Eco. Env. & Cons. 26 (February Suppl. Issue) : 2020; pp. (S177-S182)

ISSN 0971–765X

De-stunting growth of crop diversification Index: A case study from Malda District, India

Hasibur Rahaman* and Surendra Singh**

Department of Geography, A.M.U, Aligarh 202 002, U.P., India
***** ICAR- National Institute of Agricultural Economics and Policy Research, PUSA, New Delhi 110 012, India***

(Received 10 October, 2019; accepted 15 November, 2019)

ABSTRACT

Crop diversification not simply means growing multiple crops rather it offers income, generate employment, augment and maintain natural resources symbiotic over space. Since, diversification is a continuous process and it may change over time and space therefore it is necessary to carry out such study for different regions. The aim of the study is to analyze the nature and extent of crop diversification at block level across land size classes. The study is conducted on Malda district of West Bengal based on secondary data of 1995-96 and 2015-16 collected from Agricultural Census. Gibbs-Martin diversification technique has used to calculate diversification index. The study found increasing trends of diversification in different blocks on quinquennial years. The pace of diversification is higher under marginal land size class. The study felts the importance of capacity building and training programs of farmers to realize increasing menace of fast growing diversification on natural resources of agriculture.

Key words : *Crop diversification index, Gibbs-martin index, Natural resource management, Agriculture, India*

Introduction

Crop diversification may be defined as a change in product choice of input based market forces and the principle of profit maximization (*Pingali and Rosegrant, 1995*). This means that diversifying agriculture would move to areas where production is most efficient which leads to a diversity of the enterprise with co-existence of multiple agricultural enterprises including crop, livestock, fisheries, farm forestry, and horticulture. In this context, Vyas (1996) defined crop diversification as a shift from less profitable enterprises to more profitable enterprises which is based on the farmer's response to price signals according to their efforts to adjust and changes in the market. He justified agricultural diversification because it (i) leads to greater income generation along with stabilization of income over the seasons, (ii) helps to attain much fuller employment level by the farm households, and (iii) helps conservation and enhancement of natural resources.

Crop diversification is also considered a strategy to stabilize and enhance income, increase employment, minimize risk and uncertainties, improve food security and preserve and augment natural resources which ultimately leads to the development of the agricultural sector as a whole. A micro-level study by *Bala and Sharma* (2005) in the Kullu district of Himachal Pradesh round that the introduction of vegetables as part of a crop diversification programme has raised the living standards of the farmers of this area. Another study by Chand (1996) also revealed similar findings in the Western Himalayan region. It also pointed out that (a) the

marginal and small farmers participated in the diversification of crops without adversely affecting their food grain production (b) it is not the farm size but infrastructure like access to motorable road, market and irrigation which determine the extent, success and profitability of diversification.

Acharya (2006) made an attempt to bring out the linkages between crop diversification and household food security. He argued that with an increase in crop versification the pattern of consumption shifted in favour of nutritive foods like vegetables, fruits, milk and milk products. Another study by *Satyasai and Viswanathan* 1996) showed that superior cereals replaced coarse cereals among food grain crops. It is also observed that diversification was less in the livestock sector which specialized towards milk production. These developments appear to have resulted from programmes like Oilseeds Technology Mission and Operation Flood and showed that food security is not endangered, but only strengthened. *Dhawan et al.,* (1996) examined the possibility of diversification of Indian agriculture from the point of view of food security. They showed that there is no scope to diversify agriculture away from cereals unless we control India's human and animal population. In this context, a state-wise study entitled, "Crop Diversification and Food Security" by *Sharma et al.,* (1996) showed that the percentage of area under cereals has been decreasing and that there is substantial scope for increasing the degree of diversification without adversely affecting food security for the nation as a whole. *Sharma et al.,* (1996) in their study for Rajasthan argued that the changes in cropping pattern in favour of remunerative crops did not affect food security as there is enough scope to increase the cropped area. Bamji (2000) showed that agricultural diversification within food grains (millets, legumes besides cereals) between food grains, and in horticulture (fruits and vegetables) and livestock products, is essential for household food and nutrition security.

