

Crop Diversity and Farmers' Livelihood in an Agriculturally Prosperous District of West Bengal

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ABSTRACT

The present study highlights the impact of crop diversification on livelihood security and level of living of the farmers in an agriculturally prosperous district of West Bengal. A total of seven different cropping patterns were followed by the farmers, where 13 out of 120 farmers adopted more than one cropping pattern. The cropping pattern of Paddy-Potato-Sesame was preferred by most of the farmers (56.39%). The impact of crop diversification on livelihood security was measured on the basis of six indicators, each on 5-point continuum. The perception of livelihood security of all the groups of farmers was found at above average level (≥ 15) ranging from 16.26 to 18.38 except group of six farmers following Paddy-Fallow-Paddy cropping pattern. The level of living indicated through five types of assets holdings of the groups of farmers adopting various cropping pattern, each of which measured on 5-point continuum. Level of living was found to be below average (≤ 12.50) for all the groups ranging from 12.39 to 10.32, lowest for group of farmers following Paddy-Fallow-Paddy cropping pattern. Therefore, it is worth mentioning that the crop diversity is a key to the livelihood security. The change in level of living is a gradual process and also depends on initial level of resources/assets of farmers.

Keywords: Crop diversity, high value crops, livelihood security, level of living

INTRODUCTION

Indian agriculture is predominantly a small peasant based economy with approximately 80 per cent of the operational holdings being below two hectares, and 34 per cent of the agricultural land are cultivated by them (GOI, 1997). Because of small operational holdings, it is indeed very difficult by the small farmers to improve their earnings only by raising the yields of the existing crops, mainly cereals. However, with the availability of modern farm inputs in the current decades, it was possible for farmers to generate higher levels of income by introducing high value crops commonly known as cash crops in their farming units. Thus, the high value crops being more labour intensive may provide stable employment and income to a large section of the rural households who face the severe problem of seasonal unemployment and underemployment under mono-crop economy (De and Chattopadhyay, 2010). Crop diversification has been an important issue of agricultural development not only in India, but also in other parts of the world. Diversification is the single most important source of poverty reduction for small farmers in South and South East Asia (FAO and World Bank, 2001). Crop

diversification out of staples toward high-value crops (HVCs) is one of the alternatives that can augment incomes, generate employment, and reduce poverty (Barghouti *et al.*, 2004; Joshi *et al.*, 2004; Weinberger & Lumpkin, 2007; Birthal *et al.*, 2013). It can be a strategy to improve livelihood outcomes for farmers (Birthal *et al.*, 2015).

Efforts are now being made in different regions of India to cultivate those crops, which are remunerative and environment friendly. To examine this, an attempt was made to study the nature and extent of crop diversification and its impact on livelihood scenario in one of the agriculturally progressive districts in West Bengal, a rice-growing state of India.

METHODOLOGY

West Bengal to this date remains primarily an agricultural state with ten of its districts deriving 30 per cent or more of their net district domestic product from agriculture and one such district *Paschim* Medinipur (West Midnapore) was randomly selected for the present study. In *Paschim* Medinipur district, two blocks (Ghatal

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and Chandrakona-I block) and four villages under each blocks were selected containing a total number of 120 farmers (15 farmers) from each selected villages.

The status of crop diversification and its impact on the living scenario of farmers was realized through delineation of cropping patterns followed by the selected farmers and compared with the help of rice equivalent yield (REY) calculated through following formula.

$$\text{REY} = \frac{\text{Economic yield of the alternative crop} \times \text{unit price of same crop}}{\text{Unit Price of Rice}}$$

Impact of crop diversification on livelihood of farmers was assessed from their livelihood security and level of living point of view.

