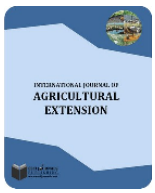

Available Online at ESci Journals
International Journal of Agricultural Extension
ISSN: 2311-6110 (Online), 2311-8547 (Print)
http://www.escijournals.net/IJAE

CONSTRAINTS AND SCOPE FOR PRACTICING SANDBAR CROPPING TECHNOLOGY IN RIVERINE AREAS OF BANGLADESH

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A B S T R A C T

The study was designed to assess the extent of constraints faced by the farmers engaged in sandbar cropping technology, and to find out the scope for practicing sandbar cropping technology. The study was conducted in riverine areas Bangladesh using cross sectional survey design. Ninety five (95) respondents were selected as sample from a recent list of 271 farmers using random sampling method. Data were collected by a pre-tested and validated interview schedule. Findings showed that among the total 24 constraints "low price during peak period of pumpkin" occupied the highest (CI= 239) scores and stand top in the ranking while "difficult to identify mature pumpkin" had the lowest (CI= 16) scores. Slightly more than three-fourth (75.8 percent) of the respondents had medium constraints, while 21.0 percent had low constraints and only 3.2 percent had high constraints of sandbar cropping technology. Scored Causal Diagrams (SCDs) explored that the main root causes to 'low practicing sandbar cropping technology' identified were low price during peak period of pumpkin. Out of nine independent variables educational qualification, training received and knowledge on sandbar cropping of the respondents showed negative significant relationship with the constraints of sandbar cropping technology. Age and fatalism showed a positive significant relationship with the same. Main scope for practicing sandbar cropping technology as mentioned by the respondents 'production of different crops along with pumpkin' followed by 'food security'.

Keywords: Constraints, scope, sandbar cropping technology, pumpkin.

INTRODUCTION

Bangladesh is the largest deltaic country with a population of 144.04 million with an area of 1, 47,569.06 square kilometers (BBS, 2013). Traditionally and predominantly Bangladesh is agriculture based country and about 25.7 percent of population is engaged in agriculture for their livelihood (BBS, 2012).When the water subsided, silted sand plains are left behind called 'char lands' i.e. Sandbars. Innumerable vast sandbars emerge in the riverbeds during the dry season (November-April) in north-western of Bangladesh. Most of these sandbars remain unused and barren because of their unfertile sandy characteristics (Rahman and Reza, 2011). In Bangladesh agriculture; sandbar cropping is an innovative practice, which was first introduced in Gaibandha district by some farmers in 2005. Since 2009, a NGO named Practical Action Bangladesh (PAB) has been introducing sandbar cropping technology suitable for use in unfertile sandbars and supporting extreme poor to cultivate pumpkins. Sandbar cropping technology is first introduced and invented by a NGO named Practical Action Bangladesh (PAB) so, still they are guiding to extreme poor farmers' living in the river embankment to cultivate pumpkin in sandbar. But, they already have taken many initiatives to expand it through government and other relevant agencies collaboration.

Sandbar cropping is a simple and cost effective option. Among various vegetables, pumpkins have proven to be particularly suited to these conditions; not only it yields well but also can be stored, providing food and income throughout the year. During the initial stage of sandbar cropping, a pit was dug into sandbar, which was one meter deep and one meter in diameter. One jute sack filled with compost was placed into the pit. After a few days, four to six seeds were placed into the compost

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filled sack. The pits are then monitored for the next five months and finally farmers got the results i.e. they were able to reap up to ten gourds from each pit. Then, sandbar cropping became popular by the farmers and was started to practice in the vast area by digging pit directly into sandbar. Per pit requires 10kg cow dung, 100gm urea, 100gm TSP, 100gm MoP fertilizers and cow dung is applied as basal dose during pit preparation and 50 percent of others chemical fertilizers are applied as basal dose and 50 percent are applied as top dress method (Bepary, 2006).

In spite of greater potential of sandbar cropping technology, beneficiaries of Practical Action Bangladesh (PAB) are not free from constraints in cultivating pumpkin. Thus, in this condition it is necessary to reveal the types of constraints faced by the PAB beneficiaries in practicing sandbar cropping. In order to identify the constraints of sandbar cropping technology and scope for practicing of this technology, keeping the above circumstance, the study was undertaken the following specific objectives:

i. To assess the extent of constraints faced by the farmers engaged in sandbar cropping technology.
ii. To explore the relationship between the demographic characteristics of the farmers and constraints of sandbar cropping technology.
iii. To find out the scope for practicing sandbar cropping technology.

