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Agricultural Diversification of West Bengal: Nature and Policy Implications

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ABSTRACT

The study relates to the changes that have taken place in the overall agrarian scenario of West Bengal over the period (1980-81 to 2014-15). Agricultural diversification seems to have gained huge significance since early 1990s. West Bengal having distinct physio-geographic zones, constitute a suitable region for the growth of diversified crops including fruits, vegetables, horticulture and minor forest produce. Given the preliminary observation that there is enormous inter-district variation in crop-diversification and that districts endowed with more irrigation and infrastructural facilities in West Bengal specialise in traditional crops, this paper analyses the nature of crop diversification in terms of the changes in cropping pattern and attempts to examine the real factors determining food availability with special emphasis on the impact of crop diversification on food availability of the masses. Agriculture, food security and economic growth supplement each other in the process of economic development. The indices of diversification indicate an increasing degree of crop diversification over time. The results indicate that West Bengal is a moderate diversified region, mostly inclined towards cash crops with cropping pattern showing a gradual rise in crop diversification in all the districts during the period of study. The results also highlight that Simpson Diversity Index for cash crops have a positive impact on food production.

Keywords: Agricultural diversification, Cropping pattern, Food availability, Economic reforms, sustainability

JEL: Q13, Q18, R1, R53.

I

INTRODUCTION

Indian economy is passing through a phase of comprehensive economic reforms encompassing all important sectors of the economy including agriculture. It is true that the process of introduction of the new policy regime is an ongoing process and the consequences are manifold as a result of which Indian agriculture has begun to experience some new trends as immediate consequence of the ongoing reforms. Some major changes brought about by the implementation of the reforms involve fall in public investment followed by the rise in private investment, improvement in terms of trade and rising price of agricultural raw materials. The globalisation of the Indian economy based on neo-liberal strategies initiated a process of shift in the cropping pattern in the agricultural sector since early 1990s. The major context of the study relates to the changes that have taken place in the overall agrarian scenario of West Bengal over the period viz., 1980-81 to 2014-15. Agricultural diversification as a neo-liberal strategy to shift the dynamics of crop pattern and crop-orientation seems to have

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gained significance since early 1990s. In particular, the World Bank experts (World Bank, 2005) have recommended the diversification of Indian agricultural production activities in favour of fruits and vegetables, contract farming and the replacement of chemical fertilisers by bio-fertilisers. However, Reddy and Mishra (2008) pointed out that small and marginal farming in the neo-liberal regime cannot be sustained without substantial public infrastructural support and a comprehensive social security net. Reddy and Mishra (2008) observed that the essential condition at the present juncture is the need for a policy shift from the mindless neo-liberal market centred reforms to the building of economic and social support systems to make small scale farming viable, particularly in the dry places. In the context of agricultural crisis in India in the post-green revolution period, Singh (2004) highlighted on how diversification may help farmers prevent critical conditions.

There is a strong support to the fact that it is not the farm size but infrastructure which is the major determinant in the case of cultivation of high value crops in the Western Himalayan region where the holding size and per capita cultivable land are so small that the traditional crops are not capable of providing sufficient income and employment (Chand, 1996). Mukherjee (2010) in a study of West Bengal, found that the farmers in extremely backward regions lacking irrigational facilities and having adverse natural conditions, resort to crop diversification as a means to protect their income and consumption requirements and in such cases high value crop production is associated with inefficiency, low productivity, low profit and negative returns. However, in places well-endowed with irrigational and other infrastructural facilities, high value labour intensive crop generates higher income, relative efficiency and profitability by putting in intensive family labour.

Crop diversification in areas lacking adequate irrigation ensure the farmers a minimum acceptable level of consumption while in places well irrigated through private investment, crop diversification assures the farmer a net positive income besides a reasonable level of consumption. The effectiveness of the strategy of crop diversification in poverty reduction depends to a great extent on the presence of adequate infrastructural facilities together with access to markets (Mukherjee, 2015). Availability of water for cultivation decides the proportional rate of increase in the degree of specialisation towards traditional crops vis-à-vis high value crops (Singh and Sidhu, 2004). Sustained economic growth and increasing urbanisation have led to rapid growth in demand for high value food commodities (Rao *et al.*, 2006). In fact, a study of West Bengal shows that diversification indices calculated for the period 1981-84 to 2005-08 report a rising tendency (Majumdar, 2014). However, a high level of diversification in an area does not necessarily correspond to the districts having a traditional resource base or a high endowment of modern inputs (Mukherjee and Chattopadhyay, 2017).