The available literature also suggests that crop diversification minimizes risk due to crop failure. Some important macro level as well as micro level studies pertaining to risk minimization exist (Agarwal, 2004; Singh *et al.,* 1985; Mani and Varadarajan 1985; Pope and Prescott, 1980 and Kumar *et al.,* 2002].

A wide range of empirical studies are available on the determinants of crop diversification Kumar and Mathur (1996) showed that besides changes in incomes and prices, changes in supply conditions brought major shifts in the consumption of milk, fruits, vegetables and livestock products in both rural and urban areas. Empirical estimates supported the hypothesis that structural changes in production can have a large influence on food demand patterns, in the long run. Sharma (2005) in his study made an attempt to understand the patterns, processes and factors that facilitated agricultural development and crop diversification in the state of Himachal Pradesh. He found that the horticulture sector registered a significant increase in terms of area and production of fruits. A study by Birthal *et al.,* (2006) examined the status of agricultural diversication and its role in speeding up agricultural growth for the north-eastern region of India. They found that lack of infrastructure and markets is an important impediment to releasing the potential of high—value agriculture in the region. This study suggested greater investment in roads and transportation, and development of innovative market institutions like co-operatives, quality inputs, technology and credit. Moreover, the study by Singh *et al.,* (2006) identied the pattern and determinants of diversication across states/crops in India. The diversication Index has been found to range from 0.47 (West Bengal) to 0.90 (Karnataka) in 1990-91 and from 0.40 (Orissa) to 0.92 (Karnataka) in 2000-01. The increase in the diversication index signied shift towards non-food crops. They further identified the coefficients, which indicated that the presence of electricity and road density is negatively associated with the diversification.

It is evident from the above studies that crop diversification may raise farm income, and create employment opportunities in the rural sector. However, there are conflicting views regarding its effect on food security. The studies also indicate that infrastructure, technology, resource endowments (water and labour) and socio-economic variables (pressure on land and literacy rate) may be influencing the diversification process. While judging these findings it may be noted that these studies are done in various micro-locations in the country or at the district or state levels using either primary household data or secondary data relating to different time periods. Since diversification is a continuing process and may change over time and across space, it is necessary to carry out such studies for different regions of the country using both aggregated data as

well as disaggregated data.

Therefore, the present study is carried out in this broader framework in the Malda district of West Bengal. It may be noted that there exists hardly any study on this subject for this state. Objectively, this study analyses the trends and patterns of crop diversification across land size categories at the block level in the district.

Materials and Methods

Study Area

Malda district of West Bengal was chosen as a study area because of; it was one of thirtieth districts selected for crop diversification enhancement by Indian Council of Agricultural Research (ICAR) after the recommendation of Swaminathan committee (2004-06). The present study is concerned to assess the impact of crop diversification program which ran in the district from 2005-06 to 2012-13.

The district spread over an area of 3733 sq.km with a population of 3988845 persons in 2011. The district of Malda covers 4.7 percent of the total area of the state and is home to 4.1 percent of the total state population. It is located between 24°4020 and 25°328 N latitudes and 87°4550 to 88°2810 E longitudes. Physio-graphically, three sub-regions can be defined within Malda district. The region of mature alluvium that had given North Bengal its old historical name as Barind which cover Manikchak, Kaliachak 1, 2 and 3 and English Bazar blocks.The Diara is a relatively well-drained flatland formed by the alluvial deposition of newer alluvium in the transitional zone between the upland and the marshy Tal track. It includes the blocks like Englishbazar, Manikchak, Kaliachak-I, Kaliachak-II and Kaliachak-III. The Tal is another region spotted with innumerable marshes, beels and oxbow lakes. Most of Tal track remains submerged under the considerable depth of water during the monsoon rains that includes Ratua-I, Ratua-II, Chanchal-I, Chanchal-II, Harishchandrapur-I and Harishchandrapur-II blocks.