The livelihood security refers to food and nutritional security, economic security, habitat security, educational security, social security and health security. Food & nutritional security refers to qualities of foods for the family members. Economic security considers sources of income, savings, loan/ credit availability, *etc.* Habitat security deals with condition of living, safety, insurance, adoption at the time of any crisis/ emergency in family, *etc.* Educational security addresses to schooling of children, family members literacy, communication ability, *etc.* Social security means recognition in society, membership in social organizations, *etc.* Health security indicates health condition, treatment of illness, readiness to meet health related expenditure, *etc.* Interval scale was used for the measurement. Each of six indicators of livelihood security was included in an interview schedule developed for present study. During survey, the sampled respondents were asked to perceive each indicator on 5-point continuum *i.e.* very high (5), high (4), medium (3), low (2) and very low (1). The indicator-wise mean perception score was calculated by averaging scores of sampled farmers that might be varied from 1 to 5. Overall livelihood security was derived by adding mean scores of all six indicators, which might be ranged from 6 to 30.

Level of living is the function of physical, social, financial, human and natural assets. Physical assets refer to type of housing condition, sanitation, conveyance, electric, cooking, communication facility, *etc.* Social assets mean recognition, social and political participation, involvement in developmental works, common services used, *etc.* Financial assets involve sources of income, kinds of savings and investment, lending, borrowing, *etc.* Human assets indicate language competencies, education/ literacy, management skill, mobility, *etc.* Natural assets consist of natural resources holdings *viz.*

farm size, irrigated land, livestock, poultry, fishpond, *etc.* Each of five indicators of level of living was assessed on the basis of perceptions of sampled respondents on 5-point continuum interval scale *i.e.* very high (5), high (4), medium (3), low (2) and very low (1) of the crop diversification with the help of an interview schedule. The mean participation score of each indicator was calculated by averaging scores of sampled farmers of each selected livelihood farmers, which might be ranged from 1 to 5. Overall level of living was measured through summation of mean scores of five indicators, which might be varied between 5 and 25.

RESULTS AND DISCUSSION

The different cropping patterns being followed by a sample of 120 farmers representing from eight villages, four villages each in Ghatal and Chandrakona-I blocks of Ghatal sub-division in *Paschim* Medinipur district were explored and compared.

Table 1: Different types of cropping pattern followed by the selected farmers in *Paschim* Medinipur district

Cropping Pattern	Frequency	Percentage
Paddy-Potato-Sesame	75	56.39
Paddy-Potato-Paddy	23	17.29
Paddy-Rapeseed-Paddy	16	12.03
Paddy-Potato-Rapeseed/ Mustard	8	6.02
Paddy-Fallow-Paddy	6	4.51
Onion -Potato- Paddy	4	3.01
Paddy-Potato-Fallow	1	0.75
13 out of 120 farmers sampled in present study adopt more than one cropping pattern	133	100.00

A total of seven different cropping patterns were followed by the farmers (Table 1), where 13 out of 120 farmers adopted more than one cropping pattern. The cropping pattern of Paddy-Potato-Sesame was preferred by most of the farmers (56.39%) followed by Paddy-Potato-Paddy (17.29%) and Paddy-Rapeseed-Paddy (12.03%). It was interesting to find Onion-Potato-Paddy cropping pattern being adopted by four farmers by growing the onion crop in *kharif* season in addition to the *aman* paddy. Other cropping patterns were Paddy-Potato-Rapeseed/Mustard (6.02%), Paddy-Fallow-Paddy (4.51%) and Paddy-Potato-Fallow being followed by one farmer.

Different types of cropping pattern followed by the sampled farmers were compared in term of Rice Equivalent Yield (Table 2). The REY of crops were found to be different, highest being the potato (18.34 t/ha) followed by onion (7.72 t/ha), sesame (4.8 t/ha), rapeseed/mustard in *rabi* season (3.75 t/ha) and

rapeseed/mustard in summer season (3.2 t/ha).

