Survey on Common Practices of Vegetables Cultivation in Floating Bed at Barishal District, Bangladesh

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INTRODUCTION

Bangladesh is the most vulnerable country experiencing bad consequences of climate change (Hoque et al., 2015; Harmeling et al., 2014; UNDP, 2007) specially shrinking the arable land, due to its geographic location, high population density, low level of awareness, infrastructure and higher reliance on climate-sensitive natural resource based production such as agriculture, aquaculture (Denissen et al., 2012; Rahman et al., 2014; CCC, 2006). The country annually and inter-annually experience floods, cyclones, droughts, river bank erosions, salinity intrusions, tornados and other natural calamities that have adverse effect on agriculture, fishery, infrastructure, water and health (ADPC & BCAS, 2008; Sutradhar et al., 2015). The southern, southwestern and the coastal areas of Bangladesh remain inundated for long periods every year, especially during the monsoon season. People in these areas have been coping with submerged/flooded conditions for generations (APEIS & RIPSO, 2004). Barishal is under AEZ-13 named Ganges tidal floodplain and one of the riverine southern districts of Bangladesh.
laying between 22°27´ and 22°52´N and 90°01´ and 90°43´E. The greater part of this region has smooth relief having large areas of salinity (FAO, 1997).

Floating agriculture is not a new practice in Bangladesh (Hoque et al. 2016); rather it is a well-established mode of conventional agriculture after receiving training and technical supports. According to their needs, people in different parts of Bangladesh have adopted, modified and named this practice differently (Islam and Atkins, 2007; Irfanullah et al. 2007, Islam et al., 2015), such as baira, boor, dhap, gathua, gatoni, geto, kandi and vasoman chash and floating agriculture; all these names represent this same traditional cultivation practice that can be scientifically referred to as hydroponics. In the past only *Eichhornia crassipes* species were used to make a floating bed, but today different aquatic macrophytes are used to build this due to lack of *Eichhornia crassipes* species at the time of bed preparation. The basic construction material of floating bed that supply nutrient to vegetables cultivated are aquatic weeds such as *Eichhornia crassipes, Pistia stratoites, Najas graminea, Salvinia spp., Potamogeton alpinus, Bluxa japonica and Hygroryza aristata* etc. (Irfanullah et al., 2011). Areas covered by the weed are cleared, with the beneficial effects of reducing breeding grounds for mosquitoes by harvesting water hyacinth (Saha, 2010). Furthermore, it is one of the popular modes of so called organic farming because once only organic fertilizers were used to yield increasing purposes. But due to competition and to meet up the demand artificial fertilizers are now being used in very few amount. Besides this, hybrid varieties along with local varieties are now being cultivated. By cultivating crops in water, it is also possible to simultaneously harvest fish populations which reside in the beds (APEIS & RIPSO, 2004). Nutrients (mainly N, P and K) result from decomposed bed materials are used by seedlings. However, cultivated vegetables seedlings can’t uptake 100% of the total nutrient released. Furthermore, now it is alarming that farmers are applying artificial fertilizers to rich in competitive market. A part of these goes into aquatic ecosystem. Fishes, aquatic macrophytes and others microscopic aquatic flora and fauna uptake nutrients from the remaining part entered in aquatic ecosystem. As a result, it is also important for fish/hatchery cultivation in Bangladesh. However a certain part of nutrient entered into aquatic ecosystem pollutes water and sometimes settle down into the base. These settle down of nutrient result the decreasing of deepness of water bodies with rich nutrient called eutrophication. As a result of this water holding capacity of wetlands will be decreased day by day resulting another dimension of causes of flooding of surrounding low land areas.

To alleviation of poverty the practice of floating agriculture also helps supplement to the income of local communities (Saha, 2010). For poor and landless people it also provides greater food security by increasing the land output and supporting capacity (Irfanullah et al. 2007). People of practicing floating-bed cultivation are enjoying a better life economically, than those in other flood-affected areas who have not yet adopted this practice (Saha, 2010). It also has the capacity to provide employment opportunities within communities because the system is fairly labor intensive, (Haq et al., 2004). As both men and women can participate in the floating agriculture practices, it leads to improvements in gender equity. Considering the above factors, Alam and Chowdhury (2018); Hasan et al., (2017) and Hoque et al., (2016) carried out different survey towards farmers view on floating bed vegetables cultivation at Kaptai lake area (Rangamati), Wazipur (Barishal) and Nazirpur (Pirojpur) respectively. In the present survey area, partial assessment related to this may be carried out. But present study was carried out at different villages in which no study was carried and with the following particular objectives: To assess the status of floating agricultural practices in the study area; to measure the demographic ratio and socio-economic aspects; to assess the respondents with regards to harvesting times & frequency, yield performance, problems faced.