While subsidised cheap imports from the developed countries adversely affect their agriculture, evidences show that these countries are able to increase their agricultural exports, especially of high value and labour intensive commodities sufficiently (Joshi

et al., 2004). In this context, recently a tendency towards diversification in cropping pattern in favour of agricultural commodities like fruits, vegetables, livestock etc. is being noticed in India and the state of West Bengal is no exception in this context. Diversification concerns a shift of resources from one crop to a large mix of crops and livestock and it can be achieved either through an increase in area under cultivation by utilising fallow lands or by crop substitution. Fruits and vegetables have acquired importance only in the post-liberalisation era, indicating a trend towards diversification of cropping pattern of the small and marginal farmers to avoid the risk of monocropping and also to search for new avenues of increasing income with an attempt to fulfill the increased consumption desires.

The rising labour and input costs, including that of fertilisers has made paddy cultivation a loss-making proposition. So, farmers instead are increasingly switching over to the production of cash crops. This however is endangering the food security of the state. The recent thrust of the State Government on a policy of land conversion for industrial development has led to a number of questions being relevant to the problem of long-run food security (Bhattacharya and Bhattacharya, 2007). Food security is an issue of global concern. The food security system of India is one of the largest in the world but is confined mostly to provisioning for cereals. Since its inception after the food shortages of the mid-1960s, this system has managed to help the country avoid famine. Of late, Government of India claims that there is “over supply” of food grains relative to demand, and so infers that food grains production should be cut back in favour of ‘diversification’. However, Patnaik (2005) points to a decline in food grain supply and drastic fall in demand for food grains especially in rural India owing to a fall in purchasing power. Crop diversification has often been thought to result in reduced household food supplies from own production due to reduction in area under cultivation of food crops. De and Chattopadhyay (2010), however, suggested that the marginal and small farmers in West Bengal, having access to modern farm inputs play a positive role in crop diversification which has been persisting since the 1970s with large inter-district variations. Even Chand (1996) emphasised that crop diversity increases household income.

The study area, West Bengal is well endowed with rich natural resources and climatic conditions favourable for agriculture including large areas of alluvial soil, enough rainfall, adequate surface water and ground water resources. West Bengal experiences hot and humid climate with an annual rainfall ranging between 1300 mm and 1750 mm. In spite of all these favourable conditions, the agricultural growth in the state was slow as in the other parts of eastern and north-eastern India and it lagged much behind the all-India average immediately after Independence. In the post-Independence period, the growth performance of agriculture undoubtedly improved but the figures of per capita growth indicated that production was much behind population in West Bengal. West Bengal having distinct physio-geographic zones, is suitable for the growth of diversified crops including fruits, vegetables, horticulture and minor forest harvests. Given the preliminary observation that there is enormous

inter-district variations in crop-diversification and that districts endowed with more irrigation and infrastructural facilities in West Bengal specialise in traditional crops, the paper attempts to bring out the factors contributing to food availability in West Bengal on the basis of an inter-district analysis over the period 2005-06 to 2014-15, with special emphasis on crop diversification.

Specifically, the study aims to: (i) explain the nature of diversification in cropping pattern in the state of West Bengal. (ii) construct crop diversification index on the basis of area under crops and measure the extent of variation in cropping pattern across the districts of West Bengal. (iii) measure inclination of crop diversification towards food or cash crop in a district. And (iv) analyse how crop diversification towards high value crop or food crop will help farmers directly or indirectly by enhancing the food availability (ensuring food supply or income).

