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RESEARCH ARTICLE

DIVERSIFICATION TOWARDS HORTICULTURE AS A SOURCE OF INCOME AND EMPLOYMENT: A CASE STUDY OF WEST BENGAL

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ABSTRACT

The cropping pattern in West Bengal has undergone a major change in the recent past, moving away from cereal to non-cereal crop cultivation. This shift has primarily been towards horticulture crops; influenced by the growth of technology, modernization, and changes in food habits. Horticulture has been one of the fastest-growing crop group within agriculture in India as well as in West Bengal. By using secondary data the share of cultivated area under different crops and crop group, growth rate of area under different crops and the various indices of crop diversification have been calculated. The crop concentration coefficient has also been calculated. The results indicate diversification towards horticulture in West Bengal. This paper has also assessed the impact of horticultural diversification on farm income and employment using farm level information from West Bengal. The results clearly reveal that horticulture production is more remunerative and labor-intensive, i.e., the gross return is much more in per hectare horticulture cultivation than that in cereals and pulses. Job opportunity is also high in case of horticulture cultivation as compared to others. Therefore, it fits well in the small farm production systems. The study also develops the econometric model like two stage least square (2SLS) regression to find the effects of crop diversification on employment and income by using secondary data.

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INTRODUCTION

Indian economy is mostly dependent on agriculture. Past strategy for development of the agriculture sector in India has focused primarily on raising agricultural output and improving food security. The strategy involved (i) an increase in productivity through better technology, increased use of quality seeds, fertilizer, irrigation and agro chemical; (ii) incentive structure in the form of remunerative price of some crops and subsidies on farm inputs; (iii) public investments in and for agriculture; and (iv) facilitating institution. The strategy paid dividends as the country was able to address severe food shortage that emerged during the mid-60s. In the last fifty years, since the adoption of Green Revolution, India's food production multiplied 3.7 times while the population multiplied by 2.55times. The net result has been a 45 percent increase in per person food production, which has made India food sufficient at an aggregate level.

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The strategy did not explicitly recognize the need to raise farmers' income, and neither did it mention any direct measure to promote farmers' welfare. This experience shows that in some cases, growth of output brought similar increase in farmers' income, but many cases, farmers' income did not grow much with the growth of output. The net result has been that the farmers' income remained low, which is evident from the incidence of poverty among farm households(4).On February 28, 2016, the Prime Minister of India set forth the target of doubling farmer's income by 2022. But given the various constraints and problems facing Indian agriculture, the feasibility of achieving such a goal has been largely debated (4, 2). However, it can definitely be asserted that farmers' income will grow up if crop-diversification[1] is practiced.

[1]Crop diversification in agriculture refers to a paradigm shift from one crop to another, bringing out a desirable change in the existing cropping pattern towards a more balanced cropping system to meet the ever-increasing demand for cereals, pulses, oilseeds, fiber crops, fodder, grasses, and fuel etc. However, in the present time, crop diversification in agriculture has a new meaning. Crop diversification envisages an increase in the total crop productivity in terms of quality, quantity, and monetary values under different agro-climatic situations of the country. It aims to improve soil health and agro ecosystem. Crop

After the Green Revolution, Indian agriculture's dependence on technology has increased. This dependence has reduced employment opportunity at the farm level. Crop diversification towards high value crops (HVCs) also offers greater scope for farmers' employment at the farm level; it provides employment to not only the adult males of a households but also to the women of the households. West Bengal is an important state of India in the context of agricultural production. The state is predominantly an agrarian State. Comprising of only 2.7 percent of India's geographical area, it supports nearly 8 percent of its population (12). The state had contributed 9.73 percent of national production and covered 4.88 percent area in the year 2014-15. West Bengal had gross cropped area of 9.6 million hectares during 2014-15 and contributed around 19 per cent to the gross state domestic product (GSDP) in 2014-15.Agriculture has been the way of life and continues to be the single most important livelihood of the rural masses in West Bengal. The Government of West Bengal is also working in a mission mode for development of agriculture and allied sector in a holistic manner with the vision of "Doubling farmers' income by 2020 by ensuring farmers' access to skills, technologies, markets and financial inclusion". There are 71.23 lakh farm families of whom 96 percent are small and marginal farmers. The average size of land holding is less than one hectare. However, the State is bestowed with diverse natural resources and varied agro-climatic conditions which support cultivation of a wide range of crops. West Bengal ranks first in paddy and vegetable production in the country. It stands second in potato production (after Uttar Pradesh). It is also the leading producer of jute, pineapple, litchi, mango and loose flowers.

The cultivation of pulses, oilseeds and maize is also picking up fast. Still a huge gap exists between the requirement and production of pulses, oilseeds and maize. Though the State has a surplus production of rice, vegetables and potato. The Green Revolution in West Bengal has also started in the early 1980s and the state concentrated on cultivating boro paddy. However, when the effect of Green Revolution started getting exhausted, the Central and the State Governments introduced many schemes to diversify cropping pattern in order to maintain food security (16). The crop composition further changed due to changes in technology, infrastructure, level of rural literacy, size of urban population and agro-climatic factors like rainfall. Then the horticultural crops started occupying an important position(West Bengal is the largest producer of horticultural crops accounting for 10.94 percent of the total horticultural production in the country during 2014-15 with a production of 30.39 million metric tonnes of horticulture produce from an area of about 1.79 million ha (8)). After the economic liberalization, international market played a significant role in changes of cropping pattern. Therefore, a marked diversification of cropping pattern away from food grains has occurred in West Bengal since economic liberalization. The share of cropped area under non-food grains has increased substantially over the past three decades. The percentage of area under oilseeds, particularly mustard, has nearly doubled during 1984-85 until2014-15. Agriculture in West Bengal has been diversifying gradually towards high value crops like fruits, vegetables, and other horticulture crops along with oilseeds and jute. The structural changes of agriculture in West Bengal have been taking place. The income and employment distribution of rural economy are undergoing change. The diversification towards high value horticultural crops are expected to enhance farmers' income and employment. These developments may provide important clues to the policy makers in allocating invesTable funds and designing employment generating strategies in West Bengal. The objectives of the present study is to analyze the extent of crop diversification towards horticulturein West Bengalover time and its impact on income and employments.