Farmers (4) with cropping pattern of Onion-Potato-Paddy achieved highest REY of 47.43 qi/acre (11.86 t/ha) while growing onion in 0.45 acre during *kharif*, potato in 1.75 acre during *rabi* and *boro* rice in 1.50 acre (Table 2). Farmers (8) followed Paddy-Potato-Rapeseed/Mustard obtained REY of 38.68 qi/acre (9.67 t/ha) by growing paddy in 2.02 acre in *kharif*, potato in 1.76 acre in *rabi* and rapeseed/mustard in 0.53 acre in summer season. However, the same cropping pattern with equal area for all crops would give REY of 8.43 t/ha. In case of Paddy-Potato-Sesame cropping pattern that was predominant in the study region, farmers (75) cultivated aman paddy in 1.56 acre, potato in 1.45 acre in *rabi* and sesame in 1.28 acre in summer season which gave REY of 36.12 qi/acre (9.03 t/ha). Paddy-Potato-Paddy cropping pattern being followed by the farmers (23) had grown *aman* paddy in an average area of 1.78 acre, potato in 1.44 acre in *rabi* and *boro* paddy in 1.57 acre and achieved REY of 34.98 qi/acre (8.74 t/ha).

Table 2: Comparing of different types of cropping pattern followed by the selected farmers in Paschim Medinipur district through rice equivalent yield (rey)

Cropping Pattern	Crop Grown in Kharif Season		Crop Grown in Rabi Season		Crop Grown in Summer Season		REY (qi/acre)
	Area (acre)	Production (qi)	Area (acre)	Production (qi)	Area (acre)	Production (qi)	
Paddy-Potato-Sesame (n=75)	1.56	23.84	1.45	118.38	1.28	6.14	36.12
Paddy-Potato-Paddy (n=23)	1.78	27.20	1.44	117.56	1.57	34.54	34.98
Paddy-Rapeseed-Paddy (n=16)	2.08	31.79	1.91	8.17	2.08	45.76	17.49
Paddy-Potato-Rapeseed/Mustard (n=8)	2.02	30.87	1.76	143.69	0.53	1.89	38.68
Paddy-Fallow-Paddy (n=6)	0.98	14.98	--	--	0.98	21.56	12.43
Onion-Potato-Paddy (n=4)	0.45	15.44	1.75	142.87	1.50	33.00	47.43
Paddy-Potato-Fallow (n=1)	1.0	15.28	0.50	40.82	--	--	20.81

Note: REY was calculated as per the average selling rates of the farmers viz. Paddy @ ₹ 1000/qi, Potato @ ₹ 900/qi, Sesame @ ₹ 4000/qi, Rapeseed/Mustard @ ₹ 3500/qi and Onion @ ₹ 900/qi

One farmer had followed Paddy-Potato-Fallow cropping pattern by growing *aman* paddy in 1 acre and potato in 0.5 acre keeping the land fallow during summer, which produced an output of 20.81 qi/acre (5.2 t/ha). Although potato was predominant crop in *rabi* season, 16 farmers had grown rapeseed during *rabi* season following Paddy-Rapeseed-Paddy cropping pattern in which mean cultivated area of those crops were 2.08 acre, 1.91 acre and 2.08 acre, respectively. This cropping pattern produced an overall output in term of REY 17.49 qi/acre (4.37 t/ha). It is evident that presence of potato crop in a cropping pattern had made the overall farm output better than a cropping pattern without potato crop. Similarly, the concentration of paddy crop in the cropping pattern would be less remunerative as evident from the output of the farmers (6) in term of REY 12.43 qi/acre (3.11 t/ha) in Paddy-Fallow-Paddy cropping pattern.

Most preferred cropping pattern included potato and/or oilseeds (sesame and rapeseed/mustard) in the present study area. Similar pattern of diversification was reported by number of researchers (Chand *et al.*, 2008; De and Chattopadhyay, 2010; Dasgupta and Bhaumik, 2014; Majumder, 2014, Birthal *et al.*, 2015). Vyas (1996) also observed that the small and the marginal farmers who dominate the agricultural scenario of most of the Indian states, can generate higher farm income and employment and mitigate risks by adopting a diversified crop portfolio. De (2003) revealed that the cropping pattern in West Bengal in terms of allocation of acreage remained skewed towards *boro* paddy, potato and oilseeds. The same was found in present study conducted at *Paschim* Medinipur district of West Bengal.