Available literature established that crop diversification generally contributes to increased agri-produce, higher income and nutrition level, employment generation, poverty alleviation and sustainable management of natural resources. Food security on the other hand, essentially involves daily intake of minimum required calories by a poor household along with sufficient diversity in the food group. Food security is influenced by various socio-economic and demographic factors including the specific nature of farm diversity. Crop diversification can influence the food security in two ways. Diversification towards food crop generally increases food availability directly while diversification towards cash crop increases food availability indirectly by increasing income. Warr (2014) suggests that higher food prices can significantly affect the food security specifically for the low-income people spending a large portion of their income on food. This study thus intends to find the impact of crop diversification on food security in general and food availability in particular.

II

DATA SOURCE AND METHODOLOGY

The present study is carried out entirely on the basis of secondary data collected from three major sources, viz. -*Statistical Abstracts and District Statistical Handbooks*, published by the "BUREAU" and Statistical Appendices to Economic Reviews of the State Government. Out of the mentioned sources, the study relies mainly on the Statistical Abstract and Handbook. The irregular data gaps have been removed by using the data available in Economic Reviews of the Government. In the present study, the researcher has computed an indicator of diversification of commodities or activities in a given time and space, using Simpson Diversity Index (SDI). The index provides a clear dispersion of commodities and ranges between 0 and 1. The index moves towards 0 if there is complete specialisation. The index is calculated as follows:

$$SDI=1-\left\{\sum(P_i/\sum P_i)^2\right\}, i=1,\dots,n.$$

where, P_i is the proportionate area of the i -th crop of a district in the district gross cropped area. As the focus of the study is to link crop diversification with food security by districts, the crops have been divided into two broad groups:

1. Food crop: food grains+ pulses + vegetables
2. Cash crop: cash crop + condiments.

The data in per cent share under food and cash crop at district level were used to calculate the SDI. The districts of the state of West Bengal have been ranked according to the Simpson Diversity Index as follows:

Rank	Value of Simpson diversity index	Diversity
1	$SDI < 0.45$	Near specialisation
2	$0.45 < SDI < 0.55$	Low diversity
3	$0.55 < SDI < 0.65$	Moderate diversity
4	$SDI > 0.65$	High diversity

Moreover, the state of West Bengal has nineteen districts, but at the time of scrutinising the collected data on relevant variables it was found analytically convenient to reduce the number of districts studied, effectively to fifteen. This was done according to the following method of combination:

- (i) Howrah +Kolkata \equiv Howrah.
- (ii) 24 Parganas (North) +24 Parganas (South) \equiv 24 Parganas.
- (iii)Medinipur (East) + Medinipur (West) \equiv Medinipur.
- (iv)Dinajpur (North) + Dinajpur (South) \equiv Dinajpur.

Of the four pillars of measuring food security, namely food availability, food accessibility, food utilisation and food stability, the study focuses on food availability also known as the Malthusian approach to food security, which is the oldest approach to food security. Food availability approach measures food security by analysing the amount of food available for consumption either through local production or import. It consists of both the national food production and net factor of food trade. Food security from availability side implies per capita aggregate food availability including food production, food stock, food aid and food trade surplus (export-import). To measure food availability, food production has been considered. The study aims to evaluate the food security at district level, but as food stock, food aid and food trade data are not available at district level, so district wise food production has been used as the benchmark for food availability. In order to determine the relationship between crop diversification and food security, the study uses fixed effect, where the dependent variable is food availability. The analysis is done across fifteen districts of West Bengal for three distinct time points, viz., 2005-06, 2010-11 and 2014-15. The data being panel in nature, the standard fixed effect test is applied to estimate the determinants of food availability. Food availability model being a macro model, the study focuses mainly

on the district information taken from various issues of Statistical Abstracts, published by the “BUREAU” from 2005-06 to 2014-15. For food availability, district wise secondary data on crops like staple crops, pulses, vegetables, oilseeds, condiments and fibre produced per hectare are used.

The following simple linear regression model has been used to identify the contribution of different factors that affect food availability as an important aspect of food security:

$$LFAVdt = \beta_1 + \beta_2 CDI dt + \beta_3 Ncadt + \beta_4 Lpopdt + \beta_5 Clmt dt + \beta_6 Ca dt + \beta_7 Liadt + \varepsilon$$

where d represents district, t represents time and the expected signs are given in parenthesis.