The specific objectives are as follows:

- Assessment of the nature and trend of crop diversification towards horticulture in West Bengal during 1982-83 to 2014-15,
- Analysis the effect of horticultural diversification on farmers' income and employment since liberalization i.e., from 1991-92.

MATERIALS AND METHODS

Material

The data on area under major crops in West Bengal for the last 33 years, i.e., from 1982-83 to 2014-15 have been collected from Land Use Statistics at a Glance (9). The data on employment (man-day's produce in agriculture) have been taken from various issues of Estimates of Area and Production of Principal crops in West Bengal (10). The post-harvest prices and yield rate of different crops are also collected from various issues of Estimates of Area and Production of Principal crops in West Bengal which are used for calculating the per hectare returns of farmers. Per hectare gross returns and labor requirement of boro Paddy, aman Paddy, pointed gourd, eggplant and cauliflower cultivationin West Bengalare collected from farmers on Minakhan and Canning II block in the districts of North 24 Parganas and South 24 Parganas respectively. Total 175 sample are collected by using simple random sampling method.

Methodology

Analysis of Growth Rate: The rates of growth of area of major crops in West Bengal have been examined. The exponential function of the following form has been used to estimate the growth rate (11). It is defined as

$$Y_{it} = A_i(1+r)^t \quad \text{——————————} (1)$$

Where,

Y_{it} = Area of i th crop at time t (ha)
r = Compound growth rate of Yi
A_i= Initial year Area of i th crop
t = time in years
By taking natural logarithm of (1),

$$ln\ Y_{it} = ln\ A_i + t\ ln\ (1+r) \quad \text{——————————} (2)$$

Now let

$a_i = ln\ A_i$
$\beta_i = ln\ (1+r)$

Equation (2) can be written as

$$ln\ Y_{it} = a_i + \beta_i\ t \quad \text{——————————} (3)$$

crops. It is different from multiple cropping, where cropping takes place in a given piece of land at a given period of time (6).

This log linear function was fitted by using ordinary least square (OLS) method. The compound growth rate (CGR) was obtained using the formula.

$r_i = (Antilog\beta_i - 1) \times 100$

Calculation of Co-efficient of Crop Concentration

To find the recent crop concentration in West Bengal, the study calculates the coefficient of crop concentration (C.C). The C.C indicates the density of a crop in a particular area at a particular period of time. The crop concentration in an area largely depends on the environmental and social factors, and on government policies. The C.C for a particular region *i* is derived as follows (7):

$$C.C = \frac{\frac{Aij}{Aj}}{\sum_{i=1}^{n} Aij / \sum_j Aj} \quad \text{——————————} (4)$$

where,

Aij = Total Cropped area under i the crop in West Bengal (jth State)
Aj = Total Cropped Area in West Bengal (jth State)
$\sum Aij$ = Gross Cropped Area under ith crop in India
$\sum Aj$ = Total Gross Cropped Area of the India

Measurement of Crop Diversification

To assess the extent of crop diversification, a few methods are available which explain either concentration (i.e, specialization) or diversification of crop or activities in a given time and space by a single indicator. The indices that have been used for study are

(i) O give Index (OI), measured by the following formula:

$$OI = N \sum_1^N \left\{p_i - (\tfrac{1}{N})\right\}^2 \quad \text{——————————} (5)$$

OI takes larger values with increasing diversification and its value decreases with rising specialization. Two other indices used in the study are Entropy Index (EI) and Modified Entropy Index (MEI).

(ii) The formula for computing EI is

$$EI = \sum_i^N P_i \, log_{10} P_i \quad \text{——————————} (6)$$

The index would increase with increase in diversification and the upper value of index can exceed 'one' when the number of total crops is higher than the value of logarithmic base i.e. 10.

(iii) MEI is expressed as follows

$$MEI = \sum_{i=1}^{N} (Pi \, log_N \, Pi) \quad \text{——————————} (7)$$

MEI incorporates the number of crops as the base of the logarithm. The lower and upper value of MEI is 0 (total concentration) and 1 (perfect diversification)

(iv) Another important index of crop diversification is Herfindahl Index (HI),

$$HI = \sum_{i=1}^{N} p_i^2 \quad \text{——————————} (8)$$

The value of HI lies between 0 (perfect diversification) and 1 (complete specialization).

(v) The study has also used Simpson's Index (SI),

$$SI = 1 - \sum_{i=1}^{N} Pi^2 \quad \text{——————————} (9)$$

The SI ranges between 0 and 1, with '0'signifyng complete specialization and '1' indicating complete diversification. Where, N = Total number of crops; Pi is the proportionate area under the i^{th} crop in the gross cropped area. Each method has some limitation and/or superiority over the other. Considering our objective of assessing the extent of diversity in crop activities, all indices have been used. To calculate the extent of crop diversification, area of twelve different crops/crop groups have been considered which include paddy, wheat, other cereals, pulses, sugarcane, oilseeds, condiment and spices, fiber, fruits, vegetables, plantation and other non-food crops of West Bengal for the period 1982-83 to 2014-15.

