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Crop Diversification and Minor Irrigation: A Comparative Analysis of Irrigated and Non-Irrigated Lands in Odisha

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Abstract: The present study an attempt is made to comparative study on crop diversification as practise by the irrigated and non-irrigated lands of the farmers in Odisha. The study based on primary survey in Keonjhar district of Odisha. For the measurement of agricultural diversification, Herfindahl Index and multiple regression model has been used. The cropping pattern as found out that paddy, being the staple food is cultivated in all regions both in irrigated and non-irrigated lands. It is observed that the share of paddy in gross cropped area is 90.81 per cent for irrigated lands and 96.87 per cent for non-irrigated lands. The regression results considering under study reveal that mostly seed, fertiliser, manures, irrigation charges and area under irrigation positively and significantly contribute towards crop diversification while non-irrigated lands there is crop concentrated comparatively. The coefficient of multiple determinations in respect of all the regions with irrigated lands being comparatively higher than that with non-irrigated lands.

Keywords: Cropping Pattern, Diversification, Irrigated Lands, Minor Irrigation, Non- irrigated Lands.

I. INTRODUCTION

The diversification of agriculture is an alternate way not only for the regeneration and conservation of land but also for enhancing its productivity (Dharmasena, P.B. and Jayawardena, S.N. 1996; Sharma, H.R. 2005; Bhattacharyya, B. 2008; De, U.K. and Chattopadhyay, 2010;). Moreover, it may result in conserving the most key resource that is water. Crop diversification means a shift from traditionally grown less remunerative crops to commercially grown more remunerative crops (Brenda, B.L. 2011). It depends on geo-climatic, socio-economic conditions and technological development in a region. It aims at improving soil health and to maintain dynamic equilibrium of the agro-ecosystem. Crop diversification is intended to promote technological innovations for

sustainable agriculture and enable farmers to choose crop alternatives for increased productivity and income (Mohanty, S. *et al.* 2013). In this chapter, an attempt is made to study the crop diversification as practise by the farmers in the study area.

II. METHODOLOGY

2.1. Sample Selection

Multistage sampling has been used with a pre-tested questionnaire. First Stage- Keonjhar district of Odisha state has been selected for the study. There are four MI sub divisions in Keonjhar district such as Keonjhar-1, Keonjhar-2, Telkoi and Champua. One MI sub-division namely Telkoi is selected randomly out of four. Under Telkoi MI sub-division there are two blocks i.e. Telkoi and Banspal having 11 MIPS spreading over 30 villages and 7 MIP spreading over 7 villages respectively. Second Stage- Three MIPs of Telkoi block namely, Sivanarayanpur, Hanumantia and Oriya having 1, 3 and 8 villages respectively and three MIPs of Banspal Block such as Kandadhar, Talajagar and Sundura covering one village each are selected randomly. One village from each selected MIP is randomly chosen for collection of data from the farmers. Thus, the villages chosen under Telkoi block are Goda, Dimiria and Oriya with total household of 300, 200 and 217 respectively. Similarly, the villages chosen under Banspal Block are Kadakala-II, Talajagar and Sundura, with 110, 120, and 210 and farm households respectively. Third Stage- Following stratified sampling method, the farm families in each village are divided into two groups such as households with irrigated land and non irrigated land. Households having 0.4042 hectares and above of land in each category constitute one stratum from which 35 farming households having irrigation facilities and 35 farming households not-having irrigation facilities from each village are selected randomly. Thus 210 numbers of farm households having irrigation facilities and 210 not having irrigation facilities have been selected for a comparative study. In total, the sample size happens to be 420.

2.2. Methods

Herfindahl Index

For the measurement of agricultural diversification, Herfindahl Index is used (Pal, S. and Kar, S. 2012; Oja, M.A. *et al.* 2014; Kumar, S., Gupta, S. and Shinde, S.E. *et.al.* 2015; Biswas, R.K. 2016; Ahmad, N. *et.al.* 2017; and Singh, K.M. *et.al.* 2018); which has the following formula.

$$HI = \sum_{i=1}^{n} p_i^2$$

Where, P_i = the proportion of area under *i*th type of crops in the Gross Cropped Area (GCA). It takes the value between 0 and 1, when HI=0, it indicates perfect diversification whereas HI=1, it indicates perfect concentration.

