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YIELD PERFORMANCES OF VEGETABLE AND SPICE CROPS ON FLOATING BED

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Abstract

An experiment was evaluated the yield performances of some vegetable and spice crop on floating bed. Ten farmers were selected near road side of Kotalipara-Rajoir and Kotalipara-Paisarhat under the upazila of Kotaliparain Gopalganj district for this experiment. Ten *dhap* has been constructed by ten farmers. The main component of *dhap* (floating agriculture) was water hyacinth (bulbous plant with bell shaped racemes especially purplish blue which grows in the water). The result indicated that yield of red amaranth, indian spinach, okra and turmeric was higher on D_5 than the D_1, D_2, D_3, D_4, D_6, D_7, D_8, D_9 and D_{10}. Average yield of red amaranth, indian spinach, okra, turmeric on *Dhap* (floating bed) $D_5$was 33.0,59.85, 49.0,36.10 t/ha, respectively. Average yield of red amaranth, indian spinach, okra, and turmeric in higher or medium high land 9.88, 12.36,49.40-74.10,13.59-16.06,12-13 ton/ha, respectively in Bangladesh. The experiment showed good result of red amaranth, okra, turmeric except indian spinach. So dissemination of this floating bed cultivation will help to increase the vegetable and spice production by this time.

Key words: Floating bed, livelihood, vegetables and spices, yield.

Introduction

Bangladesh is an agro-based country. Agriculture is the backbone of Bangladesh. About 65% of the total population lives in the village. Their livelihood is very poor and depends on agriculture.

Agriculture in Bangladesh is characterized by intensive crop production, mainly rice, vegetable, Jute etc. Vegetable production is very low in Bangladesh compared to Thailand, Japan, China, Korea *etc*. There are several factors behind it of them depletion of organic matter, submerged soils, water logging, in sufficient high land, no available cold storage, imbalance use of fertilizer, high doses of pesticide, intensive cropping, without inclusion of legume crops in rotation, nutrient leaching with monsoon rain, lack of knowledge of new inputs and technique. So, production of vegetable can be increased by replenishment of soil organic matter, well drainage, changing of cropping pattern and application of advanced technology.

In the wetlands of southern Bangladesh, most affected by floods, farmers don't have enough cropping space in terms of access to land, so people have learnt to make the most of flood water. In this context, they have developed a floating agricultural practice to vegetables in floating bed, made of water hyacinth, algae or other plant residues.

Kotalipara is the archaeological and historical heritage upazila out of five upazilas of Gopalganj district located in the low-lying areas between the Ganges floodplain. The land of Kotaliparaupazila of Gopalganj district is intensively used for agriculture, housing and settlements, forest, shrimp/prawn culture, fisheries and other infrastructural development. Hydroponics (Soil less cultivation system) was found in the upazila as a special practice of agriculture which was more or less being experienced in different wetlands of the union since two and a half century back. This practice of floating agriculture was found much more dominant in this upazila than that of other upazila of the district.

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. This system is similar to hydroponics, which is a scientific method whereby the plants are grown in the water and they derive their nutrients from the water instead of soil.

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A bio-land or floating bed is prepared with the biomass using water hyacinth, aquatic algae, water wortand the other water born creepers, straws and herbs on plant residues. Floating bed or *dhap* cultivation is found in remote, waterlogged villages of Barisal, Pirojpur, Satkhira and Gopalganj districts of Bangladesh, but is not common elsewhere in the country. The main components or materials of floating agriculture are water hyacinth (bulbous plant with bell shaped racemes especially purplish blue which grows in the water). Straw and rice stubble are also used for the same purpose.

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). Further, floating cultivation does not need any additional water nutrients, on chemical fertilizers and the beds can be recycled as organic fertilizer in the newly prepared floating bed and also in the agricultural fields, which is economical as well as environment friendly.

This cultivation practice helps to supplement people's income, which contributes towards the alleviation of poverty, and provides greater food security by increasing the landholding capacity of poor as well as landless people by allowing them to grow vegetables and crops with lower input costs, due to the minimum infrastructure required (Irfanullah *et. al.*, 2007)

Objectives:

1. To popularize the Floating bed on *dhap* cultivation in this local areas.
2. To maximum utilization of unutilized water hyacinth, weeds and stable water.
3. To keep the land in good condition and increase the soil productivity and soil fertility.
4. To increase production in the marsh land.
5. To make available nutritional foods for farmers level.