Figure 1. Overall sandbar cropping (pumpkin) activities.

METHODOLOGY

The study was carried out in Gangachara upazila under Rangpur district. Interview schedule was used as research instrument which was pre-tested and necessary correction, addition and modification were made. An updated list of 271 respondents of the study area was collected from NGO named Practical Action Bangladesh (PAB). Out of 271 respondents a sample of 95 respondents (around 35%) were selected by random sampling technique. Data were collected from the study area during 1st September to 15th October, 2012.

Four point rating scale was used to determine constraints. The scale contained 24 statements of constraints of sandbar cropping technology. Each respondent was asked to express his/her opinion in the form of one of the 4 responses such as high, moderate, low and not at all. Scores of 3, 2, 1 and 0 were assigned respectively in the responses for an item. The overall constraints of sandbar cropping technology were computed by adding together all the individual scores obtained by him/her for all the questions. Therefore, the possible overall constraints score of a respondent could range from '0 to 72' where 0 indicating no constraint and 72 indicating very high constraint.

A Constraint Index (CI) for each 24 selected constraints was computed using the following formula:

CI= (Ch×3) + (Cm×2) + (Cl×1) + (Cn×0)

Where,

Ch= Number of respondents indicating the constraint as 'high'

Cm= Number of respondents indicating constraint as 'moderate'

Cl= Number of respondents indicating constraint as 'low'

Cn= Number of respondents indicating constraint as 'not at all' Constraint Index (CI) for any one of the selected constraint could range from 0 to 285, where, 0 indicated no constraint and 285 indicated highest constraint.

To cross-check constraints of sandbar cropping technology, Scored Causal Diagrams (SCDs) of Participatory Farm Management (PFM) were used (Galpin *et al*., 2000). SCDs were used to examine in detail the causes and effects of constraints and to identify the 'root' cause which need to be addressed and to analyze the relative importance of the constraints and prioritize them. Nine selected characteristics of the respondents were considered as independent variables in this study. The selected characteristics were: age, educational qualification, family size, annual family income, training received, knowledge on sandbar cropping, aspiration, fatalism, and attitude towards PAB. Correlation of co-efficient was used for exploring the relationship between the independent and dependent variables.

Focus Group Discussion (FGD) was conducted among a group of 20 respondents to identify the perception of scope for practicing sandbar cropping technology.

RESULTS AND DISCUSSION

Comparison among the individual constraints: For having the better understanding regarding constraints of sandbar cropping technology, it was necessary to have an idea about the comparative constraints in 24 selected constraints. For this purpose, Constraint Index (CI) was computed. The computed CI of the 24 constraints ranged from 16 to 239 (against a possible range from 0 to 285) which are arranged in rank order according to their CI as shown in Table 1.

Data in Table 1 showed that "low price during the peak period of pumpkin" was number one constraint. Majority of the respondents of the study area are extreme poor. They cultivate pumpkin for the hope of instant profit. But during the harvesting period, the price remains low. In the study area, out of 95 respondents 54 respondents faced this constraint at high extent, 36 respondents faced at moderate extent and 5 respondents faced at low extent i.e. all the respondents faced any level of constraints (Table 1).

Most of the respondents complained about "attack of insects and pathogen" as their constraint of sandbar cropping technology. Sandbar is not as like as plain land. Temperatures during day time remain very high and during night remain low. So, the "attack of insect and pathogen" is occurred in high extent and it became second in the Table 1.

The CI of "lack of irrigation facilities" is 225 and ranked third in the table. During the primary stage of the crops, two times irrigation has to give to the crops during morning and evening, which is very laborious. Table 1 revealed that 50 respondents faced this constraint in high extent, 36 respondents faced this constraint in moderate extent, and 3 respondents faced this constraint in low extent in the study area, where as 6 respondents faced no constraints.

"Difficult to identify mature pumpkin", "Improper grading of pumpkin during selling" and "Insufficient training on pumpkin" are the last three constraints i.e. 24th, 23rd and 22nd in the Table 1. Their CI becomes 16, 32 and 74 respectively. The PAB personnel might have regular contact with the farmers regarding identification and grading of mature pumpkin as well as arranging training program that help them to a certain extent i.e. why the above mentioned three constraints perceived as low by the respondents. Knowledge levels of the

respondents are very low and sandbar cropping system is new to the respondents. As a result, they are facing different kinds of constraints during practicing and dissemination of this technology is being hampered.