Multiple Regression Model

The determinations of crop diversification are analysed using the multiple regression model.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + U$$

Where,

Y = Herfindahl Index

X_1 = Seeds consumption per hectare of GCA (kg)

X_2 = Pesticides consumption (millilitres)

X_3 = Fertilisers consumption (kg)

X_4 = Quantity of Manures (Quintals)

X_5 = Irrigation Charges per hectare (Rs)

X_6 = Crop loans (in '000 Rupees)

X_7 = Irrigated Area and Non-Irrigated Area (Hectare)

U = Stochastic disturbance

III. RESULTS

3.1. Cropping Pattern

A number of crops are grown in kharif and rabi seasons in the six regions of the Keonjhar district taken up for the study. The crops considered are black gram, garlic, green gram, horse gram, maize, mustard, niger, paddy, potato, sunflowers, sweet potato, vegetables, wheat and yam in both irrigated and non-irrigated lands. To understand the cropping pattern in six villages covered in the study, the area under crop as a proportion of the gross cropped area (Patil, R.B., *et.al.* 2012 and Hanumant, M.P. and Karbhari, T. B. 2014) as practised by 420 respondents has been calculated and presented in Table-1. It is observed that paddy is the major crop and it is grown in all the six study regions. It covers an area of 90.79 per cent of GCA in irrigated lands and that is 96.88 per cent in rainfed areas. Paddy, being the staple food is grown in all the regions by each and every farmer. The next highest share in GCA is that of black gram followed by vegetables which are 21.75 per cent and 11.35 per cent respectively. In the case of mustard, the cropped area is 10.67 per cent of GCA followed by sunflowers, maize and green gram

which is 6.82, 6.29 and 4.53 per cent respectively in irrigated lands. Area under wheat, niger, garlic and horse gram constitute only 3.72, 3.65, 2.66 and 1.83 per cent of the GCA in the study regions for irrigated lands. In non-irrigated lands, only seven crops are grown such as paddy, maize, potato, vegetables, sweet potato, yam and sunflowers. Four crops are common in both types of lands i.e. paddy, maize, vegetables and sunflowers. The table reveals that the paddy has covered highest area as compared to the other crops that is 96.88 per cent of GCA, while the proportion of area covered by vegetables and potato are 19.86 and 9.33 per cent respectively. The proportion of area under sunflowers is 3.59 per cent followed by maize which is 2.59 per cent. Sweet potato has covered only 1.87 per cent of GCA in the study area. The area under yam is only 1.85 per cent of GCA as shown in the table 1.

Table 1: Area under Different Crops as Proportion of GCA

(in Percentage)

Sl. No.	*Crop Name*	*Irrigated Lands*	*Non-Irrigated Lands*
1	Black Gram	21.75	-
2	Garlic	2.66	-
3	Green Gram	4.53	-
4	Horse Gram	1.83	-
5	Maize	6.29	2.59
6	Mustard	10.67	-
7	Niger	3.65	-
8	Paddy	90.67	96.88
9	Potato	-	9.33
10	Sunflower	6.82	3.59
11	Sweet Potato	-	1.87
12	Vegetables	11.35	19.86
13	Wheat	3.72	-
14	Yam	-	1.85

Source: Authors' Calculation

3.2. Region Wise Crop Diversification in Keonjhar District

This section presents the region wise crop diversification as shown by HI index estimated for them. The result shows that there is a stack variation in the crop diversification in the study area both in irrigated and non-irrigated lands. Table-2 and table-3 show the results for irrigated and non-irrigated lands. While in the Region-1 (0.564), Region-4 (0.586), Region-2 (0.588) and Region-6 (0.596) there is high level of crop diversification,

for region-3 and region-5 the HI values are 0.716 and 0.721 respectively reflect the values of HI move in a narrow range showing very less diversification. For non-irrigated lands, there is a very low level of crop diversification in the study area but the level of diversification varies across regions. Region-1, Region-4 and Region-5, the HI value are greater than 0.8 reflects minuscule crop diversification as compared to the Region-2, Region-6 and Region-3 with HI values of 0.717, 0.725 and 0.752 respectively. Therefore, it can be construed that in non-irrigated lands there is crop concentrated comparatively.