Methodology:

The experiment was conducted at road side canal of Kotalipara-Rajoir and Kotalipara-Paisarhat road named as Parcona and Ratal area of Kotalipara upazila in Gopalganj district during 26 June 2011 to31 January, 2012.

Ten farmers were selected near road side of Kotalipara-Rajoir and Kotalipara-Paisarhatroad for this experiment. Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD) supplied all inputs for ten *dhap,* farmers name & their address are shown in Table 1.

Table 1. Farmer name and address

Sl.No	*Dhap* no.	Name of Farmer's & Father's name	Address
1.	D_1	RoshomayBiswas S/o-Late: RazashorBiswas	Vill- BaganUttarpara,Post+ Upzilla-Kotalipara,
2.	D_2	JoydebBala S/o-Hutu Bala	Vill- BaganUttarpara, Post+ Upzilla- Kotalipara,
3.	D_3	AmalBiswas S/o-MonoranjanBiswas	Vill- BaganUttarparaPost+ Upzilla-Kotalipara
4.	D_4	DebrajRatno S/o-JuranRatno	Vill- BaganUttarparaPost+ Upzilla-Kotalipara
5.	D_5	ProfulloBaidho S/o-ShoshodhorBaidho	Vill- BaganUttarpara, Post+ Upzilla- Kotalipara
6.	D_6	NizamuddinMiah S/o-Late: FaluMiah	Vill- RatalPost-ShikirBazar,Upzilla- Kotalipara
7.	D_7	Shazahan Sharif S/o-Late: Imanuddin Sharif	Vill- Ratal,Post- Shikir Bazar,Upzilla- Kotalipara
8.	D_8	Hasen Sharif S/o-Late: Imanuddin Sharif	Vill- Ratal, Post- Shikir Bazar, Upzilla- Kotalipara
9.	D_9	HabibShakh S/o-Late: MonoarShakh	Vill- Ratal, Post- Shikir Bazar, Upzilla- Kotalipara
10.	D_{10}	SharoerHossain S/o-Late: Latif	Vill- Ratal, Post- Shikir Bazar, Upzilla- Kotalipara

Note: D = *Dhap*

Ten *dhap* has been constructed by ten farmers. One *dhap* made by one farmer. The main component of *dhap* (floating agriculture) was water hyacinth (bulbous plant with bell shaped racemes especially purplish blue which grows in the water). The size of each *dhap* was 8m×3mwhereas, the size of turmeric (*Curcuma longa)*plot was 4m×3m, red amaranth*(Amaranthus gangeticus)* plot 4m×1m, indian spinach *(Basella alba)* plot 4m×1m and okra (*Abelmoschus esculentus)* plot 4m×1m. Three vegetables and one spice variety were shown in Table2.

Table 2. Name of vegetable and spice variety

Sl No.	Name of vegetable / Spice	Name of Variety	Name of company
A.	Vegetable	-	-
	1. Red amaranth	Rocktolal	United seed store
	2. Indian spinach	Madhuri	Lalteer Seed Ltd.
	3. Okra	BARI-1	United seed store
B.	Spice	-	-
	1. Turmeric	Local	-

25 days required for *dhap* preparation and seeds sowing condition.

Red amaranth (*Amaranthus gangeticus*):Red amaranth seeds were sown in each *dhap* at broadcasting method on 20 July, 2011 and 16 August, 2011 Irrigation, weeding, plant protection measure and other intercultural operation were done as and when necessary. The crop was harvested at two times (13 August, 2011 and 11 September, 2011).

Indian spinach (*Basella alba*): Indian spinach seeds were sown in each *dhap* on 20 July, 2011 by spacing 40 cm distance of each row and plant to plant maintained by 20 cm Total 38 plant was each *dhap*. Irrigation, weeding, plant protection measure and other intercultural operation were done as and when necessary. For necessary data collection from selected 5 plants in each *dhap* were harvested randomly at 65 and 100 days after transplanting.