Econometric Model: This study is an attempt to understand the impact of crop diversification on farmer's income and employments. The log linear function was fitted by using ordinary least square (OLS) method. We estimate the following empirical relationship:

$lnY_t = \beta_0 + \beta_1$ Diversification $+ \beta_2$ Farm size $+ \beta_3$Education + $\beta_4$technology $+ \epsilon_i$ ——(10)

Where, Y_t= Income / Employments in *t th* period

β_i = all Co-efficient,*i* = 0,1, 2, 3, 4,

Income and employment have been used as dependent variables, separately. Crop diversification (Simpson's Index), farm size (year-wise gross cropped area used as a proxy), farmers' education level (rural literacy rate used as a proxy), and technology (dummy used for technology) are used as independent variables in this model. However, since diversification, farm size, technology and education level are correlated to each other, the OLS will yield biased and inconsistent estimates (equation 5). In order to have consistency in the estimates of this equation, an instrumental[2]variable must be derived: a new variable that satisfies certain properties. That instrumental variable is uncorrelated with ϵ_i, but is correlated with variables (except predictor variable)[3].The general concept is that of the instrumental variables estimator; a popular form of that estimator, often employed in the context of endogeneity[4], is known as two-stage least squares (17). To find the impact of crop diversification on income and employment opportunity, the study has used the two-stage least squares (2SLS) regression technique.

RESULT AND DISCUSSION

Changes in percentage share of important crops: During 1982-83 to 2014-15, the gross area under cultivation increased

[2]These are the variables used to compute the predicted values for the endogenous variables in the first stage of two-stage least squares analysis.

[3]Pair-wise correlation was used to test for the condition of the instrument.

[4]An endogneity problem occurs when an explanatory variable is correlated with the error term

from 7.77 million hectares to 9.59 million hectares in West Bengal, whereas the share of area under cereal as well as food grain crops to total gross cropped area declined continuously in the same period. This resulted in increase in area under nonfood grain. The biggest beneficiary of this were the horticulture crops. The second biggest beneficiary was the oilseed crops. The changes in share of important crops in gross cropped area of West Bengal are presented in Table 1. Paddy has the highest share of 57.30percent in gross cropped area in Triennium Ending (TE) 2014-15,followed by vegetable, oilseeds and fiber (jute) crops. The share of the major food grain crops, such as rice, has decreased over the years in the state. The share of rice has decreased from 67.03percent in TE 84-85 to 57.30 in TE 2014-15. The other food grain crops like wheat and pulses, area under these crops have decreased over the period under study. The share of Pulses has decreased from 5.00 percent in TE 84-85 to 2.43 percent in TE 2014-15. In case of wheat it has been reduced from 4.04 to 3.43 percent. At the same time the share of vegetable has doubled which has increased from 7.00 percent in TE1984-85 to 14.31 percent in TE2014-15. The share of fruits has increased from 1.48 percent to 2.34 percent. The share of condiments and spices has slightly improved over the years.

Table 1. Share of Important Crops, Total Food Grains and Non Food Grains in West Bengal

Crops and Crop Group	TE 84-85	TE 94-95	TE 2004-05	TE 2014-15
Paddy	67.03	66.87	60.93	57.30
Wheat	4.04	3.49	4.29	3.43
Other Cereal	1.38	0.88	0.74	1.60
Total Cereal	72.46	71.24	65.96	62.34
Pulses	5.00	2.98	2.51	2.43
Total Food Grain	77.45	74.21	68.47	64.77
Sugarcane	0.28	0.14	0.18	0.18
Condiments and Spices	0.66	1.03	1.08	1.34
Fruits	1.48	1.44	1.70	2.34
Others	0.01	0.02	0.01	0.13
Vegetable	7.00	9.18	12.36	14.31
Total Food Crops	86.89	86.02	83.80	83.07
Oilseeds	4.86	6.35	6.97	8.07
Fibers (Jute)	6.37	5.82	6.48	6.04
Plantation	1.71	1.50	2.42	2.52
Fodder and Other Non-Food Crops	0.17	0.31	0.33	0.30
Total Non- Food Crops	13.11	13.98	16.20	16.93
Horticulture Crops	**11.02**	**13.46**	**17.89**	**20.81**
Non Food Grain (Other than Horticulture)	11.53	12.33	13.64	14.42
Total Non-Food Grain	22.54	25.79	31.53	35.23
All total	100.00	100.00	100.00	100.00

Data Source: Authors' calculation

It is clear from the above discussion that the share of major crops like paddy, wheat, and pulses has decreased over the years in the state. However, share of minor crops like oilseeds, fiber (jute), fruits, vegetable and plantation crop (tea) has increased over the years in the state. The share of oilseeds has increased from 4.86 TE 1984-85 to 8.07 TE 2014-15. The share of fiber declining initially but increasing after 90's.The share of total food grain crops has decreased from 72.46 percent in TE 1984-85 to 62.34 percent in TE 2014-45. However, share of non-food grain crop has increased from 22.54 percent in TE1984-85 to 35.23 percent in TE 2014-15. Among the non-food grain crops, the share of horticulture are 11.02 percent, 13.46 percent, 17.89 percent and 20.81 percent in TE1984-85, TE 1994-95,TE 2004-05,TE2014-15, respectively. It is clear that the share of horticulture has

The share of nonfood crops has increased from11.52 percent in TE 1984-85 to 14.42 percent in TE 2014-15 and at the same time the share of food crops has decreased from 86.89 percent to 83.07 percent. This shows that the state is moving towards crop diversification rather than specialization. Figures (Fig.) 1-4 depict that the share of area of important crops in West Bengal.