Table 2: Region-wise Crop Diversification in Irrigated Lands

Regions	P_1^2	P_2^2	P_3^2	P_4^2	P_5^2	P_6^2	P_7^2	P_8^2	P_9^2	P_{10}^2	P_{11}^2	ΣP_i^2
Region-1	0.047	0.027	-	-	-	0.014	-	0.415	0.043	0.018	-	0.564
Region-2	0.059	-	0.038	-	-	-	-	0.499	-	0.022	-	0.588
Region-3	-	-	0.035	0.032	-	-	-	0.601	-	0.048	-	0.716
Region-4	-	-	-	-	0.045	0.032	0.048	0.409	-	-	0.052	0.586
Region-5	0.043	-	-	-	-	0.066	-	0.612	-	-	-	0.721
Region-6	0.072	-	-	-	0.053	-	-	0.402	0.069	-	-	0.596

Source: Authors' Calculation

P_i=Area under Crop/Gross Cropped Area

Note: P_1- Black gram, P_2- Garlic, P_3-Green Gram, P_4-Horse Gram, P_5-Maize, P_6-Mustard, P_7- Niger, P_8-Paddy, P_9- Sunflower, P_{10}- Vegetables and P_{11}-Wheat.

Table 3: Region-wise Crop Diversification in Non-Irrigated Lands

Regions	P_1^2	P_2^2	P_3^2	P_4^2	P_5^2	P_6^2	P_7^2	ΣP_i^2
Region-1	-	0.9188	-	-	-	-	-	0.918
Region-2	0.041	0.619	0.057	-	-	-	-	0.717
Region-3	-	0.623	-	0.061	0.068	-	-	0.752
Region-4	-	0.790	-	0.089	-	-	-	0.879
Region-5	-	0.699	-	0.076	-	0.067	-	0.842
Region-6	-	0.610	-	0.055	-	-	0.060	0.725

Source: Authors' Calculation

P_i=Area under Crop/Gross Cropped Area

Note: P_1- Maize, P_2- Paddy, P_3- Potato, P_4-Vegetables, P_5-Sweet Potato, P_6-Yam, P_7-Sunflower

3.3. Factors Influencing Crop Diversification

Crop diversification is generally possible when the conditions required for growing various crops exist. The required conditions include suitable soil, moisture and climatic

conditions, water resources, use of seeds, fertilizers and pesticides, agricultural equipments, availability of finance, insurance provisions and facilities for marketing of the produce. These are the factors of crop diversification and it is found that the significant factors influencing crop diversification are seeds consumption, pesticides consumption, fertilizer consumption, the quantity of manures, irrigation charges, crop loan, the proportion of irrigated area and non-irrigated areas.