The impact of crop diversification on livelihoods of sampled farmers was measured through analyses of livelihood security and level of living. Accordingly, cropping pattern wise six groups of farmers were identified for determination of livelihood security and level of living of farmers as one of the impacts of crop diversification. Only one farmer adopting the seventh cropping pattern (Paddy-Potato-Fallow) is not considered. Livelihood security as perceived by the farmers adopting different cropping patterns with respect to six indicators of it is presented in table 3. It is evident that farmers (75) adopting Paddy-Potato-Sesame cropping pattern perceived food and nutritional security (mean perception score 3.12), economic security (mean perception score 2.99), habitat security (mean perception score 2.77), health security (mean perception score 2.75) and educational security (mean perception score 2.57) at an above average level (mean perception score >2.5); while social security was perceived below average (mean perception score 2.20). The perception of the farmers (23)

following Paddy-Potato-Paddy cropping pattern was also similar. The group of farmers (16) under cropping pattern Paddy-Rapeseed-Paddy cropping pattern perceived food and nutritional security, economic security, habitat security and educational security at an above average level (mean perception score >2.50); while health security and social security was perceived below average (mean perception score <2.50). Farmers (8) adopting Paddy-Potato-Rapeseed/Mustard perceived food and nutritional security, economic security, habitat security and health security quite highly (mean perception score ≥ 3.00); however the perception towards both educational and social security was just average (mean perception score 2.50). In case of the farmers (6) growing only paddy both in *kharif* and summer, keeping the land fallow during *rabi*, four of the indicators were found at below average level, only habitat security and health security was just above the average level (mean perception score 2.60). The small group of farmers (4) cultivating with Onion-Potato-Paddy, perceived food and nutritional security, economic security, and health security at an above average level (mean perception score >2.50); while both habitat security and social security was average (mean perception score 2.50) and educational security was below average (mean perception score <2.50).

Table 3: Livelihood security of the groups of farmers adopting different cropping patterns in Paschim Medinipur District

Cropping Pattern	Mean Perception Score on Indicators of Livelihood Security						Overall Livelihood Security
	Food & nutritional security	Economic security	Habitat security	Educational security	Social security	Health security	
Paddy-Potato-Sesame (n=75)	3.12 (0.57)	2.99 (0.63)	2.77 (0.65)	2.57 (0.57)	2.20 (0.57)	2.75 (0.44)	16.40 (2.18)
Paddy-Potato-Paddy (n=23)	3.04 (0.56)	2.87 (0.63)	2.74 (0.81)	2.65 (0.65)	2.22 (0.60)	2.74 (0.45)	16.26 (2.43)
Paddy-Rapeseed-Paddy (n=16)	3.31 (0.60)	3.13 (0.50)	2.94 (0.85)	2.81 (0.83)	2.13 (0.50)	2.38 (0.50)	16.44 (2.10)
Paddy-Potato-Rapeseed/Mustard (n=8)	3.50 (0.53)	3.50 (0.53)	3.38 (0.74)	2.50 (0.53)	2.50 (0.53)	3.00 (0.00)	18.38 (2.39)
Paddy-Fallow-Paddy (n=6)	2.40 (0.55)	2.40 (0.55)	2.60 (0.55)	2.20 (0.45)	2.20 (0.45)	2.60 (0.55)	14.40 (0.89)
Onion-Potato-Paddy (n=4)	3.00 (0.00)	3.25 (0.50)	2.50 (0.58)	2.25 (0.50)	2.50 (0.58)	2.75 (0.50)	16.50 (2.52)

Note: Standard Deviation values are given in the parentheses. Maximum and minimum possible scores for each indicator are 5 and 1, respectively.