LFAV= log of food production (million tonnes)

CDI=Crop diversification index (+,-)

Nca= percentage of non- canal agriculture land area (+,-)

Lpop= log of district's estimated total population (+)

Clmt=climate index (temperature + rainfall + humidity) (+)

Ca= total cropped area (food + cash crop area) (+)

Lia= log of irrigated area (+,-)

CDI is expected to influence the food production positively. Areas deprived of canal irrigation depend on ground water and the monsoons for cultivation. With declining groundwater levels, it becomes increasingly difficult for the farmers both physically and economically, to arrange water for cultivation and so the study expects a negative influence of non-canal area on agriculture production. This study, due to data constraint used the availability of canal water for each district in order to arrive at area irrigated and the percentage of non- canal agriculture land area was calculated using the following formula:

Non-irrigated area of a district (in hectares) / total cropped area of a district (in hectares) X 100 = percentage of non-canal agriculture land area.

Further, since the production of agricultural commodities is expected to be the primary need for survival, hence rapid population growth of the country implies faster growth in demand for food. Thus, rise in district population is expected to have a positive impact on food production. Besides, variability of climate is one of the most important challenges faced by the agricultural sector of a country. To make the climate index, we have gone through the following four steps:

1. Temperature index= (maximum temperature+minimum temperature)/2
2. Rainfall index= current rainfall/ maximum rainfall x100

3. Humidity index= Average division's value of each parameter/ Maximum value of parameter in the district X 100
4. Climate index= (rainfall index+ temperature index+ humidity index)/3

Climate positively influences food production right from sowing to crop harvest. As agriculture is always vulnerable to climate change, hence climate change can have an adverse impact on food production and food security. Therefore, considering these important aspects of climate change comprising temperature, humidity and rainfall, this study used an index constructed on these variables in order to get a more comprehensive understanding of the impact of climate change on food production of all districts. Cropped area is the area planted or harvested. Crop production consists of area under crops, yield and the cropping intensity. An increase in cropped area can have both negative and positive influence on crop production depending on the other two components. Moreover, irrigation is not only an input of production but is also vital so far as the world's food supplies are concerned. Lack of adequate irrigational facilities indicate fall in food production. So the study considers irrigation as an important determinant of food production. This gives us a more clear picture of the impact of canal irrigation, ground water (tube well) and rainfall on the agriculture of a district.

III

RESULTS AND DISCUSSION

The time-series data on Simpson Diversity Index reported in Table 1 clearly reflect that diversification was considerably low in the pre-reforms period. Between 1990-91 and 2014-15, the diversification in cropping pattern has increased for all the districts. Purulia, one of the least diversified districts (SDI value of 0.05) in the state in 1995-96, when the process of agricultural diversification just initiated has now shown considerable progress in terms of diversifying its agricultural activities with SDI value increasing to 0.33 in 2014-15. Recently, even the district of Burdwan which has traditional expertise in the growth of paddy has been diversifying its agricultural activities in favour of high value crops (SDI value increasing from 0.22 in 1995-96 to 0.41 in 2014-15).

By constructing the Simpson Diversity Index, the study cross checks the district wise crop diversification pattern and draws an inference about the horizontal diversity towards food or cash crop (Table 2). According to the Simpson Diversity Index, the districts of Burdwan, Birbhum, Bankura, Midnapur, Howrah, Nadia, Murshidabad, Malda, Jalpaiguri, Darjeeling and Purulia did not undergo any change in their district diversity ranking within the studied time period. 24 Parganas shifted from low diversity to medium diversity range while Hooghly, Dinajpur and Coochbehar districts switched away from moderate diversity to high diversity ranking. Most of the districts of West Bengal are found to be diversified in favour of cash crops during the study period. The