The estimated value of the parameters of the regression for irrigated lands covering six regions is presented in tables 4. For region-1, seeds consumption, fertilizers consumption, irrigation charges and proportion of irrigated area have positive impact on the crop diversification and it is significant at 5 per cent level of significance. The coefficients of quantity of manures and crop loans having 0.52 and 0.35 are significant at 10 per cent level significance. Pesticides contribute positively but not substantially while in the region-2 indicates that the coefficient of irrigated areas (0.69) is significant at 1 per cent level of significance establish positive relationship between irrigation and diversification. The coefficients of seed consumption and irrigation charges are significant at 5 per cent level of significance encouraging crop diversification in the region. The fertilizer consumption, quantity of manures and crop loan used are also having a significant positive influence on crop diversification. The result found that their coefficients are significant at 10 per cent level of probability. In region-3, Quantities of manures, irrigation charges and proportion of irrigated area have positive effect on the crop diversification and it is statistically significant at 1 per cent level of significance. The coefficient of seeds consumption has a negative impact on crop diversification but it is statistically significant. On the other hand, fertilizer consumption has a positive effect on crop diversification and its coefficient (0.651) is statistical significance at the 5 per cent level of importance. Other factors are pesticides consumptions, the quantity of manures and crop loan have positive impact on diversification but that is not statistically significant. In Region-4, it is observed that fertilizer consumption, quantity of manures and proportion of irrigated areas have positive influence on crop diversification and it is statistically significant at 5 per cent level of significance. The coefficients of seeds consumption and irrigation charges are found to be statistically significant at 10 per cent level and positively influence crop diversification. The factors having negative impacts on crop diversification are pesticides consumption and crop loans and its coefficients are statistically insignificant. In Region-5 representing that the coefficient of seeds consumption (0.550) is statistically significant at 1 per cent level and positively influence diversification. Fertiliser consumption, irrigation charges and proportions of irrigated areas have coefficients statistically significant at 5 per cent level of significance with positive impact on diversification. It is noticed that the coefficient of pesticides consumption, quantity of manures and crop loan has positive

Table 4: Factors Influencing Crop Diversification in Irrigated Lands

Name of Regions	X_1	X_2	X_3	X_4	X_5	X_6	X_7	R^2
Region-1								
Coefficient	0.55	0.26	0.62	0.52	0.64	0.35	0.43	
SE	0.26	0.19	0.27	0.28	0.30	0.20	0.22	0.8558
t value	2.06**	1.37	2.26**	1.83*	2.15**	1.75*	1.97**	
p value	0.02	0.20	0.03	0.08	0.04	0.07	0.04	
Region-2								
Coefficient	0.67	0.34	0.59	0.54	0.60	0.31	0.69	
SE	0.32	0.26	0.31	0.28	0.30	0.16	0.25	0.7696
t value	2.11**	1.33	1.90*	1.88*	2.01**	1.91*	2.69***	
p value	0.03	0.41	0.07	0.08	0.04	0.08	0.00	
Region-3								
Coefficient	-0.79	0.13	0.65	0.80	0.51	0.24	0.74	
SE	0.36	0.36	0.29	0.26	0.18	0.21	0.27	0.7701
t value	-2.17**	0.36	2.18**	3.00***	2.76***	1.15	2.70***	
p value	0.03	0.16	0.03	0.00	0.00	0.73	0.00	
Region-4								
Coefficient	0.66	-0.56	0.60	0.69	0.55	-0.43	0.54	
SE	0.34	0.41	0.28	0.33	0.28	0.29	0.22	0.6578
t value	1.92*	-1.36	2.14**	2.08**	1.93*	-1.45	2.39**	
p value	0.07	0.43	0.02	0.04	0.07	0.32	0.02	
Region-5								
Coefficient	0.55	0.31	0.31	0.46	0.55	0.50	0.67	
SE	0.19	0.22	0.15	0.32	0.27	0.37	0.31	0.7733
t value	2.83***	1.40	2.05**	1.45	2.02**	1.34	2.15**	
p value	0.00	0.32	0.04	0.35	0.02	0.40	0.02	
Region-6								
Coefficient	0.80	0.21	0.53	0.49	0.61	0.03	0.52	
SE	0.40	0.14	0.21	0.17	0.31	0.07	0.18	0.8303
t value	2.00**	1.47	2.48***	2.43***	1.93*	0.41	2.90**	
p value	0.03	0.11	0.00	0.00	0.08	0.89	0.01	

Source: Authors' Calculation

Note: *** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level.

influence on crop diversification but statistically insignificant. In Region-6 the coefficient of fertilizer consumption (0.539) and quantity of manures (0.491) are statistically significant at 1 per cent level of probability and have positive influence on crop diversification. The proportion of irrigated areas and irrigation charges significantly influence crop diversification and their coefficients are 5 and 10 per cent level of significance respectively. Seeds consumption has also significant and have positive influence on crop diversification while pesticides consumption and crop loans have insignificant but positive impact.