The overall livelihood security for the farmers cultivating only paddy (Paddy-Fallow-Paddy) was found relatively low and below average level while that of other farmers following different diversified cropping pattern was at above average level. It is observed that both food and nutritional security and economic security were perceived above average by all except the group of six farmers following Paddy-Fallow-Paddy cropping pattern. The habitat security was perceived at an average and its above level (mean perception score ≥ 2.50) by all. All the farmers perceived health security at above average level except few (16 farmers) adopting Paddy-Rapeseed-Paddy cropping pattern. Educational security was perceived relatively low but at an average and its above level (mean perception score ≥ 2.50) by all except the farmers adopting Paddy-Fallow-Paddy and Onion-Potato-Paddy cropping patterns. Social security was the lowly perceived indicator as most of the farmers opined it as below average and few farmers adopting Paddy-Potato-Rapeseed/Mustard and Onion-Potato-Paddy cropping pattern perceived it just average (mean perception score 2.5).

The level of living indicated through five types of assets holdings of the groups of farmers adopting various cropping pattern is present in table 4. Level of assets holdings of groups of farmers adopting Paddy-Potato-Sesame cropping pattern (75 farmers) and Paddy-Potato-Paddy (23 farmers) cropping patterns showed that only physical and social assets holdings of them were at above average level, while financial, human and natural assets holdings were below average. Farmers following Paddy-Rapeseed-Paddy (15 farmers) and Paddy-Potato-Rapeseed/Mustard (8 farmers) cropping patterns had physical, social and human assets holdings at above average level; however, both financial and natural assets holdings were below average. Farmers (6) cultivating only paddy during two seasons (*kharif* and summer) had only physical and human assets holdings at above average level, while rest were at below average level. Group of four farmers following Onion-Potato-Paddy cropping pattern had physical, social and human assets holdings at above average level, while they had both financial and natural assets at below average level. Thus, it is evident that mean level of both financial and natural assets was below average in all the groups of farmers adopting various cropping patterns. Physical assets holding were better for all in comparison to other assets. Social assets holdings was found to be second in case of majority of the groups of farmers barring the group of six farmers following Paddy-Fallow-Paddy cropping pattern where it was just below the average. Human assets holding was found to be below average for two larger groups of farmers adopting Paddy-Potato-Sesame cropping pattern

(75 farmers) and Paddy-Potato-Paddy (23 farmers) cropping patterns. Therefore, three out of five assets as indicators of level of living found to be not up to the mark resulting overall level of living of the farmers at below average level.

Table 4: Level of living of the groups of farmers adopting different cropping patterns.

Cropping Pattern	Mean Level of Different Assets Holdings Indicating Level of Living					Overall Level of Living
	Physical assets	Social assets	Financial assets	Human assets	Natural assets	
Paddy-Potato-Sesame (n=75)	3.13 (0.62)	2.61 (0.36)	2.00 (0.40)	2.45 (0.39)	1.21 (0.51)	11.40 (1.65)
Paddy-Potato-Paddy (n=23)	3.12 (0.84)	2.55 (0.27)	1.91 (0.42)	2.32 (0.39)	1.08 (0.46)	11.00 (1.72)
Paddy-Rapeseed-Paddy (n=16)	3.33 (0.74)	2.63 (0.22)	2.17 (0.37)	2.55 (0.39)	1.31 (0.52)	12.05 (1.62)
Paddy-Potato-Rapeseed/Mustard (n=8)	3.35 (0.72)	2.56 (0.29)	2.16 (0.53)	2.56 (0.53)	1.28 (0.58)	11.92 (2.24)
Paddy-Fallow-Paddy (n=6)	2.63 (0.31)	2.45 (0.48)	1.80 (0.48)	2.60 (0.22)	0.84 (0.26)	10.32 (1.38)
Onion-Potato-Paddy (n=4)	3.39 (1.09)	2.75 (0.54)	2.13 (0.25)	2.63 (0.25)	1.50 (0.87)	12.39 (2.67)

Note: Standard Deviation values are given in the parentheses. Maximum and minimum possible scores for each indicator are 5 and 1, respectively.

