventory/db/pdf/0146.pdf.

Chowdhury, K.R. 2004. 'A glimmer of hope for victims of climate change', The Independent (Dhaka), 9 March.

Haq, A.H.M.R., Asaduzzaman, M. and Ghosal, T.K. 2002. Soil-less Agriculture in Bangladesh.Green Trust, dhaka, Bangladesh.pp.1-111.

Haq, A.H.M.R., Ghosal, T.K. and Ghosh, P. 2004. Cultivating wetlands in Bangladesh. India: LEISA. Available from: http://bit.ly/c3Ah0o [Accessed: 05/08/10].

Hasan, M. S. and Syed, M. 2014. Detection of water logging areas based on passive remote sensing data in Jessore district of Khulna division, Bangladesh. *International Journal of Scientific and Research publication.* 4:1-7.

Irfanullah, H.M. 2009. Floating gardening in Bangladesh: Already affected by climate variability? *In*: Biodiversity conservation and response to climate variability at community level, IUCN, UNEP, UNU, Dhaka, Bangladesh.pp.7-14.

Irfanullah, H.M., Azad, M.A.K., Kamruzzaman, M. and Wahed, M.A. 2011. Floating gardening in Bangladesh: a means to rebuild life after devastating flood. *Indian Journal of Traditional knowledge*. 10(1):31-38.

Islam, T. and Atkins, P. (2007). Indigenous Floating Cultivation: A Sustainable Agricultural Practice in the Wetlands of Bangladesh. Development in Practice, 4(1), 130–136. (LEISA, 2009).

IUCN Bangladesh. 2005. Baira: the floating gardens for sustainable livelihood. IUCN Bangladesh Country Office, Dhaka, Bangladesh.pp.1-61.

Kabir, W. and Robson, M. 2015. Water logging in south west Bangladesh: Putting into operation Master plan for Agricultural Development in Southern region. www.fao.org / file admin/ user_upload/FAO/WL_ Presentation_11_Feb_final.pdf.

Appendix 1. Area of floating bed in the study area

Sl No.	Area per bed					Bed	
	L × W	L × W	Sq.ft	Sq.m	Hectare	Number	Percent
	50ft×4ft ×3ft/ 40ft ×5ft×5ft 40ft ×5ft ×6ft	15.24 m ×1.2192 m ×0.9144m/ 12.192m ×1.524m ×1.524m 12.192 m ×1.524 m ×1.8288m	200	18.58	0.001858	3	4.918033
	35ft ×6ft ×7ft	10.668 m ×1.8288 m ×2.1336m	210	19.509	0.001951	1	1.639344
	45ft×5ft ×5ft/ 45ft×5ft ×4ft/ 45ft ×5ft ×6ft	13.716 m ×1.524 m ×1.524m/ 13.716 m ×1.524 m ×1.2192m/ 13.716 m ×1.524 m ×1.8288m	225	20.9025	0.00209	3	4.918033
	40ft ×6ft ×6ft	12.192 m ×1.8288 m ×1.8288m	240	22.296	0.00223	1	1.639344
	50ft×5ft ×5ft/ 50ft ×5ft ×4ft	15.24 m ×1.524 m ×1.524m/ 15.24 m ×1.524 m ×1.2192m	250	23.225	0.002323	2	3.278689
	45ft×6ft ×6ft/ 45ft×6ft ×7ft/ 45ft ×6ft ×5ft	13.716 m ×1.8288 m ×1.8288m/ 13.716 m ×1.8288 m ×2.1336m/ 13.716 m ×1.8288 m ×1.524m	270	25.083	0.002508	3	4.918033
	50ft×6ft ×5ft/ 50ft×6ft ×4ft/ 50ft×6ft ×6ft/ 60ft ×5ft ×6ft	15.24 m ×1.8288 m ×1.524m/ 15.24 m ×1.8288 m ×1.2192m/ 15.24 m ×1.8288 m ×1.8288m/ 18.288 m ×1.524 m ×1.8288m	300	27.87	0.002787	4	6.557377
	65ft ×5ft ×5ft	19.812 m ×1.524 m ×1.524m	325	30.1925	0.003019	1	1.639344
	50ft ×7ft ×6ft	15.24 m 2.1336 m ×1.8288m	350	32.515	0.003252	1	1.639344
	60ft×6ft ×5ft/ 60ft×6ft ×4.5ft/ 60ft×6ft ×4ft/ 60ft×6ft ×6ft/ 60ft ×6ft ×7ft	18.288 m ×1.8288 m ×1.524m/ 18.288 m ×1.8288 m ×1.3716m/ 18.288 m ×1.8288 m ×1.2192m/ 18.288 m ×1.8288 m ×1.8288m/ 18.288 m ×1.8288 m ×2.1336m	360	33.444	0.003344	5	8.196721
	75ft ×5ft ×5ft/ 75ft ×5ft ×4ft	22.86m ×1.524m ×1.524m/ 22.86 m ×1.524 m ×1.2192m	375	34.8375	0.003484	2	3.278689
	100ft ×4ft ×4ft	30.48 m ×1.2192 m ×1.2192m	400	37.16	0.003716	1	1.639344
	70ft ×6ft ×5ft/ 70ft ×6ft ×4ft/ 60ft×7ft×6ft	21.336 m ×1.8288 m ×1.524m/ 21.336 m ×1.8288 m ×1.2192m/ 18.288 m ×2.1336 m ×1.8288m	420	39.018	0.003902	3	4.918033
	75ft×6ft ×4.5ft/ 75ft ×6ft ×5ft/ 75ft ×6ft ×6ft/ 75ft ×6ft ×4ft	22.86 m ×1.8288 m ×1.3716m/ 22.86 m ×1.8288 m ×1.524m/ 22.86 m ×1.8288 m ×1.8288m/ 22.86 m ×1.8288 m ×1.2192m	450	41.805	0.004181	4	6.557377
	80ft ×6ft ×5ft/ 80ft ×6ft ×6ft	24.384 m ×1.8288 m ×1.524m/ 24.384 m ×1.8288 m ×1.8288m	480	44.592	0.004459	2	3.278689
	70ft×7ft×6ft	21.336 m ×2.1336 m ×1.8288m	490	45.521	0.004552	1	1.639344
	100ft ×5ft ×5ft/ 100ft ×5ft ×4ft	30.48 m ×1.524 m ×1.524m/ 30.48 m ×1.524 m ×1.2192m	500	46.45	0.004645	2	3.278689