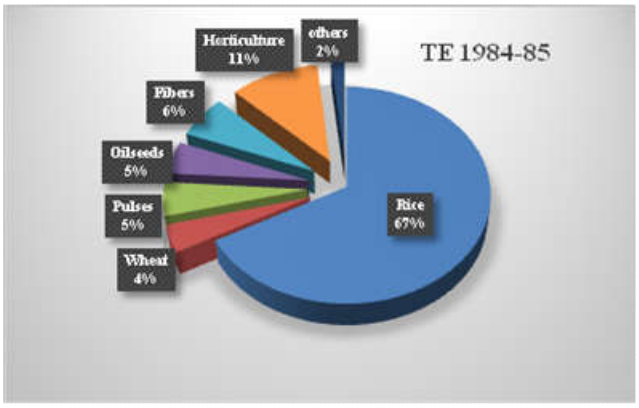

Fig. 1. Share of different cropsin TE 1984-85

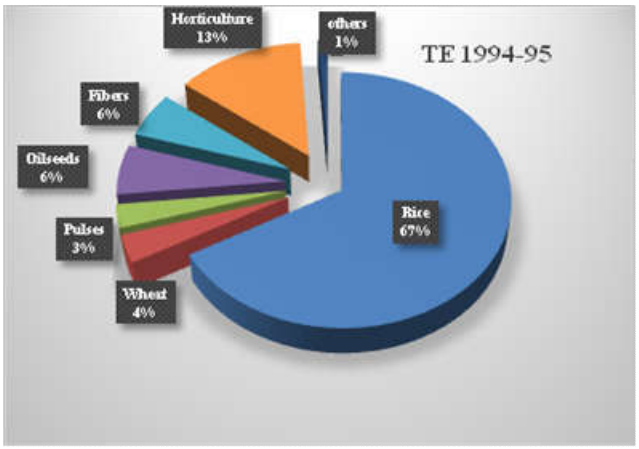

Fig. 2. Share of different crops in TE 1994-95

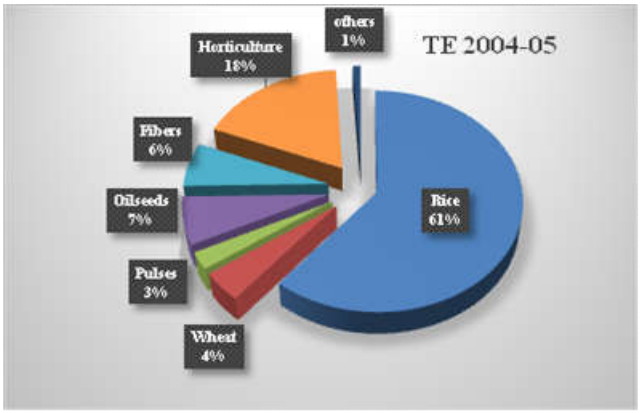

Fig. 3. Share of different crops in TE 2004-05

They indicate that major food grain crop paddy's area is declining continuously whereas the share of area of horticulture increasing rapidly. The share of other food grain crop pulses area is also declining and the share of area of another food

Oilseeds cultivation increased from 5 percent in TE 1984-85 to 8 percent in 2014-15 whereas area of fiber cultivation is around 6 percent over the analyzing periods.

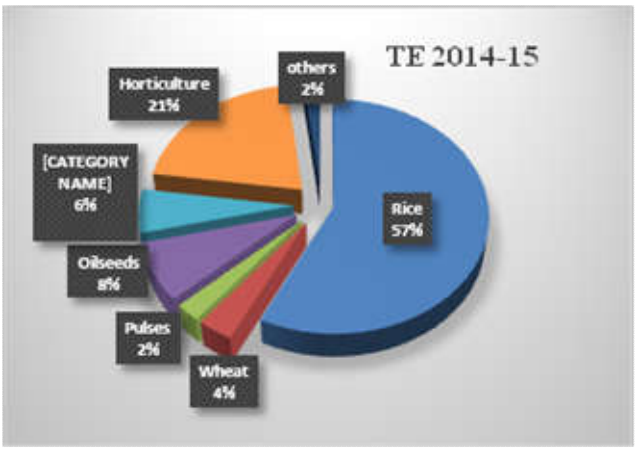

Fig. 4. Share of different crops in TE 2014-15

The share of area of different crop and crop groups reveal that crop pattern in West Bengal during the 1980s diversified in favor of horticulture, oilseeds and cash crops like jute. Economic reforms and policies adopted since 1991-92 further increased the pace of diversification in favor of horticulture crops. According to the land use statistics horticulture crops are now(TE 2014-15) grown on more than 1.97 million hectares area as compared to the 0.833 million hectares during 1984-85.