**METHODOLOGY**

2.1. Study area

The survey was conducted at 10 villages of Banaripara upzilla in Barishal district during the cultivation time (wet season) where cultivation has been performed for many years and has a socio-economic impact on their livelihood.
2. 2. Floating bed preparation and cultivation

For making floating bed locally available aquatic weeds named *Eichhornia crassipes* (locally calle tagor/kochuripana), *Hygroryza aristata* (locally called fenna) are commonly used. Farmers makes bottom part of bed with *Eichhornia crassipes* and top most layer with *Salvinia molesta*. During sowing of seeds of small size, farmers uses coconut dusts which stimulates decomposition of bed material and also prevent disturb from birds.

![Bed at initial stage of decomposition](image1)
![Bed at medium stage of decomposition](image2)
![Bed at final stage of decomposition](image3)
![Crops cultivated on beds](image4)

Figure 1: Floating beds at different stages of cultivation

2. 3. Data collection and analysis

Interviews of 102 farmers who has been working for this cultivation were taken at the year 2019. Data related with required seed germination times, harvesting times were collected from farmers. While starting interview, the researcher took utmost care to make a relationship with the respondents, so that they feel free to share the information. All possible precautions were taken to avoid bias and to maintain fidelity of responses. Suitable statistical analysis was done after data collection.
RESULT AND DISCUSSION

3. 1. Demography and socio-economy of the informants

Demographic information of informants was depicted in Table 1. It was seen that people from both of the sex contributed equally in this cultivation system, whereas male contributed more than female in today’s land farming. In addition, people from age old contributed more than young. Occupation of the respondents are presented in Figure 2. About 62% of the respondents were found engaged in agricultural activities (Farmers) in the study area, respondents are housewives (22%). People engaged in business and service sectors are negligible (Figure 2).

| Parameters | Demographic group | Number of respondents | % of respondent (about) |
|------------|-------------------|-----------------------|-------------------------|
| Age        | 18-30             | 12                    | 12                      |
|            | 31-45             | 37                    | 36                      |
| Gender     | 46-60+            | 53                    | 52                      |
|            | Female            | 61                    | 59                      |
|            | Male              | 41                    | 41                      |

Table 1: Demographic profile of the informants included during survey

Half of the year of the survey area remains inundated with water as a result there is no alternative scope of cultivation. As a result, farmers move towards to floating bed vegetable cultivation and the cultivation area is increasing day by day due to increase awareness. In addition, besides cultivating different vegetables and spices farmers can cultivate guava, banana, sugarcane, hog palm, papaya, coconut, betel nut, others fruit and different types of field crops between the space of two beds. Furthermore, our female correspond can also participate into this cultivation system and ultimately play vital role in family income sources.

3. 2. Types of crops grown

Different types of crops that include both vegetables and spices are grown on floating bed as a single or mixed cropping. During survey it was recorded that raising seedling for selling purposes is more beneficial than harvesting yield purposes. But seedlings of all crops can’t be sold to the local markets. The lists of cultivated vegetables for both raising seedling for selling and harvesting yield are showed in Table 2.

Figure 2: Percentage of respondent’s occupation
### Table 2: List of vegetables and spices that cultivated in floating bed cultivation

| Name              | Scientific name                        | Crops Family     | Single crops | Mixed crops |
|-------------------|----------------------------------------|------------------|--------------|-------------|
| Ladies finger     | Abelmoschus esculentus (L) Moench.    | Malvaceae        | +            | +           |
| Spinach           | Spinacia oleracea L.                   | Amaranthaceae    | -            | +           |
| Indian spinach    | Basella alba L.                        | Basellaceae      | -            | +           |
| Red spinach       | Amaranthus sp L.                       | Amaranthaceae    | +            | +           |
| Tomato            | Lycopersicon esculentum Mill.          | Solanaceae       | +            | +           |
| Taro              | Colocasia esculenta (L.) Scott.        | Araceae          | -            | +           |
| Cucumber          | Cucumis sativus L.                     | Cucurbitaceae    | +            | +           |
| Pumpkin           | Cucurbita moschata Poir.               | Cucurbitaceae    | -            | +           |
| Bottle gourd      | Lagenaria siceraria (Mol) Standl.      | Cucurbitaceae    | -            | +           |
| Bitter gourd      | Momordica charantia L.                 | Cucurbitaceae    | -            | +           |
| Cabbage           | Brassica oleracea var. capitate L.     | Brassicaceae     | -            | +           |
| Eggplant          | Solanum melongena L.                   | Solanaceae       | -            | +           |
| Coriander         | Coriandrum sativum L.                  | Apiaceae         | +            | +           |
| Carrot            | Daucus carota L.                       | Apiaceae         | +            | +           |
| Chili             | Capsicum annum L.                      | Solanaceae       | -            | +           |
| Turmeric          | Curcuma longa Lin.                     | Zingiberaceae    | +            | +           |
| Bean              | Lablab purpureus (L.) Sweet            | Fabaceae         | +            | +           |

*+* indicates positive response to status; 
*-* indicates negative response to status

3. **Intercultural operation**

The informants practiced various types of intercultural operation from seedling stage to harvesting time to different extents and when necessary. The list intercultural operations adopted by the respondents are shown in Table 3.