Table- 5 presents the estimated value of the regression parameters for non-irrigated lands in six regions of Keonjhar district. For region-1, it is found that the coefficient of fertilizer consumption and proportion of rainfed area has a positive impact on crop diversification and statistically significant at 1 per cent level. The coefficient of quantity of manures has a positive effect and it is statistically significant at the 10 per cent level of significance. Seeds consumption has a negative effect on crop diversification and its coefficient is statistically significant the 10 per cent level. While the coefficients of consumption of pesticides and crop loans have positive impact on crop diversification, it is found to be statistically insignificant. In region-2 the coefficient of proportion of non-irrigated area (0.54) shows significant and positive impact on crop diversification. Pesticide consumption is statistically significant at 10 per cent level of significance and its coefficient is negative. Seed consumption, fertiliser consumption and the quantity of manures have positive influence on crop diversification but statistically insignificant. Crop loan also has positive influence on crop diversification but it is insignificant statistically. In Region-3 the coefficients of seeds and pesticide consumption are positive and statistically significant at 1 and 5 per cent level of significance respectively. The coefficient of fertilizer consumption (0.41), the quantity of manures (0.34) and proportion of non-irrigated areas (0.54) show a significantly positive influence on crop diversification. Crop loans have positive effect on crop diversification but it is insignificant influencing crop diversification. For Region-4 it is observed that the coefficient of seeds consumption (0.48) and fertilizer consumption (0.44) are found to be statistically significant at 10 per cent level and reflect positive impact on crop diversification. The coefficients of quantity of manures (0.58) and proportion of non-irrigated area (0.74) have positive influence on crop diversification and statistically significant at 5 and 1 per cent level of probability. Pesticides consumption and crop loans have exerted a positive impact but do not play a significant role in crop diversification. For Region-5, impact of pesticides consumption and proportion of non-irrigated area are found to be statistically significant at 10 and 1 per cent level of significance and positive impact on crop diversification in the study region. While fertilizers consumption negatively influence crop diversification and has statistically significant at 5 per cent level. The

regression coefficient of seeds consumption, manures and crop loans are insignificant but positively influence the crops. The model estimated for non-irrigated land in Region-6 reveals that the coefficient of fertilizer consumption (0.53) and proportion of non-irrigated areas (0.36) have positive influence on crop diversification and statistically significant at 5 per cent level of significance. Seeds consumption and pesticides

Table 5: Factors Influencing Crop Diversification in Non-Irrigated Lands

Name of Regions	X_1	X_2	X_3	X_4	X_5	X_6	R^2
Region-1							
Coefficient	-0.60	0.30	0.88	0.61	0.34	0.32	
SE	0.30	0.41	0.34	0.31	0.26	0.10	0.7018
t value	-1.97*	1.25	2.59***	1.76*	1.27	2.98***	
p value	0.04	0.11	0.00	0.09	0.63	0.00	
Region-2							
Coefficient	0.21	-0.49	0.48	0.67	0.26	0.54	
SE	0.11	0.28	0.14	0.19	0.17	0.26	0.7241
t value	1.92*	-1.75*	3.31***	3.45***	1.52	2.01**	
p value	0.08	0.06	0.00	0.00	0.21	0.03	
Region-3							
Coefficient	0.46	0.62	0.41	0.34	0.15	0.54	
SE	0.11	0.31	0.23	0.18	0.10	0.28	0.6438
t value	3.89***	2.00**	1.76*	1.82*	1.42	1.93*	
p value	0.00	0.03	0.07	0.07	0.39	0.06	
Region-4							
Coefficient	0.48	0.19	0.44	0.58	2.68	0.74	
SE	0.26	0.27	0.23	0.24	3.12	0.22	0.6029
t value	1.83*	0.69	1.92*	2.39**	0.85	3.36***	
p value	0.06	0.76	0.06	0.04	0.78	0.00	
Region-5							
Coefficient	0.61	0.38	-0.48	0.82	0.37	0.44	
SE	0.51	0.21	0.23	0.65	0.41	0.17	0.5819
t value	1.19	1.77*	-2.07**	1.24	0.90	2.53***	
p value	0.21	0.09	0.04	0.27	0.66	0.00	
Region-6							
Coefficient	0.34	0.35	0.53	-0.68	0.24	0.36	
SE	0.19	0.18	0.21	0.30	0.18	0.15	0.6970
t value	1.68*	1.92*	2.45**	-2.23**	1.31	2.42**	
p value	0.09	0.08	0.02	0.01	0.17	0.01	