	75ft ×7ft ×6ft/ 75ft ×7ft ×5ft/ 75ft ×7ft ×7ft	22.86 m ×2.1336 m ×1.8288m/ 22.86 m ×2.1336 m ×1.524m/ 22.86 m ×2.1336 m ×2.1336m	525	48.7725	0.004877	3	4.918033
	90ft×6ft ×4.5ft/ 90ft ×6ft ×6ft/ 90ft ×6ft ×5ft	27.432 m ×1.8288 m ×1.3716m/ 27.432 m ×1.8288 m ×1.8288m/ 27.432 m ×1.8288 m ×1.524m	540	50.166	0.005017	3	4.918033
	80ft ×7ft ×6ft/ 80ft ×7ft ×8ft	24.384 m ×2.1336 m ×1.8288m/ 24.384 m ×2.1336 m ×2.4384m	560	52.024	0.005202	2	3.278689
	100 ft ×6ft ×6ft/ 100ft 6ft ×4ft/ 100ft ×6ft ×5ft/ 120ft ×5ft ×5ft/ 120ft ×5ft ×6ft	30.48 m ×1.8288 m ×1.8288m/ 30.48 m ×1.8288 m ×1.2192m/ 30.48 m ×1.8288 m ×1.524m/ 36.576 m ×1.524 m ×1.524m/ 36.576 m ×1.524 m ×1.8288m	600	55.74	0.005574	5	8.196721
	100ft ×7ft ×6ft	30.48 m ×2.1336 m ×1.8288m	700	65.03	0.006503	1	1.639344
	120ft ×6ft ×6ft/ 120ft ×6ft ×4.5ft/ 120ft ×6ft ×4ft/ 120ft ×6ft ×5ft	36.576 m ×1.8288 m ×1.8288m/ 36.576 m ×1.8288 m ×1.3716m/ 36.576 m ×1.8288 m ×1.2192m/ 36.576 m ×1.8288 m ×1.524m	720	66.888	0.006689	4	6.557377
	125ft ×6ft ×5ft/ 150ft ×5ft ×6ft	38.1 m ×1.8288 m ×1.524m/ 45.72 m ×1.524 m ×1.8288m	750	69.675	0.006968	2	3.278689
	130ft ×6ft ×5ft	39.624 m ×1.8288 m ×1.524m	780	72.462	0.007246	1	1.639344
	150ft ×6ft ×5ft	45.72 m ×1.8288 m ×1.524m	900	83.61	0.008361	1	1.639344
	Total					**61**	**100.00**

Here, L= Length, W= Width, T= Thickness, N.B. Data L × W × T third position have been excluded to find out area. As area means L × W i.e. thickness is not calculated.