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Exploring the Status, Prospects and Constraints of Riverbed Cultivation in Cooch Behar district of West Bengal, India

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ABSTRACT

Riverbed farming is a sustainable, productivity-enhancing technology suitable for dissemination in other appropriate areas. It has been shown to be economically viable, environmentally sustainable, socially acceptable and technologically appropriate for landless and land-poor farmers in the Terai region. The study was conducted on five villages from three riverbed systems with 20 respondents from each village thereby totaling number of 100 respondents. The data were collected on information about riverbed cultivation, marketing of riverbed products, prospects of riverbed cultivation and constraints of riverbed cultivation. The results shows that 100% respondents give first rank to proper utilization of riverbed land for adopting riverbed cultivation and 100% accept that they have used income from riverbed cultivation to setup other occupations. It was also shown that most of the farmers sell their produce through middlemen from the farm that was 75% in Singimari river bed system followed by 65% in Torsha and 60% in Shiltorsha respectively and transportation was the most important constraint having mean value 2.83.

Key words: *Riverbed cultivation, Market information, Constraints, Prospects*

Introduction

Presently, in South Asian countries, majority of cucurbitaceous vegetables are extensively being grown in riverbeds (called *diara* land) for off season produce. Growing cucurbitaceous vegetables on river-beds or river basins constitute a distinct type of farming. River bed cultivation in India specially facilitate off season production of cucurbitaceous vegetable. A key factor affecting riverbed farmers' economic performance is their early and timely access to inputs, especially seeds. Riverbed farmers who can harvest cucumbers, pumpkins, and gourds in March and April benefit from the high prices these vegetables fetch during this off-season time (Tiwari, 2008). Riverbed or riverbank farming was an innovative agricultural farming that maximizes use of marginal land and contributes and food Security and livelihood of the poor and marginalized farmers (Schiller *et al.*,2013). Singh (2012) conducted a study

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on Cucurbits Cultivation under Diara-Land and found that about 65% of total cucurbit cropped area of the country falls under riverbeds. Helvetas Nepal (2016) reported that the surplus incomes from the riverbeds were re-invested to other productive sectors by the farmers. Shree Kumar Maharjan (2017) reported that riverbed farming was an alternative source of livelihood for the poor farmers in the terai region of Nepal for their family nutrition, income and food security. Joshi (2012) reported that the nurseries, operated by either a riverbed farmer or a neighbor, could ensure access to vegetable seeds early in the season, and generate additional rural employment opportunities. ICIMOD (2013) reported that riverbed farming provides opportunities to the poor and landless people in the Terai region where at least 20% of the households are landless, usually depending on share cropping and off-farm jobs. Reena Kumari *et. al.* (2018) reported that riverbed cultivation was best suited for small and marginal farmers, who could work themselves along with their families in the fields, producing a large number of cucurbits and other vegetables economically. In spite of many problems a large number of growers were cultivating cucurbits in the river-bed areas, especially in summer producing large quantities of musk melon, water melon, cucumber etc. Riverbed or Riverbank farming is gaining popularity in recent decades, especially in Cooch Behar region of West Bengal as an alternative form of agriculture for poor and landless farmers to enhance their food security .The farmers usually prepare the field and cultivate vegetables and fruits in the pits in the riverbanks after the post-monsoon season. Riverbed farming benefits the poor and marginalized in wider geographical areas. In West Bengal the riverbed cultivation is going on in Cooch Behar district. Cooch Behar is surrounded by the rivers like *Torsha, Singimari* and *Siltorsha*. The farmers mainly cultivated in these riverbeds. But due to the lack of awareness about riverbed cultivation, lack of cultivation practices, high cost of seed the farmers are facing many problems in riverbed cultivation. Due to the unawareness of farmer the unauthorized agents convinced the farmers to spraying their product which are mainly pesticide which increases the cost of production. With these backdrops the present study was undertaken in Cooch Behar district with the following objectives to study the status and prospects of riverbed cultivation in Cooch Behar district of West Bengal and to study the constraints faced by the riverbed cultivators in Cooch Behar district of West Bengal.