TABLE 1. SIMPSON DIVERSITY INDEX FOR DIFFERENT DISTRICTS OF WEST BENGAL

Districts (1)	1980-81 (2)	1985-86 (3)	1990-91 (4)	1995-96 (5)	2000-01 (6)	2005-06 (7)	2010-11 (8)	2014-15 (9)
Burdwan	0.24	0.25	0.3	0.22	0.28	0.36	0.40	0.41
Birbhum	0.15	0.19	0.23	0.14	0.22	0.48	0.60	0.49
Bankura	0.16	0.15	0.21	0.19	0.2	0.40	0.56	0.44
Midnapur	0.12	0.13	0.16	0.21	0.21	0.40	0.40	0.39
Hwh	0.23	0.19	0.14	0.17	0.28	0.35	0.40	0.42
Hooghly	0.42	0.46	0.49	0.49	0.59	0.60	0.64	0.67
24 Pdns	0.22	0.2	0.19	0.18	0.26	0.48	0.54	0.57
Nadia	0.47	0.54	0.47	0.52	0.58	0.78	0.79	0.81
Murshidabad	0.36	0.44	0.41	0.44	0.52	0.75	0.79	0.77
Dinajpur	0.39	0.45	0.3	0.31	0.39	0.59	0.64	0.70
Malda	0.27	0.33	0.26	0.22	0.33	0.69	0.69	0.72
Jpg	0.5	0.55	0.51	0.54	0.55	0.71	0.74	0.75
Darjeeling	0.49	0.53	0.38	0.44	0.5	0.82	0.82	0.83
Coochbehar	0.43	0.41	0.35	0.42	0.43	0.64	0.65	0.67
Purulia	0.04	0.05	0.06	0.05	0.03	0.36	0.44	0.33

Source: Computed from data collected from Statistical Handbook, various issues.

aggregate value of crop diversification in West Bengal was 0.579 in 2005-06, varying from the lowest 0.345 (near specialisation) in Howrah to the highest 0.82 (high diversity) in Darjeeling. In 2014-15 however, aggregate diversification in West Bengal improved slightly to 0.621 with the lowest value of 0.329 (near specialisation) in Purulia to the highest value of 0.832 (high diversity) in Darjeeling. The results reveal that overall West Bengal is a moderately diversified region, mostly inclined towards cash crops with the cropping pattern showing a gradual shift in crop diversification pattern in all the districts

TABLE 2. SDI ACROSS DISTRICT AND TIME

District (1)	2005-06					2014-15				
	Food crop (2)	Cash crop (3)	Diversity towards (4)	District diversity (5)	Rank (6)	Food crop (7)	Cash crop (8)	Diversity towards (9)	District diversity (10)	Rank (11)
Burdwan	0.159	0.647	C	0.360	1	0.197	0.599	C	0.409	1
Birbhum	0.353	0.457	C	0.475	2	0.375	0.459	C	0.487	2
Bankura	0.238	0.532	C	0.395	1	0.267	0.532	C	0.436	1
Midnapur	0.193	0.585	C	0.402	1	0.186	0.552	C	0.390	1
Howrah	0.183	0.569	C	0.345	1	0.243	0.592	C	0.419	1
Hooghly	0.28	0.518	C	0.599	3	0.311	0.546	C	0.668	4
24 Parganas	0.347	0.603	C	0.482	2	0.437	0.625	C	0.566	3
Nadia	0.621	0.657	C	0.780	4	0.675	0.614	F	0.805	4
Murshidabad	0.599	0.549	F	0.749	4	0.621	0.557	F	0.773	4
Dinajpur	0.397	0.572	C	0.591	3	0.537	0.558	C	0.696	4
Malda	0.597	0.635	C	0.693	4	0.634	0.647	C	0.715	4
Jpg	0.446	0.573	C	0.715	4	0.477	0.613	C	0.745	4
Darjeeling	0.8	0.646	F	0.820	4	0.805	0.627	F	0.832	4
Coochbehar	0.388	0.535	C	0.644	3	0.436	0.618	C	0.674	4
Purulia	0.337	0.661	C	0.361	1	0.314	0.661	C	0.329	1
West Bengal			0.579					0.621		

Source: Computed from data collected from Statistical Abstracts, various issues. F indicates Food Crop, C indicates Cash Crop.