Table 1. Rank order of selected constraints of sandbar cropping technology.

Sr. No.	Constraints	Extents of constraints				CI*	Rank order
		High	Moderate	Low	Not at all		
1.	Low price during peak period of pumpkin	54	36	5	0	239	1
2.	Attack of insect and pathogen	54	31	9	1	233	2
3.	Lack of irrigation facilities	50	36	3	6	225	3
4.	Rotting of immature pumpkin in the field	42	40	12	1	218	4
5.	Difficult to find out soil layer	33	49	12	1	208	5.5
6.	Requiring more labor in pumpkin cultivation in sandbar	48	30	4	13	208	5.5
7.	Lack of fuel	38	43	7	7	207	7
8.	Facing constraints in getting fair price for middle men	26	56	12	1	202	8
9.	Land owner discourage to provide same land for next year cultivation	39	27	21	8	192	9
10.	Rotting of pumpkin during storage	19	34	39	3	164	10
11.	Lack of proper communication facilities	6	53	29	7	153	11
12.	Demanding share of crops by land owner	12	36	39	8	147	12
13.	Non-availability of seeds in time	9	24	50	12	125	13
14.	Facing constraints for stealing of pumpkin	15	18	40	22	121	14
15.	Damage of pumpkin by rodent and insects during storage	8	17	61	9	119	15
16.	Lack of store-house facilities for pumpkin	1	42	29	23	116	16
17.	Improper land demarcation	10	29	27	29	115	17.5
18.	Lack of manures in time	7	21	51	16	115	17.5
19.	Inadequate knowledge regarding the control of pests and diseases	3	27	42	23	105	19
20.	Individual harvesting require more time and labor	1	9	66	19	87	20
21.	Pit preparation in sand is laborious	4	22	29	40	85	21
22.	Insufficient training on pumpkin cultivation	2	19	30	44	74	22
23.	Improper grading of pumpkin during selling	0	1	30	64	32	23
24.	Difficult to identify mature pumpkin	0	4	8	83	16	24

*CI= Constraints Index (possible score range 0 to 285).

Overall constraints of sandbar cropping technology: Overall constraints scores for 24 selected constraints of sandbar cropping technology could theoretically range from 0 to 72, where 0 indicating no constraints and 72 indicating high constraints. However, the observed constraints scores of the respondents ranged from 22 to 57 with a mean of 36.91 and standard deviation 7.21. Based on their constraint scores, the respondents were classified into three categories viz. 'low', 'medium' and 'high' has been presented in the Figure 1. Data furnished in the Figure 2 reveal that slightly more than three-fourth (75.8 percent) of the respondents had medium constraints while 21.0 percent had low constraints and only 3.2 percent had high constraints. The average (mean) value of the constraints indicates that the respondents in average had medium constraints of sandbar cropping technology.

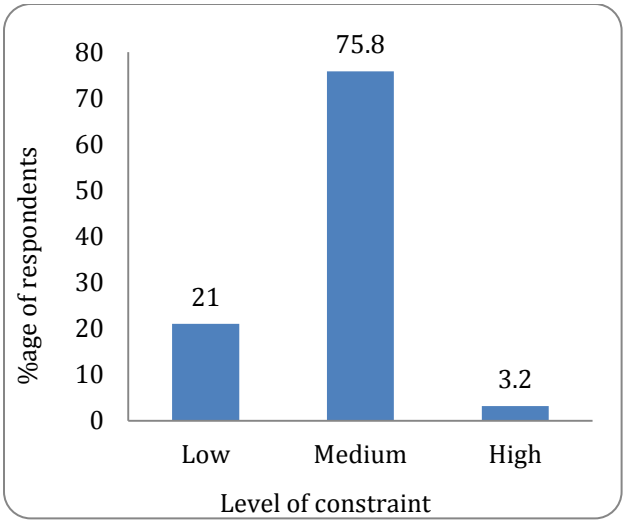


Figure2: Distribution of the respondents according to their overall constraints of sandbar cropping technology.

So, from this finding, it can be said that the desired level dissemination of sandbar cropping will not occur if the various constraints of the respondents are not minimized by the concerned authority. Constraints faced by the respondents of sandbar cropping technology were cross-checked through making Scored Causal Diagrams (SCDs) of Participatory Farm Management (PFM). Constraints were discussed with the respondents, assuming the 'end problem' being 'low dissemination of sandbar cropping technology'. Firstly the constraints mentioned by the respondents were listed, secondly diagrams were drawn by them on the plain ground to show causal relationships between the constraints, and finally scoring of selected constraints were performed again by them. In this way SCDs was prepared by the group of respondents (Figure 3). The constraints identified by the group has been listed here with their relative importance indicated by the original score numbers as shown inside the parentheses.