A comparison of overall livelihood security and level of living of the groups of farmers adopting different types of cropping pattern is depicted in Fig. 1. The perception of livelihood security of all the groups of farmers was found at above average level (≥ 15) ranging from 16.26 to 18.38 except group of six farmers following Paddy-Fallow-Paddy cropping pattern; however, the level of living was found below average (≤ 12.50) for all the groups ranging from 10.32 to 12.39.

Therefore, it is worth mentioning that the crop diversity is a key to the livelihood security. The change in level of living is a gradual process and depends on initial level of resources/assets farmers having that rises with the accumulation of different assets over a period of time, which does not only depend on crop diversity alone but also on other factors. But, certainly crop diversity would make an impact to enhance level of living of marginal and small farmers who use to have the initial assets holdings at a lower level.

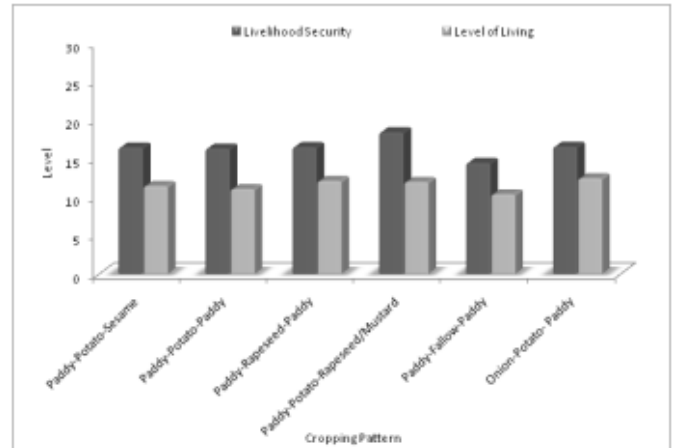


Fig. 1 Comparing overall livelihood security and level of living of the groups of farmers adopting different cropping patterns.

The present study suggested that crop diversity is one of the vital factors for livelihood security and have the potential to improve level of living of the farmers. Vyas (1996); Bhalla and Singh, (1997) reported that the phenomenon of crop diversification in India could be viewed as the survival needs of the farmers especially of the small and marginal ones. Ellis (2000) stated that livelihood diversification is an important survival strategy for rural households, wherein while agriculture plays an important role, households are looking for diverse opportunities to increase and stabilize their household incomes, hence enhancing their livelihoods. Ellis (2000) also indicated that rural livelihood diversification is defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living. FAO and World Bank (2001) stated that diversification is the single most important source of poverty reduction for small farmers in South and South East Asia. De and Chattopadhyay (2010) stated that marginal and small farmers play a positive role in crop diversification and that has been supported by the growth of various infrastructure networks during the period of three decades. They argued that the small and marginal farmers, depending on a small piece of land and having no alternative sources of employment, would always try to produce the maximum output on the given piece of land. They would also try to cultivate as many crops as possible and choose such commercial crops (e.g., *boro* paddy, oilseeds, potato, vegetables and fruits), which after meeting their consumption needs, would meet their minimum cash requirements for the maintenance of their daily life. Even the medium and large farmers approach diversification for the improvement of their living standard. Thus, the phenomenon of crop diversification in India could be viewed as the survival needs of the farmers

especially of the small and marginal ones.

CONCLUSION

The different cropping patterns being followed by the farmers at village level in Paschim Medinipur district showed the crop diversification towards non-paddy/ non-food grain crops like potato, sesame, rapeseed/mustard especially during *rabi* and summers season occupying 50 per cent of total gross cropped area in the region. Paddy-Potato-Sesame was found as predominant cropping pattern. The *boro*/summer paddy cultivation was still preferred by many farmers. The marginal and small farmers were able to enhance the overall farm output following the crop diversity ensuring better livelihood security and level of living. The crop diversification was found to be the effective survival and livelihood improvement strategy adopted by the marginal and small farmers.

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