Table 3 provides discussion on the impact of crop diversification on food availability given the control variables, the determinants of food availability, on the basis of Simpson Diversity Index. Column (2) of the table attempts to discover the influence of aggregate crop diversity of a district on food availability. In other words, the table tries to reflect whether aggregate crop diversity ensures food security through crop production. Column (3) tries to determine the relationship between crop diversification towards cash crop and crop production and its indirect influence on food security in the region by improving the income of farmers. The last column tries to determine the relationship between crop diversification towards food crop and its impact on food security through horizontal or vertical diversification. The F-test with a p-value less than 1 per cent shows that the models are statistically significant. The table indicates that a one unit increase in aggregate diversity index value results in 0.15 unit increase in crop production for cash crop inclined model. However, CDI is negatively but not significantly related to food production for aggregate and food crop diversified models. Thus, diversity index positively influences the production of cash crops and hence is positively related to food security as SDI is positively related to diversity. Cash crop contributes significantly to income and employment generation along with a great potential for self-sufficiency of farmers. The result proved the main idea that the small farmers adopt crop diversification as an instrument for minimisation of risk and to increase their sources of income for ensuring a better standard of living.

TABLE 3. FOOD AVAILABILITY AND CROP DIVERSIFICATION: A SIMPSON APPROACH

Log of Production (metric tons) (1)	Model 1 (2)	Model 2 (3)	Model 3 (4)
Independent variables	Aggregate diversity	Diversity towards cash crop	Diversity towards food crop
CDI	-0.1312 (0.393)	0.1485 ⁺ (0.184)	-0.0496 (0.711)
Non canal agriculture	0.0005 (0.770)	-0.0004 (0.797)	0.0001 (0.959)
Log of Population	0.7718* (0.000)	0.7137* (0.000)	0.7386* (0.000)
Climate Index	0.0004 (0.314)	0.0003 (0.402)	0.0003 (0.359)
Cropped Area	0.0009* (0.000)	0.0009* (0.000)	0.0009* (0.000)
Log of Irrigated Area	0.0092 (0.785)	-0.0089 (0.765)	0.0015 (0.964)
R ² within	0.8704	0.8760	0.8671
F (6,24),	26.88	28.26	26.11
Probability > F	(0.000)	(0.000)	(0.000)

Note: * shows significance at 1, ** at 5, *** at 10 and + at 20 per cent,

Figures in parentheses denote significance levels.

R² within shows how much of the variation in the dependent variable is captured by the given model. In other words, it indicates how well the explanatory variables account for changes in dependent variable over time.

Among the other independent variables, log of population has positive and highly significant relation with food availability as 1 unit increase in it causes 0.77 per cent

increase in crop production for aggregate diversity model, 0.71 per cent increase for cash crop inclined model and 0.74 per cent increase for food crop inclined diversity model. As expected, when population increases, there is an upward pressure on the demand for food and production of agricultural commodities. Hence, population growth increases agricultural production growth. Even the cropped area has proved to have significant positive relation with crop production. One hectare increase in cropped area results in 0.0009 per cent increase in crop production for all the three models of diversity. Thus, greater the area under crops more is the growth in agricultural production.

Non-canal agriculture area is already in percentage and has positive but insignificant impact on aggregate crop diversity and food diversified crop production. Non-canal irrigated area in percentage terms however, has negative but insignificant impact on cash crop production. Irrigation comprises of providing extra water in agricultural areas with limited water supply. It helps in increasing crop yield and income, thereby reducing poverty and food insecurity. Log of irrigated area shows that rise in irrigated area also influences the crop production positively but it is highly insignificant. One per cent increase in irrigated area leads to 0.0092 per cent increase in crop production for aggregate diversity and 0.0015 per cent increase in food inclined crop production. However, irrigated area has a negative but insignificant influence on cash inclined crop production.

The impact of climate change in our agricultural system is unquestionable. Climate index signifies a positive but insignificant relationship with food production. One unit positive change in climate index results in about 0.0003 per cent increase in food production in all models. Climate is an important determinant of crop diversification to increase food production. The climate factor in many situations can also negatively affect food production through flood or drought but these negative effects can be compensated by adopting the new variety seeds or by early/delayed sowing. Due to global climate change following global warming, the production of enough food for the growing population while preserving the environment, itself becomes an important challenge. On the whole, the results show significant positive impact of diversification towards cash crop on food availability. The insignificant effect of food crop and the significant effect of cash crop reveal that the farmers give more weightage to cash crop because of its profit potential which ultimately affect aggregate food security in general and food availability in particular. This is also evident from Table 4 which shows that