Data sources and Estimation Method

The present work is mainly based on secondary data sources from Agriculture Census of India.

Since, the date of 2015-16 is not published yet therefore, data of 2015-16 Agriculture Census is extrapolated. For extrapolation, data of 2005-06 and 2010-11 Agricultural Census is interpolated first, and then an average of last three years were taken as the data for 2015-16.

$$\text{Interpolation} = \frac{\text{Base year data} + (\text{Recent year data} - \text{Base year data}}{\text{Number years (here Five)}}$$

Here for Agriculture Census data, the base is 2005-06 and the recent year is 2010-11.

In the present study, Gibbs-Martin and Simpson Index has been used because of nature of data.Gibbs-Martin technique used to calculate diversification on the areal extent of crops which required continuous data while homogeneity of diversification is calculated through the Simpson's Index on discrete data.

$$\text{Gibbs and Martin's Technique} = 1 - \frac{\Sigma X^2}{(\Sigma X)^2}$$

Here, X is the percentage of area occupy by an individual crop at a point of time. His index value ranges from 0 to 1. Higher is the index value, higher would be the diversity and vice versa. This technique actually helps us to understand the magnitude of diversification.

Results and Discussion

Table 1 reveals that crop diversification index in the district has been increasing over time. In the last twenty years, there is increased of 0.162 index value which suggest district is moving toward diversification of crops. The pace of changes in index value is higher from 2000-01 to 2005-06, and it is least in 1995-96 to 2000-01. Though there is again increased in index value from 2005-06 to 2010-11 and 2010-11 to 2015-16 but the pace of increased is slow as compared to 2000-01 to 2005-06 presumably, it is because of shift in cropping pattern from food crops to non-food crops.

In 1995-96, the maximum number of crops was grown in Manikchak block which reflects in diversification index. Five blocks namely Kaliachak-I, II and III, Manikchak and Ratua-Iwere having more than 0.700 index value signify that the maximum number of crops were grown over the years. In same year, block like Habibpur which is in the last ladder of diversification indexassume an increased from one to two crops. Bamangola, Gazole, Harishchandrapur-II have medium index value from 0.500 to 0.800. Old Malda and Ratua-II were

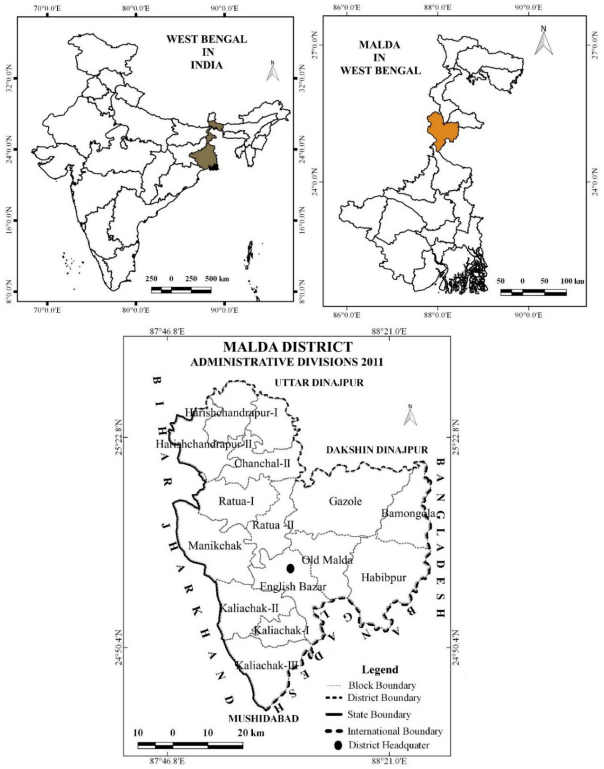

Fig. 1. Location of the Study Area
Source: Author's mapping

having an index value of less than 0.400.