Growth of Areaof Different Crops

Compound growth rates (CGR) of area of important crops is presented in Table 2. The entire period under study has been divided into three sub-periods. Sub period I is the pre-reform period (1984-85 to 1994-95), sub period II represents the period during economic reform i.e., between 1994-95 and 2004-05, sub period III is post reform period (2004-05 to 2014-15). It is observed from the Table that the growth rate of area for paddy has been positive in the pre-reform period but negative in the period during economic reform and in the post reform period. The area under wheat, pulses, fiber, sugarcane, and other cereals have grown negatively during sub period I. In sub period II, i.e., in the reform period, the growth rates of area of all crops and crop groups have remained positive except paddy. But in post reform period (sub period III), the area under wheat and jute grew negatively along with paddy. The area under crop groups namely cereals, total food grains and total food crops have shown negative growth rate. The growth rate of area under different horticultural crops like vegetable, fruits, spices, and plantation crops are positive in all the sub-periods. The rate of growth of area under all horticultural crops remained positive in all the periods under analysis. The area under oilseeds has also grown positively in the three sub-periods. During the entire period under study, the area under rice and wheat have grown at the rate of 0.03 percent and 0.25 percent per annum, respectively and that under pulses grew at the rate of -1.91 percent. While the growth rate of area under condiments and spices, fruits, vegetables and plantation crops are 2.82 percent, 2.74 percent, 3.07 percent, 2.91percent, respectively, the area allocated for oilseeds, fiber crops have grown at the rate of 1.89 percent and 0.55 percent, respectively. Based on the growth rate of area under different crops in the state of West Bengal, it is clear that paddy occupies the major

However, this area has grown at a negative rate during sub-periods II and III though it was positive in sub-period I. The area under crops having minor share like oilseeds, condiments and spices, fruits, vegetables and plantations crop have grown positively over the whole period under consideration. The growth rate of area under all the horticultural crop taken together is approximately 3 percent during the same period. This clearly indicates towards crop diversification in the state. Figs 5- 8 indicate that the growth rate of area of important crops in West Bengal.

Table 2. Compound Growth Rate of Area of Important Crops and Crop Group in West Bengal

Crops and Crop Groups	Sub-Period I	Sub-Period II	Sub-Period III	Whole Period
Paddy	1.28	-0.57	-0.76	0.03
Wheat	-1.98	2.63	-1.58	0.25
Other Cereal	-3.98	0.21	6.10	1.08
Total Cereal	1.03	0.11	-0.68	0.06
Pulses	-5.01	1.17	0.62	-1.91
Total Food Grain	0.70	0.15	-0.63	-0.30
Sugarcane	-0.77	0.15	0.71	0.83
Condiments and Spices	5.75	0.89	1.28	2.82
Fruits	1.25	2.94	2.85	2.74
Vegetable	3.72	2.89	1.05	3.07
Total Fruits and Vegetable	3.34	2.90	1.28	3.01
Total Food Crops	1.06	0.57	-0.23	0.47
Oilseeds	3.31	3.00	1.11	1.89
Fibers	-1.53	1.30	-0.21	0.55
Plantation	0.31	6.10	0.31	2.91
Total Horticulture	**3.05**	**3.16**	**1.13**	**2.98**
Total Non-food Crops	0.59	2.69	0.48	1.42
Total Non-food Grain	1.81	2.70	0.91	2.14
NSA	0.31	-0.14	-0.29	-0.12
GCA	0.98	0.88	-0.11	0.61