Source: Authors' Calculation,

Note: *** Significant at 1 per cent level, ** Significant at 5 per cent level, * Significant at 10 per cent level.

consumption are significant at 10 per cent level of significance. The coefficient of the quantity of manures (-0.68) is negative and it has a significant effect on crop diversification.

IV. DISCUSSION

4.1. Reasons behind Low Crop Diversification: Farmers' Views

In this section table-6 presents the farmer's views on reasons behind the crop concentration in the study regions across irrigated and non-irrigated lands. These reasons include natural calamities, lack of market and storage facilities, lower level of awareness, fragmentation of the land holding, lack of farm mechanization, lack of proper distribution of irrigation water, erratic rainfall, lack of knowledge about input use, following their ancestors, labour availability, soil fertility, shifting to other profession and borrowing. 21.42 per cent of the farmers think that occurrence of natural calamities and consequent crop losses are the reasons behind low crop diversification. 42.85 per cent and 53.33 per cent of the sample respondents having irrigated and non-irrigated lands respectively expressed that they are facing marketing problems. Farmers have weak bargaining power because of illiteracy and lack of knowledge about marketing facilities and also non-availability of warehouse and go downs. 46.66 per cent and 74.28 per cent of the farmers do not have knowledge about crop insurance facilities. So they are afraid of diversifying crops as to avoid the risk. Fragmentation of land holdings is another reason behind the crop concentration as expressed by farmers in the study region. When land holdings and land parcels are fragmented, they get gradually smaller and disperse widely. 42.38 per cent of the farmers view is that crop concentration is due to the fragmentation of land holdings for rainfed areas.19.04 per cent of farmers in the irrigated regions support this view. Out of these all plausible reasons the strongest reason for crop concentration is absence of farm mechanization as opined by 88.33 per cent of farmers of non-irrigated lands and 57.14 per cent of farmers with irrigated lands. Poor farmers cannot afford modern equipments like the thresher, plough machine and rotary tillers. 49.52 per cent and 61.90 per cent of the farmers of both types of lands respectively express that they lack necessary infrastructure facilities like roads, power, transport and communications. In study regions, village roads are not adequately connected with main market centres. Under these circumstances, the farmers cannot carry their produce to the main market and are forced to sale it in the local market at a low price. This discourages crop diversification. 9.52 per cent of the farmers express that absence of proper distribution mechanism of irrigation water is one of the reasons behind the crop concentration. Most of the farmers in the study regions are small and marginal farmers. Some areas are affected by salinity and water logging due to faulty