Materials and Methods

The present study was an attempt to the prospect and constraints of river bed cultivation in Cooch Behar district of West Bengal as perceived by the farmers. The study was conducted in the Cooch Behardistrict of West Bengal. The district and five village namely *Salmara* part- III under Cooch Behar-II block, *East Panisala* under Cooch Behar-I block, *Deochorai* under Tufanganj-I block and *Modnakura singimari* and *Takimari* under Dinhata-I blockwere selected purposively considering the dominance of riverbed cultivation, convenience and time frame for the study. 20 growers from each village were randomly selected totaling 100 respondents from whole area. The information about riverbed cultivation mainly deals with the crops growing in the riverbed, number of pits, distance between pits, varieties cultivated, distance from the river bank, planting direction,yield/plant (kg) and application of manure, growth regulator and protection chemicals. The market information mainly includes channel of marketing that is through middlemen from farmgate, through middlemen in market place and own retail marketing. Where they marketed that is local market and export to distance market. Another part is price of the products that is in early, mid and end season respectively. The prospects are mainly measured by taking the reasons of adopting riverbed cultivation and benefits extracted from riverbed cultivation with score 1 for yes and 0 for no. A list of constraints was enlisted discussing with the experts and finally selected by a pilot survey (see appendix: the battery of schedules). Constraints were measured as perceived by the water melon grower in river bed area. Different constraint situations were exposed with a 4-point scale for response as 0=no constraint, 1=somewhat constraint, 2=moderate constraint,3=extreme constraint. The statistical methods in this study include Mean and Chi-Square (÷2) test were used as per the characteristics of data.

Results and Discussion

Status and prospect of riverbed cultivation in study areas

Table 1 represents the information about the pits in

Table 1. Information About Pits

River system	Total No. of farmers	Av. No. of Pits/ Farmer	minimum Pits/ Farmer	Maximum Pits/ Farmer
Shiltorsha	20	1355	800	2500
Torsha	40	1520	400	3000
Singimari	40	1767.5	700	3000
Total	100	1586	400	3000

F=3.415**

the riverbed system.It shows that in Singimari river bed system pits per farmer is 1767 followed by 1520 pits in Torsha and 1355 in Shiltorsha respectively. In total pit per farmer is 1586.The number of pits varies in the river bed system is 400 to 3000 in total. But it ws different in different riverbed system that is 800 to 2500 in Shitorsha, 400 to 3000 in Torsha and 700 to 3000 in Singimari.

Table 2 represents the planting directions used by the riverbed farming by the farmers. They were mainly using three types of planting direction. Most of the farmers uses parallel planting direction that is 33% in Singmari riverbed system followed by 26% in Torsha and 21% in Shiltorsha respectively. In Singmari and Torsha riverbed system 26% and 21% farmers follows perpendicular type of planting direction. The statistical value indicates that there is a significant difference between the three river bed systems.

Table 2. Planting Direction

	Shiltorsha	Torsha	Singimari
Parallel	21	26	33
Perpendicular	3	21	26
Haphazard	0	3	3

Chi-square=16.22p=.013

Table 3 shows the mean yield of watermelon per pit in Kilogram. It shows that the yield is almost same in the three riverbed systems that are 13.19kg/ pit in Singmari followed by 13.04kg/pit in Siltorsha and 12.92 kg/pit in Torsha respectively. The average mean yield per pit is 13.07kg.The f value indicates that there is no significant relationship between the three riverbed systems.

Table 4 reflects the varieties of watermelon in cultivated by the farmers in the river bed system. There are mainly three varities cultivated by the farmers that are Madhuri, Sandwitch and Potol. Most of the farmers that is 37% in Singmari followed by 24% Torsha and 13% Shiltorsha cultivated potol variety

Table 3. Yield/Pit (Kg) * River System

River-system	Mean Yield (kg/Pit)	Min.	Max.
Siltorsha	13.04	10	15
Torsha	12.92	10	16
Singimari	13.19	10	17
Average	13.07	10	17

F=0.127NS

Table 4. Varieties of Watermelon in the River System

	Shiltorsha	Torsha	Singimari
Madhuri	8	23	12
Sandwitch	3	3	13
Potol	13	24	37

Chi-square=11.42 p=.022

of watermelon. The sandwitch variety was mostly cultivated in Torsha river bed that is 23% followed by 12% in Singmari and 8% in Madhuri.