In 2000-2001, three blocks namely Kaliachak-I, II and III were having maximum diversification index that is more than 0.800 meaning by the maximum number of crops were grown over the year. English Bazar, Manikchak, Gazole, and Ratua-II range diversification index from 0.500 to 0.800; hence, they are categorized as medium crop diversified blocks. Bamangola, Chanchal-I, II, Habibpur, Harishchandrapur-I, II and Old Malda were having less than 0.500 index value.

In 2005-2006 again Manikchak block has recorded high diversification followed by Kaliachak-I, II, and Ratua-I. Chanchal-I, II, English Bazar, Harishchandrapur-I, II, Kaliachak-II, Ratua-I scored more than 0.500 index meaning thereby moderate diversification index. In same year Old Malda was the least diversified block in the district.

In 2010-11 Kaliachak-I, II, Manikchak, English Bazar, Chanchal-II, Ratua-I have found more than 0.700 index value. This year again Old Malda is in the bottom of the ranking. In 2015-16, five blocks namely Kaliachak-I, II, Manikchak, Ratua-I, and II reports more than 0.800 index value. Chanchal-I, English Bazar, Kaliachak-III finds moderate diversification index between 0.500 to 0.800.

The common pattern evolves out from Table 1 is that the Old Malda, and Habibpur blocks are consistently having lower diversification index meaning thereby there is a smaller number of crops grown from1995-96 to 2015-16. Maximum gain in diversity index is concerned the Chanchal-II, English Bazar and Ratua-II are in the list. In the overall scenario, three blocks namely Manikchak, Kaliachak-II, III, and Ratua - I are very consistent in crop diversification index.

Table 1. Trends of Gibbs-Martin Crop Diversification Index in Malda District

Blocks	1995-96	2000-01	2005-06	2010-11	2015-16
Bamangola	0.446	0.364	0.425	0.512	0.572
Chanchal-I	0.542	0.449	0.652	0.631	0.692
Chanchal-II	0.514	0.239	0.635	0.740	0.760
Englishbazar	0.643	0.732	0.656	0.760	0.791
Gazole	0.472	0.560	0.478	0.586	0.687
Habibpur	0.308	0.296	0.389	0.428	0.491
Harishchandrapur-I	0.431	0.469	0.677	0.497	0.578
Harishchandrapur-II	0.512	0.251	0.530	0.498	0.520
Kaliachak-I	0.735	0.802	0.856	0.854	0.809
Kaliachak-II	0.761	0.801	0.770	0.797	0.817
Kaliachak-III	0.807	0.831	0.806	0.682	0.727
Manikchak	0.825	0.738	0.865	0.805	0.812
Old Malda	0.359	0.473	0.163	0.212	0.284
Ratua-I	0.764	0.662	0.789	0.783	0.805
Ratua-II	0.365	0.500	0.737	0.692	0.814
District	0.584	0.598	0.683	0.710	0.746

Source: Computed by authors

Table 2. Trends in Gibbs-Martin Crop Diversification Index by Land Size Category in Malda District

Land Size Class	1995-96	2000-01	2005-06	2010-11	2015-16
Marginal	0.600	0.634	0.650	0.726	0.759
Small	0.544	0.568	0.596	0.695	0.718
Semi-medium	0.549	0.581	0.617	0.640	0.621
Medium	0.589	0.583	0.626	0.561	0.541
Large	0.196	0.273	0.331	0.461	0.468
All Classes	0.584	0.598	0.683	0.710	0.746

Source: Computed by authors

Land size wise Crop Diversification

Land size class category wise diversification index shows an increasing trend from 1995-96 to 2015-16 (Table 2). The pace of increase in crop diversification index under marginal land size category is higher than the rest of the class categories. Although small and semi-medium and large land size categories were again successively positive but in medium land size class category there is a decreasing trend in diversification index over 1995-96 to 2010-11 and 2015-16. The maximum increase in index value was in the large land size class category from 2010-11 to 2015-16. The least diversification index was found in 2010-11 to 2015-16 in medium land size class category.