TABLE 4. YEAR WISE ESTIMATED NUMBER OF FARMERS' HOUSEHOLDS AND FARMERS' HOUSEHOLD INCOME

Year (1)	Estimated Farmers' Household ('000) (2)	Individual Farmers' Household Income per annum (Rs.) (3)
2013-14	7202.20	140459.54
2014-15	7228.60	158939.13
2015-16	7255.00	199927.81
2016-17	7281.00	239123.84

Source: Department of Agriculture, Government of West Bengal.

the farmers in West Bengal could not only sustain their economic growth but also could raise their household income from Rs.140459.54 per annum in 2013-14 to Rs.239123.84 in 2016-17.

IV

LIMITATIONS OF THE STUDY

The present research work is based only on secondary data. Out of a total of 19 districts in the state, data was prepared for 15 districts by treating the relatively recent administrative decomposition of the districts of Medinipur, Dinajpur and 24 Parganas into sole district units. This formulation was necessary because suitable and consistent data could not be made available for the actual sub-divided district units for the reference time points. Further, the district of Kolkata was to be dropped from the analysis due to its non-agricultural urban status. While some of the research questions and objectives could be addressed properly with an analysis of secondary data, a number of data gaps and information inadequacy were challenged. For example, due to non-availability of quantitative data on different variables such as cooperative membership and access to credit facilities which also affect food production in the state, those variables could not be used for estimation purpose in our analysis of the factors influencing food availability of the districts.

V

CONCLUSION AND POLICY IMPLICATIONS

An analysis of district level secondary data on crop diversification reveals that with the advent of globalisation, the process of crop diversification started gathering momentum. Crop Diversification Index towards cash crop is found to be positive, indicating that food availability has improved substantially because of crop diversification. The results of the study confirm the basic assumption that crop diversity has a great potential to ensure rural food security by enhancing agricultural income. Hence, diversification should become a desired strategy. The crop diversification drive and the changing economic environment in the country might have prompted the farmers to go for higher levels of diversification. This seems to be a combined outcome of neo liberal government policies, increased market and export orientation and a high penetration of corporate capital in agriculture which has become evident in recent years. A successful process of diversification in the areas of comparative advantage is expected to reduce seasonality of consumption of a range of processed foods, minimise post-harvest losses, increase profitability and value productivity per unit of land and safeguard sustainability of production systems. Besides, effective diversification in cropping pattern ensures increased farm income, rural employment and foreign exchange earnings and reduces marketing risks.

A farmer intends to produce a combination of crops that complement each other and cover both his subsistence and cash needs. This is possible by providing better opportunities for supply of inputs, marketing and storage and through adequate investment in development of rural infrastructure so as to upgrade the technical efficiency of the farmers. This will not only protect crop loss but will also ensure increased yield and income thereby leading to alleviation of food insecurity. A number of policy actions can be identified to reduce production and marketing risks and help the diversified small farmers increase the basic food crop production to enhance household food security. Augmenting per hectare yield of food crops on a sustainable basis is the prerequisite to achieve food security. Crop-specific research must be emphasised to help the farmers diversify their cropping pattern in response to changing incentives and accommodate a variety of crops within a season. Government has to play a pivotal role in promoting research and development in technological upgradation and development of seeds and plants on the basis of biological and other resources and traditional knowledge base. Food crops as well as cash crops should be targeted by extension services. Since, water availability is a prime determinant of food security, there is a need to focus on the possibilities of irrigation through storage of rain water. In terms of infrastructure, rural roads need to be planned in areas where small and marginal farmers are concentrated rather than where large production units are located so as to ensure access to market both for cash crops and for the marketed share of food crops. Besides, development of co-operative system in the areas of production, processing, marketing, consumption and credit and savings can ensure supply of cheap indigenous resource based technology along with greater availability of credit and marketing facilities. Exchange of innovative ideas among farmers would also help in identifying better plant varieties suitable for local condition. Only then these high value cash crops can be a good source for raising household incomes, increase household productivity and raise state revenues that would in turn improve food security.

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