Okra (*Abelmoschus esculentus*): Okra seeds were sown in each *dhap* on 20 July, 2011 by spacing 40 cm distance of each row and plant to plant maintained by 40 cm Total plant was each *dhap* 20. Irrigation, weeding, plant protection measure and other intercultural operation were done as and when necessary. For necessary data collection from each *dhap* were harvested at 52,56,60,64,68,72,76,80,84,88,96,100,104,108 and 112 days after transplanting.

Turmeric (*Curcuma longa*): Turmeric seeds were sown in each *dhap* on 20 July, 2011 by spacing 40 cm distance of each row and plant to plant maintained by 20 cm Total plant was each *dhap* 114. Irrigation, weeding, plant protection measure and other intercultural operation were done as and when necessary. The crop was harvested on 31 January, 2012 and data were collected on plant height (cm) and yield gram/plant, kg/*dhap* and tons/ha.

Result and Discussion

Red amaranth (*Amaranthus gangeticus*)

The average yield (gm) of red amaranth were weight from the selected 0.04m^2 area in each *dhap* and data was recorded first and second crop after 25 days of sowing. Total yield were expressed *dhap*/kg and ton/ha, the highest yield of red amaranth (D5)13.3 kg/*dhap* and 33 tons/ha and lowest (D4) 6.1 kg/*dhap* and 15.3 ton/ha was found in this study (Table3).

The yield of red amaranth in high or medium high land 9.88-12.36 ton/ha (Bipanno Jonogosttir Pusti Unnayane Bosatbarir Shabje o Falerabad, Proshikhon manual, 2010, FAO, WFP and DAE),but we found in *dhap* 15.3-33.0 ton/ ha. As a result, farmers are showing their interest about floating bed cultivation.

Table 3. Yield of red amaranth

Sl. No.	*Dhap* No.	1st crop 0.04m^2 (gm)	2nd Crop 0.04m^2 (gm)	Total (gm)	Kg/*Dhap*	Ton/ha.
1.	D_1	64	60	124	12.4	31.0
2.	D_2	45	35	80	8.0	20.0
3.	D_3	30	48	98	9.8	24.5
4.	D4	31	30	61	6.1	15.3
5.	D_5	71	62	133	13.3	33.0
6.	D_6	68	60	128	12.8	32.0
7.	D_7	41	40	81	8.1	20.2
8.	D_8	55	51	106	10.6	26.5
9.	D_9	70	50	120	12.0	30.0
10.	D_{10}	69	55	124	12.4	31.0

Note: D = *Dhap*

Indian spinach (*Basellaalba*)

The weight (gm) of average plant of Indian spinach was measured from the selected 5 plants in each *dhap* and data was recorded after 65 and 100 days of transplanting. Total yield were expressed *dhap*/kg and tons/ha. The highest yield of Indian spinach (D5) 24 kg/*dhap* and 59. 85 tons/ha and lowest (D6) 13.49 kg/*dhap* and 34.0 tons/ha was found in this study (Table4).Yield of Indian spinach in high or medium high plain land 49.40-74.10 tons/ha. (Bipanno Jonogosttir Pusti Unnayane Bosatbarir Shabje o Falerabad, Proshikhon manual, 2010, FAO, WFP and DAE),but we found in *dhap* 34.00-59.88 ton/ ha. Farmers obtained not satisfactory yield because of Indian spinach is a deep rooted vegetable.

Table 4. Yield of indian spinach

Sl. No.	*Dhap* No.	65 DAT (Plant/gm)	100 DAT (Plant/gm)	Total (gm)	Kg/*Dhap*	Ton/ha
1.	D_1	251.79	165.79	381.58	14.50	36.10
2.	D_2	250.00	144.74	394.74	15.00	37.05
3.	D_3	263.16	221.05	484.21	18.39	45.60
4.	D4	284.21	189.47	473.68	17.93	44.65
5.	D_5	378.95	252.63	631.58	24.00	59.85
6.	D_6	210.53	144.74	355.26	13.49	34.00
7.	D_7	215.79	152.63	368.42	13.99	35.15
8.	D_8	210.53	131.58	382.11	14.52	36.10
9.	D_9	289.47	171.05	460.52	17.49	43.70
10.	D_{10}	289.47	184.21	473.68	17.99	44.65

Note: D = *Dhap*

Okra (*Abelmoschus esculentus*)