Source: Authors' calculation

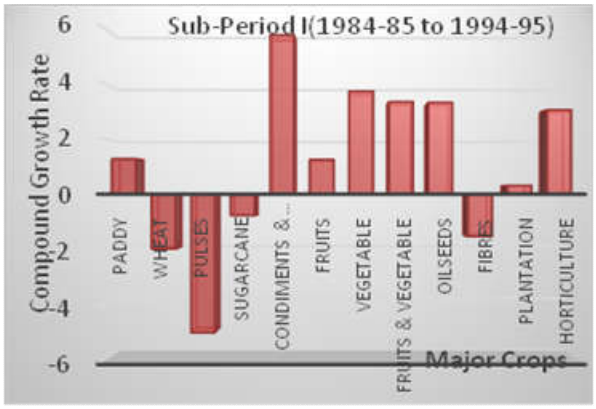

Fig. 5. CGR of different crops during sub-period I

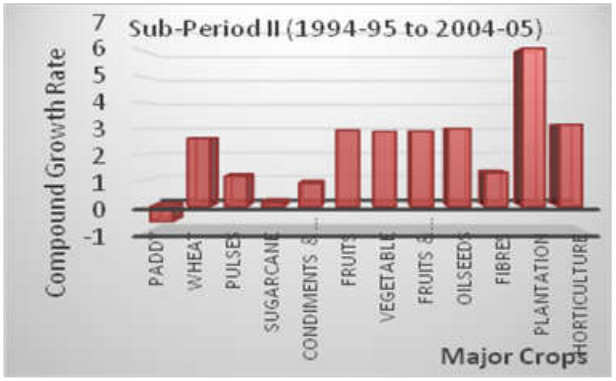

Fig. 6. CGR of different crops during sub-period II

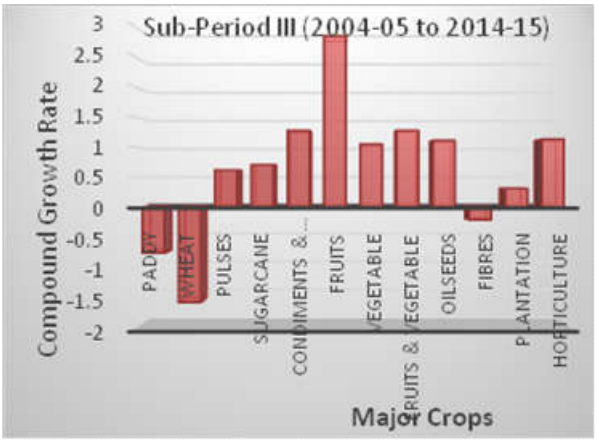

Fig. 7. CGR of different crops during sub-period III

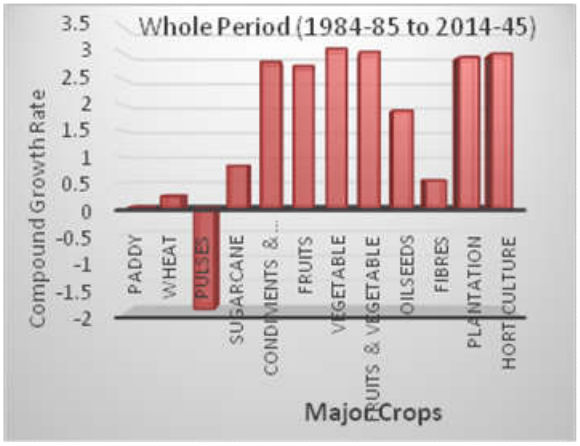

Fig. 8. CGR of different crops during whole period

Table 3. Magnitude of Crop Concentration Co-efficient in West Bengal

Years	Rice	Wheat	Pulses	Oilseeds	Fruits & Vegetables	Fibers	Plantation
TE 1984-85	2.89	0.30	0.38	1.18	2.75	1.27	2.54
TE 1994-95	2.94	0.26	0.23	1.13	2.74	1.25	2.34
TE 2004-05	2.68	0.30	0.20	1.36	2.78	1.28	3.33
TE 2014-15	2.59	0.22	0.21	1.65	3.37	1.29	3.38

Source: Authors' calculation

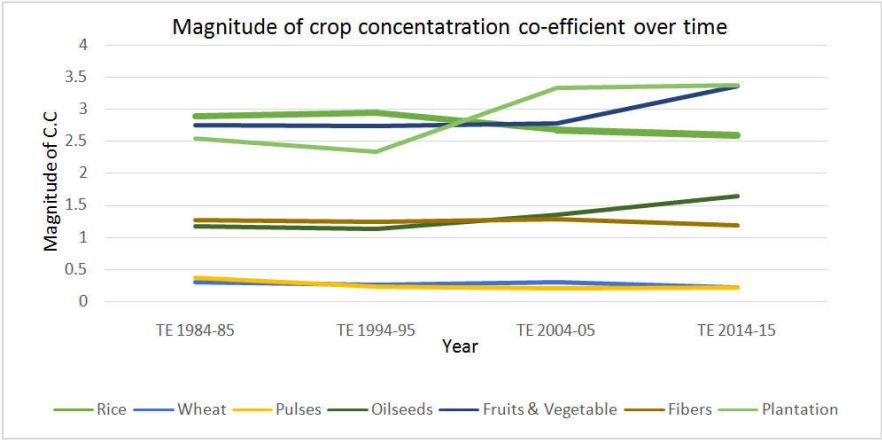

Fig. 9. Magnitude of CC of different crops at different periods

They indicate that growth rate of area under paddy is negative during sub-period II and III whereas the growth rate of area of different horticultural crops are positive.

Crop Concentration: Table 3 indicates that the concentration of fiber (jute), plantation crop, fruits and vegetables are high. The value of C.C of such crops are more than one and is increasing continuously over time. West Bengal agriculture is basically rice dominant agriculture. Even though crop diversification, rice concentration is also high till now in the state. But the magnitude of C.C has shown declining trend. The concentration of other cereal crops like wheat and pulses have been very low. The share of oilseeds area to state gross cropped area and growth rate of area have increased over time in the state. The growth rate and the share of area cultivated indicate that oilseeds is an emerging crop in West Bengal. The magnitude of C.C of oilseeds is also more than one. In Fig 9, the C.C of leading crops are presented graphically. It indicates that the concentration of two food grain crops wheat and pulses are very low; the magnitude of C.C is less than 0.5 in all the periods. The major food grain crop paddy's concentration is still high but magnitude of C.C declining after liberalization. The concentration of oilseeds and fiber are moderately high. The concentration of horticultural crop like fruits and vegetables and plantation is very high and the magnitude of C.C increasing after economic reform. West Bengal agriculture has diversified towards horticulture crops like 'fruits and vegetables' and plantation crops. Diversification is also towards oilseeds and other commercial crop like fiber (jute).

Magnitude of Crop diversification: Results of Crop diversification is presented in Table 4. The value of Simpson's index (increasing)are 0.53, 0.53, 0.60 and 0.63 in TE 1984-85, TE 1994-95, TE 2004-05 and TE 2014-15, respectively. It has increased from 0.53 in TE 1984-85 to 0.64 in TE 2014-15. The values of crop diversification, using other indices like 'HI (decreasing), OI (decreasing), EI (increasing), and MEI (increasing)' also show a similar pattern for all the chosen sub-periods. The magnitude of diversification in first two sub

Table 4. Different Crop Diversification Index at Different Time Periods in West Bengal

Index	TE 1984-85	TE 1994-95	TE 2004-05	TE 2014-15
Ogive Index	4.45	4.45	3.67	3.23
Entropy Index	0.46	0.46	0.49	0.53
Modified Entropy Index	0.42	0.42	0.46	0.50
Herfindahl Index	0.47	0.47	0.40	0.36
Simpson's Index	0.53	0.53	0.60	0.64