irrigation. When there is deficient rainfall or fluctuation in rainfall there is and reduction in yield is the result. 36.66 per cent of the sample farmers (for non-irrigated lands) reported that the decrease in the rainfall is the primary reason for crop failure and low agricultural productivity level for which they are not much interested in crop diversification. Seeds, fertilizers and manures play a crucial role in agricultural production. These inputs are costly and the farmers are not able to purchase due to poor financial conditions. 57.14 per cent of farmers for non-irrigated lands and 46.19 per cent respondents from irrigated lands expressed that they do not have any idea about appropriate quantities of inputs they should use for different crops and that is the reason behind the crop concentration. About 56.66 and 68.09 per cent of the sample respondents of irrigated and non-irrigated lands respectively expressed that they follow their ancestors in both the lands regarding the technique of cultivation. Thus they concentre mostly on paddy cultivation for their livelihood with minuscule intervention for commercial crops like pulses, oilseeds and other high- value crops including sugarcane, fruits and vegetables. Nearly 37.61 per cent of the sample farmers in irrigated areas and 42.38 per cent of the respondents in non-irrigated lands told that it is the scarcity of labour that accounts for low crop diversification. It may be due to easy food obtained through PDS. 35.23 per cent (irrigated lands) and 58.57 per cent (for non-irrigated lands) of the farmers expressed that due to soil erosion, fertile lands are getting

Table 6: Farmers Views on Reasons behind Low Crop Diversification in Study Area

Sl. No.	*Reasons*	*Irrigated Lands (%)*	*Non-Irrigated lands (%)*
1	Visit of natural calamities, Drought and Cyclone	-	21.42
2	Lack of marketing and storage facilities	42.85	53.33
3	Lower awareness about crop insurance	46.66	74.28
4	Fragmentation of land holdings	19.04	42.38
5	Lack of farm mechanization	57.14	83.33
6	Poor basic infrastructures	49.52	61.90
7	Lacking of Proper Distribution of Irrigation water	9.52	-
8	Erratic Rainfall	-	36.66
9	Lacking Knowledge of Inputs use	46.19	57.14
10	Followed their Ancestors	56.66	68.09
11	Lacking labour availability	37.61	42.38
12	Soil fertility and erosion	35.23	58.57
13	Shifting to other profession	31.42	15.71
14	Borrowing	52.85	76.19

Source: Authors' Calculation

degraded by wind and water and it becomes unsuitable for cultivation. They do not have enough knowledge towards soil conservation methods. This reduces land productivity therefore they are not interested in crop diversification much. People are not much interested to go for manual labour. Around 31.42 per cent of farmers with irrigated lands opined that farming is no more an attractive occupation. The educated masses of present generation are shifting to the profession other than agriculture. Same is the opinion of 15.71 per cent of farmers with non-irrigated lands. Farmers are having low access to institutional credit forces them to fall prey to money lenders and prefer to concentrate on paddy production is the opinion of 76.19 per cent farmers in non-irrigated and 52.85 per cent of irrigated lands respectively.

4.2. Price Disadvantages

Farmers of the study area usually sale their farm products in door to door basis, village market, local market and regulated markets (LAMPS). The numbers of crops cultivated and grown are higher in the irrigated land as compared to that of non-irrigated areas. The farmers with irrigated lands sale their products mostly in village markets and few in local markets, whereas in case of the door to door and regulated market, the sale of crops is very minimal. Same is picture in case of non-irrigated lands. Table-7 reflects the price disadvantages faced by farmers while selling the paddy, sunflower, green gram and maize crops in at the door step, local markets and village markets. The minimum support price for green gram is higher as compared to other crops followed by sunflower crop. As per price of door to door sale is concerned, the information is only available for paddy (MSP-Rs. 1470 and PDD- Rs. 800), where they face the disadvantage of Rs.670. The farmers face disadvantages across different kind of crops; the price disadvantage is much higher for the green gram and sunflower crop both in the local market (Rs. 1885 and Rs.1060) and village market (Rs. 2105 and Rs. 1720). The price disadvantage is much higher in the village market as compared to the local market. It is found that the farmers in the study area face a price disadvantage. It indicates that the

Table 7: Price Disadvantages Faced by farmers (in Rupees/Quintals)

Crop Name	*MSP*	*Price door to door*	*Disadvantages*	*Price in Local market*	*Disadvantages*	*Price in the Village market*	*Disadvantages*
Paddy	1470	800	-670	1430	-40	1330	-140
Sunflowers	3950	-	-	2890	-1060	2230	-1720
Green Gram	5225	-	-	3340	-1885	3120	-2105
Maize	1365	-	-	1000	-365	950	-415

Source: Field Survey and MSP (2017-18)

actual price in different markets is less than the minimum support price. This might be discouraging crop diversification.