The okra (kg/*dhap*) was collected from 4m ×1m=4m^2 areas in each *dhap*. First data was collected after 52 days of transplanting, then 4 days interval another data were collected from each *dhap* and final data were collected after 112 days of transplanting. Total yield were expressed kg/*dhap* and ton/ha. The highest yield of okra was (D5) 19.5 kg/*dhap* and 49.0 ton/ha and lowest (D4) 15 kg/*dhap* and 37.5 ton/ha in this study (Table5 and Table6). The yield of Okra in high or medium high land 13.59-16.06 ton/ha (Bipanno Jonogosttir Pusti Unnayane Bosatbarir Shabje o Falerabad, Proshikhon manual, 2010, FAO, WFP and DAE), but we found in *dhap* 37.5-49.0 ton/ ha. Farmers obtained two or three times yield of Okra in *dhap* than that of plain land.

Table 5. Yield of okra (kg/*dhap*)

Sl. No.	*Dhap* No.	1st Data (kg)	2nd Data (kg)	3rd Data (kg)	4th Data (kg)	5th Data (kg)	6th Data (kg)	7th Data (kg)	8th Data (kg)	9th Data (kg)	10th Data (kg)	11th Data (kg)	12th Data (kg)	13th Data (kg)	14th Data (kg)	15th Data (kg)	Total (kg)
1.	D_1	2.5	2.1	2.0	1.6	1.5	1.4	1.3	1.1	1.2	0.8	0.7	0.5	0.5	0.5	0.3	18.0
2.	D_2	2.4	2.3	2.1	1.4	1.4	1.3	1.2	1.0	1.1	0.9	0.7	0.5	0.4	0.4	0.2	17.0
3.	D_3	2.5	2.3	2.2	1.4	1.2	1.3	1.3	1.1	1.2	1.0	0.8	0.6	0.5	0.3	0.1	17.8
4.	D4	2.2	2.0	2.0	1.3	1.3	1.0	0.9	0.8	0.7	0.7	0.6	0.4	0.5	0.2	0.2	15.0
5.	D_5	3.0	2.5	2.1	2.0	2.0	1.4	1.3	1.2	1.0	1.0	0.8	0.5	0.4	0.2	0.1	19.5
6.	D_6	2.6	2.2	2.0	1.8	1.3	1.4	1.3	1.1	1.2	0.8	0.6	0.6	0.5	0.4	0.4	18.2
7.	D_7	2.4	2.1	2.1	2.0	1.4	1.2	1.1	1.0	0.6	0.4	0.4	0.3	0.3	0.4	0.2	16.0
8.	D_8	2.4	2.2	2.1	2.0	1.5	1.3	1.2	1.2	0.8	0.5	0.5	0.4	0.4	0.3	0.3	17.1
9.	D_9	2.6	2.4	2.3	2.0	2.0	1.5	1.4	1.2	1.0	0.5	0.4	0.2	0.2	0.2	0.1	18.0
10.	D_{10}	2.5	2.5	2.4	2.1	1.9	1.5	1.4	1.3	0.8	0.5	0.3	0.2	0.3	0.4	0.4	18.5

Note: D = *Dhap*

Table 6. Yield of okra (ton/ha)

Sl. No.	D_1 Ton/ ha.	D_2 Ton/ ha.	D_3 Ton/ ha.	D4 Ton/ ha.	D_5 Ton/ ha.	D_6 Ton/ ha.	D_7 Ton/ ha.	D_8 Ton/ ha.	D_9 Ton/ ha.	D_{10} Ton/ ha.
1.	45.0	52.5	44.5	37.5	49.0	45.5	40.0	43.0	45.0	46.5

Note: D = *Dhap*

Turmeric (*Curcuma longa*)

Plant height:

The average plant height (cm) of turmeric was measured from the selected 5 plants in each *dhap* and data was recorded after 150 days of transplanting. The tallest and shortest plant height of turmeric was recorded as (D5) 90.00cm and (D1,) 80.00 cm (Table7) similar data was found in the reference of M.A. Ullah*et.al*.2008.