| Operation          | Frequency | % Respondent |
|--------------------|-----------|--------------|
| Weeding            | 2-3       | 100          |
| Irrigation         | 1-2       | 74           |
| Control of diseases| 1-2       | 65           |
| Control of insects | 2-3       | 70           |
| Repairing          | 2-3       | 80           |

Table 3: Intercultural operations that are required

3. **Harvesting time**

| Crops              | Harvesting time (DAC) | Frequencies       | Yields (ton/ha) |
|--------------------|-----------------------|-------------------|----------------|
| Ladies finger      | 45-65                 | Two times/week    | 14-18          |
| Indian spinach     | 42-55                 | 1-2 times/week    | 18-20          |
| Red spinach        | 22-35                 | 1-2 times/week    | 08-10          |
| Tomato             | 50-70                 | 1-2 times/week    | 35-40          |
| Taro               | 65-85                 | 1-2 times/week    | 08-12          |
| Cucumber           | 45-60                 | 1 time/week       | 08-10          |
| Pumpkin            | 80-90                 | 1 time/week       | 27-32          |
| Bottle gourd       | 95-100                | 1-2 times/week    | 15-18          |
| Bitter gourd       | 65-70                 | 1-2 times/week    | 18-20          |
| Ribbed gourd       | 60-65                 | 1 time/week       | 12-14          |
| Cabbage            | 70-75                 | 1-2 times/week    | 55-65          |
| Eggplant           | 65-60                 | 1-2 times/week    | 58-65          |
| Coriander          | 30-40                 | 2-3 times/week    | 05-07          |
| Chili              | 70-80                 | 1-2 times/week    | 02-03          |
| Turmeric           | 160-180               | 1 time            | 25-30          |
| Bean               | 50-55                 | 1-2 times/week    | 08-12          |
| Carrot             | 55-65                 | 1-2 times/week    | 20-25          |
| Kalmi shak         | 20-25                 | 1-2 times/week    | 15-20          |
| Spinach            | 20-25                 | 1-2 week          | 10-12          |

*DAC means Days after cultivation*

Table 4: Time, harvesting frequency and yield of produced vegetables in the study area.
The time and frequency of harvesting of crops depends on factors named life span, habit and decomposition status of bed construction materials. However the time and frequency of harvesting of some frequently cultivated crops are represented in Table 4.

3. 5. Durability of floating beds

It is beneficiary to the farmers if they can use the floating beds 7-8 months. Most of the floating beds (68%) sustain 4-6 months; only 26% beds sustain 6-8 months to use (Figure 3). The materials which are used to make the floating beds determine sustainability of a floating bed.

![Figure 3: Percentage of respondents to durability](image)

3. 6. Cost of making a floating bed

In the study area the labor cost is not fixed, the range of labor cost to build a floating bed it varies from 200-400 taka. Once the female labor cost was low but nowadays it almost equal due to continuous increase of this cultivation and lack of male labor. Nearly 76% respondents that to build an average size floating bed it needs 350-500 taka. About 16% respondents answered that they need 250-350 taka to build a floating bed as a labor cost (Figure 4). Almost 8% people told they need 500-600 taka as labor cost. Very few family are interested to collect aquatic macrophytes to construct bed only for selling purposes. As a result farmers sometimes get readymade floating bed with comparatively high cost than homemade. Some families conserve aquatic macrophytes in their fallow land during monsoon season for selling purposes. This is one of the economic aspects of aquatic weeds.

![Figure 4: Percentage of respondents to labor cost](image)
Total cost to make a floating bed varies village to village and time to time. However, Where the water hyacinths are available, labor cost and other material cost is low there need less amount to make a bed of standard size. Some 72% respondents told they need 600-800 taka to build a complete floating bed. However, 20% of the respondents answered they need 800-1000 taka to build a bed. Some (8%) of them told they need 1000-1200 taka to build a complete floating bed (Figure 5).

![Figure 5: Percentage of respondents to total cost](image)

### 3. 7. Problems to practice this cultivating system

There are some problems to practice the system of floating bed in this study area. These are machine-run boats (26%) and lack of labor at optimum time (22%), lack of training (20%), lack of proper capital (19%) and middle man dealers (13%) system. Machinery boats are very common in this area. As it is a large area people generally use these types of boats for their transportation (Figure-6). Due to less benefit in yield production than retailers because of middle man dealer, farmers intend to sell seedlings of different crops at yearly stages. As a result of this same bed can be used more than one time at same year.

### CONCLUSION

Sea level rises due to global warming will under logged so more areas of Bangladesh and more land will become unavailable for crop production (BARC, 1991). The findings of the present survey conclude that farmers’ idea about climate change are more or less appropriate and they are aware of climate change and floating agriculture is identified as sustainable and a profitable practice. For extension of this practices in other areas of Bangladesh it is recommended that necessary steps need to be taken by GOs and NGOs to provide financial help and training facilities that will motivate farmers towards this cultivation technology.

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![Figure 6: Percentage of respondents to problems faced.](image)
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