End constraint: low practicing sandbar cropping technology (100)

Intermediary constraints:

- Lack of knowledge and experience (20)
- Laborious to cultivate (15)
- Marketing problem (25)
- Damage of crops (10)
- Decreased production/ low yield (15)
- Access to the sandbar is becoming difficult (15)

Root causes:

- Low price during peak period of pumpkin (21)
- Lack of training and education/awareness (20)
- Land owner discourage to give same land for 2nd year (9)
- Difficult to find soil layer (7)
- Lack of irrigation facilities (7)
- Imposing higher share of crops (6)
- Attack of insect and pathogen (5)
- Non-availability of inputs in time (5)
- Require more labor (4)
- Not getting fair price for middle men (4)
- Store immature crops (3)
- Stealing of crops (3)
- Lack of proper communication (2)
- Not getting fair price for middle men (2)
- Lack of storehouse facilities /cold storage (2)

On exploration of the root causes of sandbar cropping technology, 15 root causes have been identified by the farmers. Among the 'root' causes 'low price during peak period of pumpkin' got the highest score (21) and was the most crucial root causes. Then 'lack of training and education/awareness' was the second root cause with a score of 20. It was highly logical because lack of training caused lack of knowledge and experience resulting in constraints facing and accordingly there was low dissemination of sandbar cropping.

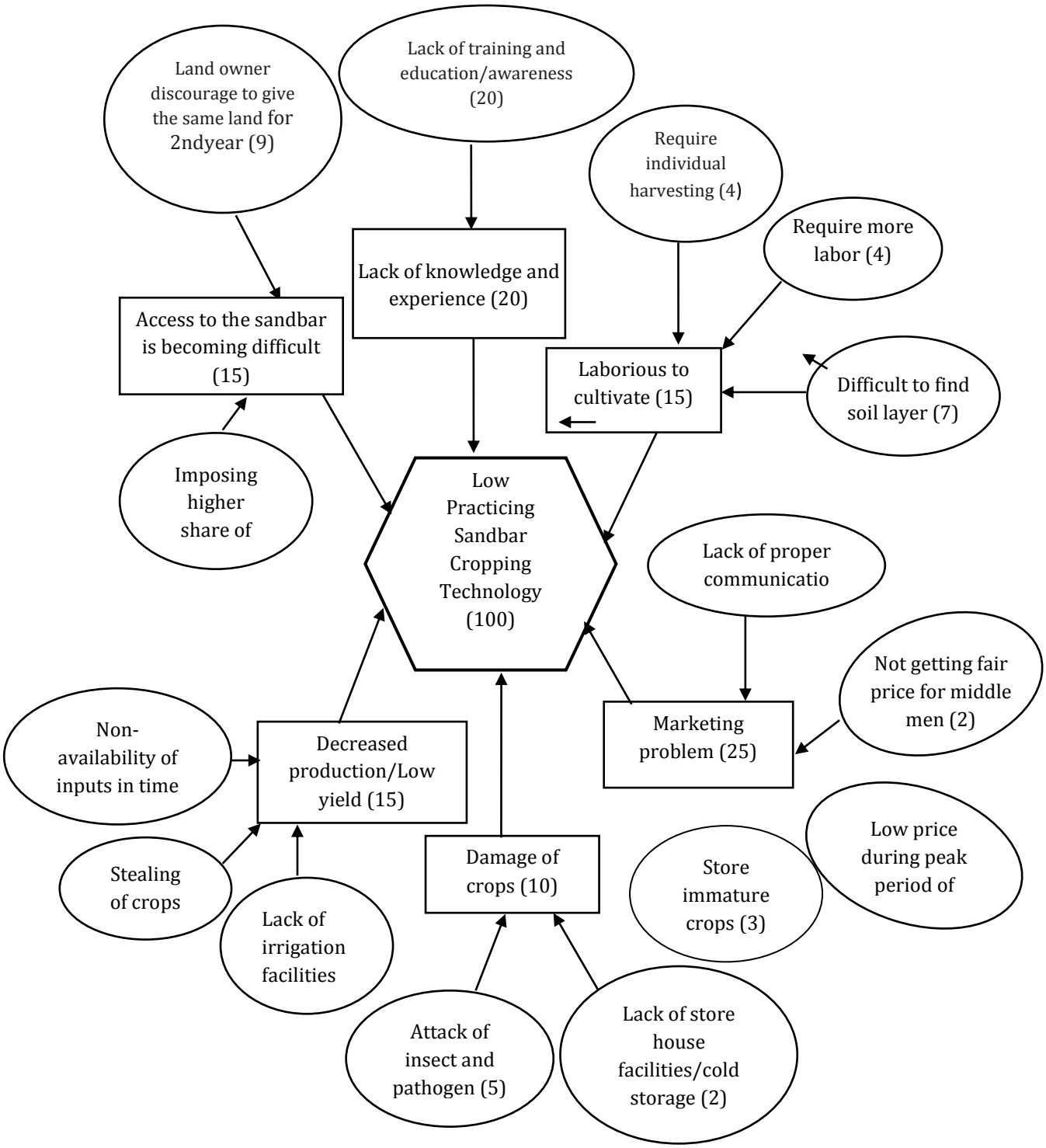
Though the other root causes such as 'lack of proper communication', 'not getting fair price for middle men' and 'lack of storehouse facilities/cold storage' bear less significance but these could never be avoided. These cause also some sorts of influences on the dissemination of sandbar cropping technology.