Table 7. Plant height (cm) of turmeric

Sl. No.	D_1 (cm)	D_2 (cm)	D_3 (cm)	D4 (cm)	D_5 (cm)	D_6 (cm)	D_7 (cm)	D_8 (cm)	D_9 (cm)	D_{10} (cm)
1.	80.0	85.5	86.3	86.1	90.0	87.1	85.2	82.5	80.2	81.3

Note: D = *Dhap*

Yield:

Gram/plant:

The turmeric was harvested on 31 January 2012. The average weight of turmeric from the selected 5 plants in each *dhap* was recorded. The highest and lowest weight of turmeric was (D_5) 380.00gm and (D_1) and (D_9) were same 360gm (Table8), which is similar to the observation as M. A.Ullah*et. al.* 2008.

Table8.Yield (gm/plant) of turmeric

Sl. No.	D_1 gm/plant	D_2 gm/plant	D_3 gm/plant	D4 gm/plant	D_5 gm/plant	D_6 gm/plant	D_7 gm/plant	D_8 gm/plant	D_9 gm/plant	D_{10} gm/plant
1.	360	370	373	370	380	375	370	365	360	368

Note: D = *Dhap*

Kg/*dhap*

The average weight of turmeric from the selected plants in each *dhap* was recorded and then total plant of turmeric weight in each *dhap* and expressed kg/*dhap*. The highest and lowest weight of turmeric was (D_5) 43.32 and (D_1.), (D_9) 41.04kg (Table9).

Table 9. Yield (kg/*dhap*) of turmeric

Sl. No.	D_1 kg/*dhap*	D_2 kg/*dhap*	D_3 kg/*dhap*	D_4 kg/*dhap*	D_5 kg/*dhap*	D_6 kg/*dhap*	D_7 kg/*dhap*.	D_8 kg/*dhap*	D_9 kg/*dhap*	D_{10} kg/*dhap*
1.	41.04	42.18	42.52	42.75	43.32	42.75	42.18	41.61	41.01	41.95

Note: D = *Dhap*

Ton/ha:

The exprimentof turmeric area was 120m^2 (10 *dhap*) 114 turmeric plants were in 12 m^2 (each *dhap*) area, 95,000 turmeric plants was in 1 hectare area. Production of turmeric in each *dhap* was shown in table 9. In this study the highest and lowest yield of turmeric per hectare were recorded (D_5) 36.10 tons and (D_1), (D_9) 34.20 tons (Table10). The yield of turmeric in high, medium high land and hilltracts 12-13 ton/ha (Mosla Fashaler Udpadon Poddati, 2012, Spice Research Centre, BARI, Shibgonj, Bogra) but it was found in *dhap* 34.20-36.10 ton/ha. This result is shown better performance of this study.

Table 10. Yield (ton/ha) of turmeric

Sl. No.	D_1 ton/ha	D_2 ton/ha	D_3 ton/ha	D_4 ton/ha	D_5 ton/ha	D_6 ton/ha	D_7 ton/ha	D_8 ton/ha	D_9 ton/ha	D_{10} ton/ha
1.	34.20	35.15	35.43	35.62	36.10	35.62	35.15	34.67	34.20	34.96

Note: D = *Dhap*

Conclusion and recommendation

Land is the most valuable resource. Among all the natural resources of a country which provides food shelter including lifesaving elements to her ever increasing population. Kotalipara upazila is enriched with natural ecosystem consisting of rivers, khals, beels, fisheries/shrimp (Prawn/ Galda) ghers and other natural resources. Most of the people of low-lying areas of the upazila for their survival adopted alternative source of income to support their livelihood through floating agriculture in the area. The hydrological condition of kotalipara upazila is suitable for this activity, which is found to practice in the lean period in most of the unions of this upazila. The People of Kotalipara upazila are unemployed since May to September. This time is suitable for preparing *dhap*. Production of vegetables and spices were producing two or three times on *dhap*. There is no organizational arrangement as such. The people use their traditional techniques, knowledge and the conventional wisdom to cope with the flood and submerged condition. The experiment on Bangabandhu Poverty Alleviation training complex on *dhap* showed good result that per hectare yield of red amaranth 33.0 tons, indian spinach 59. 85 tons, Okra 49.0 tons and turmeric 36.10 tons. Vegetables and spices shortfall can be gradually meet in Bangladesh if the newly developed techniques or model is promoted extension and the farmers are given required technological support of rivers, *khals, beels* and waterlogged areas. Although *dhap* preparation cost is little higher than that of land preparation of farmers will be triple benefited except indian spinach from bigger yield and higher market price.

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