Table 5 presents the distance of the river bed cultivation from the river bank. There are mainly three types of distance taken in foot. From the table it shows that less than 41 ft was taken by the farmers from the river bank that was 48% in Singimari river bed system followed by 28% in torsha and 17% in Siltorsha. The statistical value indicates that there was no significant difference between the three river bed system.

Table 5. Distance from Bank

	Shiltorsha	Torsha	Singimari
<41ft	17	28	48
41-100ft	0	9	8
>100ft	7	13	6

chi-square=11.49 p=.022

Table 6 represents the pit distance in river bed system. Most of the famers follow 5×5 ft distance that was 39% in Singmari, 39 % in Torsha and 11%

Table 6. PxP Distance in The River System

	Shiltorsha	Torsha	Singimari
4x4ft	0	6	4
4x5ft	13	5	19
5x5ft	11	39	39

Chi-square=18.10 p=.001

in Shiltorsha. The statistical value indicates that there was significant difference between the three river bed system.

Table 7 represents the application of nutrients like FYM, Vermicompost (organic source) and inorganic sources are nitrogen, phosphorus and potassium. The recommended dose for the cultivation per pit is 5 kg organic manure per pit, 0.03 kg nitrogen, 0.02 kg phosphorus and 0.02 kg potassium. From the table it shows that the farmers in the river bed cultivation applied 1.65 kg FYM which is less than the recommended dose. Nitrogen and phosphorus application was double than the recommended dose that is maximum 0.06 kg. Application of potassium was 30 to 50 percent less than the recommendation which increases the disease infestation more and the sweetness of watermelon become low.

The data in the Table 8 indicates the application of micronutrient. The farmers were mostly applying boron which was three times more than the recommendation that is maximum 0.01 kg. Other micronutrients (zinc, copper, molybdenum) were mostly not applied or sometimes applied in a negligible amount which reduce the quality f the fruits and subsequently the price of the produce.

Table 9 represents the application of growth regulator hormone. The farmers mostly applying three types of growth regulator that were Enzyme (Zyme), Humic acid (Poshak) and centre plus with a mean dose of 0.001 kg per pit, 0.244 ml per pit and 0.095 ml per pit respectively to encourage the vegetative growth of the plant.

Table 10 represents the application of insecticide and fungicide in the riverbed cultivation. The recommended dose for the insecticide ektara is 0.5 ml/ Lit, Solemon is 0.3ml/lit, Marshal is 0.5 ml/l and for blitox 3 ml/l. From the table it was shown that the farmers applied more or less equal to the recommended dose. The application should be done seven days interval. To get instant relief from the insect and diseases they applied the chemical in two days interval.

Table 11 represents the application of microbial inoculants. The recommended dose for the microbial inoculants is 1 ml/l. From the table it was shown that the dose is less than recommended dose that is 0.5 ml/l.

Table 12 presents the ranking of reasons given by the farmers for adopting riverbed cultivation. It shows that from the twelve reasons, 100% respondents give first rank to proper utilization of riverbed land for adopting riverbed cultivation. Other reasons like have good experience on riverbed cultivation from tradition (98%), free/low cost occupy land in riverbed (97%), cultivation method is easy than in main field method (95%), fruit quality is good than main field (92%), having no land of my own (90%), price realization is good than main field cultivation (84%), less costly than main field method (74%), marketing and other infrastructural facilities are good (70%), less requirement of manure and fertilizer than main field (63%), does not know about main field cultivation (63%) respectively. The farmers do not get any government support for cultivation in riverbed.