Source: Authors' calculation

Table 5. Average Return*(Rs/ha) of different in West Bengal

	Aman Paddy	Boro Paddy	Pointed gourd	Cauliflower	Eggplant
Production(Q)	35	55	145	26000 (N)	106
Return (Rs)	47,410.00	73,920.00	4,61,230.00	2,08,000.00	1,28,280.00

*Data collected from farmers', N = number, Q= quintal

Table 6. Requirement of Labor for crop (per hectare)in West Bengal

Crops	Nursery	Transplanting	Whole Cultivation Process#	Picking	Total
Pointed Gourd	4	15	666	160	845
Cauliflower	5	30	165	110	310
Eggplant	5	30	195	150	395
Jute	5	5	74	221	305
Paddy(aman)	5	25	35	90	155
Paddy (boro)	6	30	50	105	191

#Raising, Frequent Watering, Spraying, Weeding, Hoeing, Staking

during third and fourth sub period. It is clear from the results that the crop diversification is taking place after new economic reform, in the state.

Impact of Crop Diversification on Income and Employment

The high value crops (horticultural crops, jute) are found to be carrying great potential for broadening their income base and provide them employment for more number of days (due to horticulture being labor-intensive crops). Not only there is a direct impact on income and employment by diversification but indirect effects are also present. Increase in the importance of high value crops, especially fruits and vegetables, results in increased development of processing industry that demands labor for packaging, processing and other high value activities(5). In this context, diversification has been taking place in favor of the horticultural crops. It is felt that if the small and marginal farmers diversify into high value crops, they improve their net farm income and employments. There are instances of such impact in West Bengal agriculture.

1Income: Higher profitability is the main driving force for shifting production portfolio in favor of horticultural crops. A study, comparing the returns from vegetable production against cereals and other food grains would throw some interesting observations. The net profit over cost of vegetables ranges from Rs. 5591/ha for radish to Rs. 12094/ha for eggplant. In contrast, the net profit over cost of cereals ranges between Rs 2519/ha for maize and Rs 10384/ha for paddy .It is noted that a majority of the horticulture crops are more profiTable than cereals and other crops (13). The above feature has also been noted in a study by Ramesh Chand, the study shows that during 1980-81 per hectare return of cereals, pulses, oilseeds and cotton was below Rs.10,000 at 1999-2000 prices while sugarcane and condiments and spices provided gross return of around Rs. 33.5 thousand. Fruits and vegetables were far ahead with per hectare value of output at Rs. 86 thousand.

The next two decades witnessed increase in return of all crop groups but absolute gains were much larger for horticultural crops. There is some slowdown in return of all crop groups after 2000-01 but the change is negative for fruits and vegetables. Per hectare return of fruits and vegetables at 1999-2000 prices declined from Rs. 1.12 lakh to Rs 1.04 lakh. Though still fruits and vegetables are about five times more return compared to other crops (3). A study conducted by Bati et.al. in 1994 also shows that the net returns of vegetable (horticulture) crops have been quite higher as compare to the cereal crops. The net returns per hectare from tomato, capsicum, cauliflower production are Rs. 36623, Rs.32875 and Rs.33587, respectively. On the other hand, net returns from cereal crops have remained quite low. Per hectare net return from paddy is Rs.1811 and from wheat is Rs.1299 (1). *The present study intends to show that the horticulture crops generated more income for the farmers compared to cereal. The analysis has been done using data both from secondary and primary sources.* Table 6 depicts thatthe average returns from pointed gourd (around Rs. 4.6 lakhs/ha), cauliflower (around Rs.2.08 lakhs/ha) and eggplant (around Rs. 1.28 lakhs/ha) are much more than gross return from cereal (aman around Rs. 47,000 and boro around Rs. 74,000) in West Bengal at 2015-16 prices. These data are collected from primary survey. Therefore, this study has showed that the average return from horticulture cultivation is much more than that from cereal.

Employments: Agricultural diversification can help in generate additional employment opportunities in rural areas. Besides profitability and market access, the crop preference is largely influenced by the labor supply at the prevailing wage rates. While the smallholders opted for labor intensive crops then the smallholders have comparative advantage in switching-over to more remunerative and labor-intensive crops. Therefore, agricultural diversification may generate productive employment for smallholders (13) Vegetable production as compared to cereal production requires a larger number of operations like nursery, raising, transplanting, frequent

Table 7. Two Stage Least Square Regression Statistics during 1991-92 to 2014-15

	Constant	Diversification (predictor)	Farm Size (Instrumental)	Technology (Instrumental)	Education (Instrumental)
Income (Dependent)					
Coefficient	3.913*	0.979*	-	-	-
t-value	6.616	11.134	-	-	-
S E of the Estimate	0.591	0.997	-	-	-
F Statistic	123.97 (2,22)				
R- Square	0.86				
Adjusted R Square	0.854				
Employment (Dependent)					
Coefficient	20.057*	0.960*	-	-	-
t-value	187.540	10.199	-	-	-
S E of the Estimate	0.107	0.180	-	-	-
F Statistic	104.01(2,22)				
R- Square	0.825				
Adjusted R Square	0.817				

Source: Authors' calculation

watering, spraying, weeding, hoeing, staking, picking etc. Therefore, per hectare labor requirement for vegetable crop cultivation is not only more but is also more evenly distributed throughout the growing period of crop cultivation. In case of cereals, the major labor requirement are during the sowing and harvesting times of the crop (1). Hence, even a slight shift in area from cereal to vegetable crop will give a big boost to labor employment in the region. *In this section, the study analyses the hypothesis that diversification towards horticultural crops and other commercial crops provides more employment opportunities in West Bengal vis-a-vis food grain crops.* Per hectare requirement of labor for horticultural crops cultivation are collected from primary survey[5] which is presented in Table 6. It has clearly indicates that the average labor requirement (per hectare) of horticulture crops like pointed gourd (845), eggplant(395)and cauliflower (310) cultivation is much more than that of cereal crops cultivation. As can be seen from the Table 6 the labor requirement is very high in the cultivation of pointed gourd. The process of its cultivation entails the manual cross pollination which is very labor intensive process. The total requirement of labor per hectare is much higher in case of horticulture cultivation compared to cereals. It has been estimated that one hectare shift in area from paddy to eggplant would generate 200-240 additional man-days. Similarly, one hectare from paddy to cauliflower would generate 120-150 more employment. But in case of pointed gourd it is much more than paddy.