Conclusion

Gibbs-Martin crop diversification index observed increasing trends in index value over the years both at block level as well as land size class category level. Nature of change in index value was dominated in case of some blocks. Land size category wise index also suggests a dominance improvement in index value under marginal land size class category. However, small and semi-medium category found significant improvement but their index value lower than the marginal land size classes. So, diversification in the district is dominated under marginal and small land size category. After realized the continuous and increasing trends of diversification (from 0.584 to 0.746) in twenty years the study suggests proper capacity building and training programs for stakeholders to continuing diversificationin the district.

References

Acharya, S.S. 2006. Agricultural price policy and development: some facts and emerging issues. *Indian Journal of Agricultural Economics*. 52 (1) : 1- 47

Agarwal, I. 2004. Rational of Resource Use through Farm Diversification. *Agricultural Economics Research Review*. 17 (1) : 85-100.

Agricultural Census, 2015-16. Agricultural Census: Block-level database, Ministry of Agriculture and Farmers Welfare, Government of India, New Delh.

Bala, B. and Sharma, S. D. 2005. Effects on Income and Employment of Diversification and Commercialization of Agriculture in Kullu District of 38 Himachal Pradesh, *Agricultural Economics Research Review*. 18 (2) : 261-269.

Bamji, M.S. 2000. Diversification of agriculture for human nutrition. *Current Science*. 78(7) : 1-7.

Birthal, P.S., P.K. Joshi, Devesh Roy and Amit Thorat .2006. Diversification in Indian Agriculture Towards High-Value Crops: The Role of Small Holders, IFPRI Discussion Paper # 00727, November, *International Food Policy Research Institute*, Washington D.C., U.S.A.

Chand, R. 1996. Ecological and Economic Impact of Horticultural development in the Himalayas: Evidence from Himachal Pradesh. *Economic and Political Weekly*. 31 (26): A93-A99

Dhawan, K.C. and Kahlon, A.S. 1996. Adequacy and Productivity of Credit on the Small Farms in Punjab. *Indian Journal of Agricultural Economics*. 33 (4) : 91-99.

Gibbs, J. P. and Martin, W. T. 1962. Urbanization, technology and the division of labour. *American Sociological Review*. 27 : 667–677.

Kumar, P., Mruthyunjaya and Birthal, P.S. 2000. *Changing Consumption Pattern in South Asia,* Paper presented in the International Workshop on Agricultural Diversification and Vertical Integration in South Asia, Organised by FICCI-ICRISAT-IFPRI, November 5-6, New Delhi.

Mathur, V.S. 1996. Structural changes in the demand for food in India. Indian *Journal of Agricultural Economics* 51(4): 664-673.

Mani,K. and Varadarajan, S. 1985. Diversification of Farms. *Indian Journal of Agricultural Economics.* 40(3) : 350-351.

Pingali, P. L. and Rosegrant, M. W. 2004. *Agricultural Diversification: Opportunities and Constraints*", *FAO Rice Conference*. Food and Agricultural Organization of

the United Nations, Rome, Italy, 12-13.

Pope, R.D. and Presscott, R. 1980. Diversification in Relation to Farm Size and other Socio- economic Characteristics. American Journal of Agricultural Economics, 62(3): 554-559.

Satyasai, K. J. S. and Viswanathan, K. U. 1997. Commercialisation and Diversification of Indian Agriculture, Occasional Paper-5, National Bank for Agriculture and Rural Development, Mumbai.

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.

Singh A. J., K. K. Jain and Inder Sain 1985. Diversification of Punjab Agriculture: An Econometric Analysis. *Indian Journal of Agricultural Economics*. 40(3) : 298-303.

Vyas, V. S. 1996. Diversification in Agriculture: Concept, Rationale, and Approaches. Indian *Journal of Agricultural Economics*. 51(4) : 636-651.