V. CONCLUSION

Based on the empirical evidences, the following recommendations are suggested to promote crop diversification in the 6 regions such as provision of storing and marketing facilities, right price for the agricultural product may encourage people to adopt multiple cropping and crop diversification on a commercial basis so that the irrigation potential created shall be utilised and also the economic status of farmers will improve. This will prove farming a profitable business and attract people towards agriculture as an occupation. Farmers need to be trained on the right selection of crops and seeds, soil testing, right combination of inputs and practice of crop rotation by agriculturists and extension workers so that production can be increased. The soil will benefit because crop rotation is a proven management technique. Care need be taken so that the direct benefits from diversification should reach the marginal and small farmers. Kisan cards and Green cards have to be judiciously distributed to the people below poverty line. NGOs and Panchayati Raj Institutions may be involved in creating awareness among the farmers regarding the commercialisation of farming and availability of different government schemes for the purpose and benefits of crop diversification. Mechanization of farming, creating awareness among farmers regarding crop insurance, provision of crop loans and proper distribution of irrigation water can help the farmers a lot.

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References

Ahmad, N., Singh, K.M., Sinha, D., and Kumar, A., (2017). 'Determinants of Crop Diversification in Bihar Agriculture: An Economic Analysis', *Environment & Ecology*, 35, 3683-3687.

Bhattacharyya, B., (2008). 'Crop Diversification: A Search for an Alternative Income of the Farmers in the State of West Bengal in India', *International Conference on Applied Economics*, 88-94.

Biswas, R.K., (2016). 'An Economic Analysis of Crop Diversification under Inorganic and Organic Farming in West Bengal', *International Journal of Bio-resource Science*, 3 (1), 25-30.

De, U.K. and Chattopadhyay, M., (2010). 'Crop Diversification by Poor Peasants and Role of Infrastructure: Evidence from West Bengal', *Journal of Development and Agricultural Economics*, 2(10), 340-350.

Dharmasena, P.B., (1996). 'Planning Strategies for Crop Diversification in Minor Irrigation Schemes', *International Irrigation Management Institute* held at the Irrigation Department, Colombo, Sri Lanka 20 February, 31.51.

Hanumant, M.P., and Karbhari, T.B., (2014). 'Demands of Changes in Cropping Pattern: A Case Study of Akole Tahasil (M.S., India)', *International Journal of Science and Research*, 3 (5), 1314-1319.

Jayawardena, S.N., (1996). 'Socio-Economic Constraints and Future Prospects for Crop Diversification in Minor Irrigation Schemes', *International Irrigation Management Institute* held at the Irrigation Department, Colombo, Sri Lanka 20 February, 53-66.

Kumar, S., and Gupta, S., (2015). 'Crop Diversification towards High Value Crops in India: A State Level Empirical Analysis', *Agricultural Economics Research Review*, 28 (2), 339-350.

Oja, M.A., Ojo, A.O., Odine, A.I., and Ogaji., A., (2014). 'Determinants of Crop Diversification among Small- Scale Food Crop Farmers in North Cental, Nigeria', *Production, Agriculture and Technology*, 10 (2), 1-11.

Pal, S., and Kar, S., (2012). 'Implications of the Methods of Agricultural Diversification in Reference with Malda District: Drawback and Rationale', *International Journal of Food,, Agriculture and Veterinary Sciences*, 2(2), 97-105.

Patil, R.B., Patil, A.B., and Shinde, S., (2012). 'Impact of Water Percolation Tank on Changing Cropping Pattern: A Case Study of Rampur Villages', *International Interdisciplinary Research Journal*, II (VI), 94-103.

Sharma, H.R., (2005). 'Agricultural Development and Crop Diversification in Himachal Pradesh: Understanding the Patterns, Processes, Determinants and Lessons', *Indian Journal of Agricultural Economics*, 60(1), 71-93.