Table 13 presents ranking of the type of benefit got by the farmer from riverbed cultivation. Most of the farmers, i.e. 100% accept that they have used income from riverbed cultivation to set other occupation. Other type of benefits also got by the farmer from the riverbed cultivation like income increased (99%), provide employment to other labourers in the

Table 7. Application of Nutrients

Name of the Nutrient	**Amount/Pit**			Remarks
Organic Source	Mean	Minimum	Maximum	
1. FYM (kg)	1.65	0.89	4.5	
2. Vermicompost (kg)	0.01	0	0.05	
In-Organic Source				
1. Amount Of N (kg)	0.02	0.01	0.06	Urea, 10:26:26,DAP.
2. Amount Of P (kg)	0.02	0	0.04	10:26:26, SSP, DAP
3. Amount of K (kg)	0.01	0	0.02	10:26:26, MOP

Table 8. Application of micronutrients

Application of Micro-Nutrient				
Name of The Nutrient	Amount/Pit			Remarks
	Mean	Minimum	Maximum	
1.Agromin (kg)	0.0003	0	0.01	Boron+copper+Zinc+Magnasium
2.Boron (kg)	0.0003	0	0.01	Borux/Boron

Table 9. Application of growth regulator

Application of Growth Regulator Hormone				
Name of The Growth Regulator Hormone	Amount/Pit			Remarks
	Mean	Minimum	Maximum	
1. Trade Name=Zyme (Enzyme) (Kg)	0.001	**0**	0.01	Enzyme
2. Trade Name=Poshak (Humic Acid) (ml.	0.244	**0**	1	Humic Acid
3. Trade name -Center Plus (ml)	0.095	**0**	1.25	

Table 10. Application of Insecticide and fungicide

Application of Insecticide				
Name of the Insecticide	Amount/Pit			Remarks
	Mean	Minimum	Maximum	
1. Trade Name=Ektara (Thiamithoxcom 25%) (gm.)	**0.18**	**0**	**0.75**	To control insect
2. Trade Name=Solemon (Beta eyfluthrin 8.49+ Imidacloprid 19.8%) (ml)	0.18	0	0.5	To control insect
3. Trade Name=Marshal (Indocharb) (ml.)	0.15	0	1.73	To control insect
4. Trade Name=Klip-5, (Imamectin Benjoyed)(ml.)	0.11	0	0.4	To control insect
5. Trade Name=Blitox (Copper Oxichloride) (ml)	0.077	0	0.3	To control diseases

Table 11. Application of microbial inoculant

Application of Fungicide and Bactaria				
Name of the microbial inoculant	Amount/Pit			Remarks
	Mean	Minimum	Maximum	
1. Trade Name=Nisharga (*Tricodarma viridi*), (ml.)	0.15	0	0.5	To control soil borne fungal disease
2. Trade Name=Sparsha (*Pseudomonas* sp.) (ml.	0.16	0	0.5	To control soil borne fungus

riverbed for time being (97%), femle member can join in riverbed cultivation (88%) and all family members got job in riverbed (87%).

Marketing information of riverbed cultivation

Table-14 shows the channel of marketing of the product in the river bed system. The farmers mostly cultivated watermelon in the river bed. Most of the farmers sell their produce through middlemen from the farm that was 75% in Singimari river bed system followed by 65% in Torsha and 60% in Shiltorsha respectively. It was also shown that 40% of farmers in Shiltorsha River bed system having own retail marketing followed by 27.50% in Torsha and 22.50% in Singimari riverbed system. The chi square value implies that there was no significant relationship between the three riverbed systems.

Table 15 represnts that the marketing of the produce by the farmer. The farmers were mainly market the produce in two markets that is local market and export to distance market. From the table it shows that most of the farmers export the product to distance market that was 80% in Torsha followed by 65% in Singimari and 60% in Shiltorsha river bed

Table 12. Reasons of adoption of riverbed cultivation

SlNo.	Reasons	% farmers	Rank
1.	Having no land of my own	90.00	**VI**
2.	Have good experience on riverbed cultivation from tradition	98.00	**II**
3.	Cultivation method is easy than in main-field method	95.00	**IV**
4.	Less costly than main-field method	74.00	**VIII**
5.	Fruit quality is good than main-field	92.00	**V**
6.	Price realization is good than main-field fruit	84.00	**VII**
7.	Dose not know about main-field cultivation	63.00	**XI**
8.	Proper utilization of riverbed land	100.00	**I**
9.	Free / low cost to occupy land in riverbed	97.00	**III**
10.	Less requirement of manure and fertilizer than main-field	63.00	**X**
11.	Marketing and other infrastructural facilities are good	70.00	**IX**
12.	To get Govt. support	0.00	**XII**