Relationship between Independent and Dependent Variable: To determine the relationship between independent variables and dependent variable, the following null hypothesis was tested, "There is no relationship between nine independent variables and constraints of sandbar cropping technology". Pearson's Product Moment Co-efficient of correlation (r) has been used to explore the relationship. The relationships of independent variables and constraints of sandbar cropping technology have been shown on Table 2.

Table 2. Co-efficient of correlation between constraints of sandbar cropping technology and the selected characteristics of respondents (N=95).

Dependent variable	Independent variables	Pearson Correlation (r) values with 93df	Tabulated value of 'r'	
			0.05 level	0.01 level
Constraints of sandbar cropping technology	Age	0.430**	± 0.210	±0.274
	Educational qualification	-0.243*		
	Family size	0.050NS		
	Annual family income	-0.168NS		
	Training received	-0.311**		
	Knowledge on sandbar cropping	-0.388**		
	Aspiration	-0.072NS		
	Fatalism	0.245*		
	Attitude towards PAB	0.040NS		

*= Correlation is significant at the 0.05 level (2-tailed); **= Correlation is significant at the 0.01 level (2-tailed); NS= Non-significant.



= Intermediary Constraint, =Root Constraint, = End Constraint.

= ⟶ Causal relationship between constraints and the number of parenthesis indicates score of the concerned constraints.

Figure 3. Scored Causal Diagram (SCDs) prepared by the beneficiaries of Practical Action Bangladesh (PAB).

Table 3. Perception Index of Scope for practicing sandbar cropping technology.

Sr. No.	Statements	Extent of perception of scope				PIS	Rank
		High	Moderate	Low	Not at all		
1.	Production of different crops along with pumpkin	70	15	10	0	250	1
2.	Food security	40	30	15	10	195	2
3.	Employment opportunity for youth	35	30	20	10	185	3
4.	Marketing	25	35	20	15	165	4
5.	Development of leadership	20	25	20	30	130	5

Scope for Practicing Sandbar Cropping Technology: The respondents expressed their opinion regarding scope for practicing sandbar cropping technology and the "Perception Index of Scope" i. e. PIS has been presented in Table 3. The respondents mentioned their opinion on five scopes of sandbar cropping technology. 'Production of different crops along with pumpkin' ranked first followed by 'food security' obtaining PIS of 250 and 195 respectively. 'Development of leadership' becomes lowest in the perception index of scope table with PIS of 130.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions drawn on the basis of the findings and their logical interpretation in the light of the other relevant facts are presented below:

Finding indicates that the respondents faced considerable constraints in all 24 selected constraints. However, the extent of constraints for "low price during the peak period of pumpkin" was the highest. Regarding overall constraints of sandbar cropping technology, about three-fourths (75.8 percent) of the farmers faced medium constraints. From this finding, it may be concluded that until the farmers are free from different constraints of sandbar cropping, dissemination of this technology may be hampered. As farmers' age showed a positive significant relationship with their constraint of sandbar cropping technology. Thus, it could be told that old farmers faced more constraints in sandbar cropping than the younger farmers. Sandbar cropping is a very much laborious task. Probably due to less energy and more fatalistic characteristics, old farmers faced greater constraints than that of younger ones. Level of education and agricultural knowledge of the farmers had significant negative correlation with the constraints of sandbar cropping technology. This means that higher the educational qualification of the farmers and their agricultural knowledge, lower were their constraints. So, it may be concluded that unless the literacy rate of the farmers is increased, they might continue to face constraints in practicing sandbar cropping. Agricultural knowledge level also appeared to be very important in conducting sandbar techniques. Significant negative correlation of annual family income of the farmers with the constraints of sandbar cropping technology may lead to an understanding that they face less constraint if their family income is higher. In other words, farmers having low family income face more constraints. Thus, financial support from family for the sandbar farmers is important towards facing lesser problems in practicing sandbar techniques.

Fatalism level of the respondents showed significant positive relationship with their constraints faced in sandbar farming. This means the farmers, who were more fatalists, faced more constraints. Thus, it may mean that fatalistic attitudes of the farmers stood on way of practicing improved sandbar farming.

Recommendations drawn on the basis of the findings are presented below:

i. It was observed that farmers received low market price during peak of harvest of pumpkins. Steps might be taken so that reasonable price can be ensured to the farmers, otherwise the intermediaries would be benefited. As a result, farmers would be discouraged to practice this technology. The concerned policy makers of PAB, other NGOs and local government should improve the marketing system so that farmers could get the fair price from their product round the year especially during the peak period of production. In General, about three-fourths of the farmers had been facing medium constraints. Thus, the concerned NGOs and DAE should have their strategic actions in order to identify the constraints associated with this specialized farming and minimize the constraints towards appropriate dissemination of this technology.

ii. As the sandbar cropping system is laborious and the constraint facing in it is related more to the old

farmers, any initiatives related to this may be started with the younger farmers. DAE and concerned NGO may care for it.

iii. A major part of the respondents were illiterate or could sign only. And their situation of problem facing was linked to their literacy. Hence, it is recommended that concerned PAB authority, GOs and other NGOs may come forward to provide functional literacy to the farmers so that they can at least read and write. The adult farmers should be encouraged to increasingly take part in adult education program. The minimal literacy of the farmers may bring them to a state to face less constraint. Similarly, the farmers who received higher training on sandbar cropping technology seem to face low constraints on this aspect. Also, enhanced agricultural knowledge of the farmers was associated with less problem confrontation. Therefore, more training programs on sandbar cropping should be arranged to upgrade knowledge and skills of the farmers on sandbar cropping technology and its related issues.

iv. Annual family income played a role towards facing lesser constraints. If possible PAB should manage credit for the farmers from any commercial bank or NGOs working in the study area without or with least interest so that their limited income may not stand against the proper flourishing of this farming.

v. Sandbar cropping is now practiced under NGO (PAB) and private level and has already gained its popularity. So, the government should give special emphasis on this issue and take necessary supportive measures for ensuring easy availability of inputs at reasonable prices.

ACKNOWLEDGEMENTS

All praises and appreciation are due to Almighty Allah who enabled the author to complete this study peacefully and successfully. The author deems it a proud privilege to express heartfelt gratitude and thanks to his reverend supervisor, Kbd. Dr. Saiful Huda, Professor, Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur for his scholastic supervision, sincere interest, encouragement, cooperation, constant and need based help at each stage from the beginning to the completion of this research work. The author also wishes to express his profound gratefulness to his co-supervisor Md. Sadekur Rahman, Assistant Professor, Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur for his creative suggestions, constructive criticism, constant supervision and scholastic co-operations to bring this thesis up to its present standard. The author humbly desires to expresses his thanks and gratefulness to all teachers of the Department of Agricultural Extension, Hajee Mohammad Danesh Science & Technology University, Dinajpur.

The author deeply acknowledges the cooperation and sincere help of the concerned personnel of PAB in the research working area. The author also expresses his deep sense of gratitude to the respondents of the study area who patiently provided the information during the interview with the author.

Thanks and sincere gratitude is also due to Mrs. Fahmida Khanum for her gracious, cordiality and hospitality during discussion with the thesis supervisor at residence at any suitable time.The author expresses his grateful thanks to all staff and employees of the Department of Agricultural Extension, Hajee Mohammad Danesh Science and Technology University, Dinajpur.

Last but not least, the author expresses his deepest sense of gratitude, indebtedness and profound respect to his beloved parents, sisters, relatives and friends for their blessings, encouragement, and moral support in all phases of this academic pursuit from beginning to the end.

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