Table 13. Benefit extracted from riverbed cultivation:

SlNo.	Reasons	% farmers	Rank
1	My income increased	99.00	**II**
2	I have used income from riverbed to set other occupation	100.00	**I**
3	All my family member get job in riverbed	87.00	**V**
4	I can provide employment to others	97.00	**III**
5	Female member can also join and get job in riverbed cultivation	88.00	**IV**

Table 14. Channel of Marketing

Channel of marketing	Shiltorsha	Torsha	Singimari
Through middlemen in farm gate	60.00	65.00	75.00
Through middlemen in market place	0.00	7.50	2.50
Own retail marketing.	40.00	27.50	22.50

Chi Square=4.244 NS; NS-Non Significant

system respectively. The farmers get more price by sale their product in distance market than the local market. There was very less farmers who sale their product in local market that was 40% in Shiltorsha, 35% in Singimari and 20% in Torsha. The chi-square value indicates that there was no significant difference between the river bed systems.

Table represents the price of the produce in three different seasons. The seasons are mainly early, mid and late seasons. It shows that the farmers got more prices for the product in the early season that varies between Rs.3/kg to Rs.12/kg. The quality and taste of the watermelon was decreases in the late season. So the farmers did not get so many prices in the late seasons.

Table 15. Where marketed the produce

Where markted	Shiltorsha	Torsha	Singimari
Local Market	40	20	35
Export to distance market	60	80	65

chi-square 3.33 NS

Constraints faced in riverbed cultivation

Table presents the ranking of constraints perceived by the farmer in riverbed cultivation. The different types of constraints are infrastructure and policy, personal, situational, managerial and economic.

Infrastructure and Policy constraints: Good infrastructure and policy helps the farmer to improve their cultivation in riverbed system. From the table it shows that transportation was the most important constraint having mean value 2.83 followed by the

Table 16. Price of the produces

Price (Rs./kg)	Min.	Max	Mean
Early	3	12	6.73
Mid	2	6	3.85
Late	1	4	2.03

other constraints like price less than expected because of monopoly (2.34), depends on distance market (2.28) and input availability in time (2.19) respectively. No policy has formed to improve the riverbed cultivation in our country. If the government takes necessary steps like training on riverbed cultivation, proper infrastructural facility to the farmer, then the constraints can be minimized.

Personal Constraints: From the table it was revealed that the personal constraints were nearly same mean score which implies that every personal constraint was important for the farmers. Most of the famers gives first rank to no knowledge of plant protection(2.94) having first rank followed by no knowledge of good short variety(2.93) and no knowledge of package of practice(2.54). Most of the farmers dependent on the input dealer for plant protection as the input dealer are nearer to him. Some of the unauthorized agents take benefit as the farmers were no knowledge about the plant protection and varieties.

Situational Constraints: From the table it was shown that human pest and robbery was the most extreme situational constraints having mean value 2.88 followed by mono cropping invites diseases and pest (2.70),labour crisis in time(2.56), no dry spell in harvesting time(2.04), sandy soil creates problem(1.79), long period between harvesting and procuring of fruits by market(1.58) respectively. As the river bed near to the national highway and no one was staying for watching, so the robbery was more.

Managerial Constraints: Table reflects that high infestation of disease and pest was the most serious constraint having mean score 2.97 followed by quality of fruits lowers price of produce (2.71), low sweetness of fruits lowers price of produce (2.58), poor initial growth (2.27) respectively. High infestation of weed was the less serious problem in riverbed cultivation perceived by farmer.

Economic Constraints: Table reveals that seed cost was the most extreme constraint having mean score 2.92 followed by total cost of production is higher (2.27). Due to unawareness of the farmers the unauthorized agents succeed to convince them to spraying their product which increases the cost of production.

Conclusion

The study revealed that the farmers cultivated in river bed for the proper utilization of the riverbed land. Riverbed cultivation was done by the farmers to start another occupation. The recommendations for improving the river bed cultivation are improved package and practice for riverbed cultivation, institutional intervention to improve the production and marketing, aware about the application of nutrients to reduce the constraints faced, Government should provide necessary steps for riverbed cultivation.

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