The above discussion clearly demonstrates that diversification towards horticulture crops would generate considerable income and employment opportunities for the farmers, particularly the smallholders.

Results of Two Stage Least Square Regression

This study tries to find the effects of crop diversification on income and employment during post liberalization periods (i.e. 1991-92 and onward) also based on time series data by the help of two stage least square regression (2SLS).In our analysis crop diversification (SI) has been used as a predictor variable whereas farm size, technology and education level have been used as instrumental variable. The 2SLSresults are presented in Table 7. The results show that the predictor variable, i.e., crop diversification has positive influence on both income and employment.

[5]The primary survey was conducted by the authors covering two blocks-Minakhan in North 24 Parganas and Canning II in South 24 Parganas in state of West Bengal. The detailed results may be obtained from the authors.

The magnitude of coefficients are very high in both cases. These results are highly significant. The regression results are at 1 percent level of significance. Therefore, we can summarize that crop diversification practices help to raise farmers' income as well as employment opportunity more than that in traditional farming.

Conclusion

The study reveals that the share of major crops like paddy, pulses and wheat have decreased over the years in the state. However, share of minor crops like oilseeds, fiber (jute), condiment and spices, plantation crops, fruits and vegetable have increased over the years. This shows that state is moving towards crop diversification rather than specialization. Based on the compound annual growth rate of area of crops, it is evident that major crops like paddy, pulses and wheat have grown negatively and minor crops like oilseeds, condiment and spices, plantation crop, fruits and vegetable have grown positively over the years. The magnitude of crop diversification indices indicate that diversification has taken place over the years. Hence, it can be concluded from the study that crop diversification has been taking place in the state over the years. After diversification, horticultural crops like fruits and vegetable, plantation, oilseeds and commercial crop (fiber) are emerging crops in West Bengal agriculture. The magnitude of paddy concentration is declining over time even though paddy concentration is high in West Bengal. The main factor underlying the diversification is in favor of horticultural crop like fruits and vegetables, plantation crops etc. have witnessed higher returns relative to food grain crops and per hectare employment generation of horticulture cultivation is much higher than cereal and pulses. This showed that crop diversification toward horticulture has positive and significant impact on farmers' income and employment. It can be inferred that farmers who are more diversified towards horticulture have more income and more employment than the others. Thus, crop diversification toward horticulture should be promoted in the state for improving the well-being of the farmers.

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REFERENCES

Bati, Jagadish P & Sing, Ranveer.1994.*Change in Population, Labour Force and Land use in Himachal Pradesh: A Strategy for Sustainable Agricultural Development in Hilly Area,* Development Planning for Agriculture Polices Economic Application, edited by Jagdish Prasad &Arvind Prasad, Mittal Publication, New Delhi..

Birthal, Pratap S., Digvijay, Negi S. and Roy, Devesh. 2017. *Enhancing farmers' income: Who to target and how?* Policy Paper No. 30, ICAR – National Institute of Agricultural Economics and Policy Research, New Delhi.

Chand, Ramesh.,Raju, S.S. and Pandey, L.M. 2008. Progress and Potential of Horticulture in India, *Indian Journal of Agriculture of Economics,* Vol. 63, No.3.

Chand, Ramesh. 2017. *Doubling Farmers' Income, Rationale, Strategy, Prospect and Action Plan*, NitiAyog, National Institution for Transforming India, New Delhi.

Deshpande, R. S., Mehta Pradeep and Shah Khalil. 2007. Crop Diversification and Agricultural Labour in India, *The Indian Journal of Labour Economics,* Vol. 50, No. 4.

Dutta Upma, Dogra Julie, Srivastava, J.N. and Kumar, Rakesh. 2011. Diversification in Agriculture : Opportunities and Strategies in India, Diversification in Agriculture, *RashtriyaKrishi*, Vol. 6, No. 2 , pp.50-51.

Eveline, S., Van Leeuwen, Dirk Strijker and Ida J. Terlui. 2010. Regional Concentration and Specialisation in Agricultural Activities in EU-9 (1950-2000), *European Spatial Research Policy*, Vol. 17, No.1. downloaded 06/04/17-11:25.

Government of India. 2017. Horticulture -Statistical Year Book India 2017, Ministry of Statistics and Programme Implementation, GOI.

Govt. of India, Land Use Statistics at a Glance - State Data, Directorate of Economics & Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, GOI. Different Issues (1990-91 to 2014-15).

Govt. of West Bengal, Estimates of Area & Production of Principal Crops in West Bengal, Evaluating Wings, Directorate of Agriculture, Govt. of West Bengal, Different Issues (1990-91 to 2013-14).

Gujarati, Damoder N.1992. *Basic Econometrics*, McGraw Book Company, New York, p.169.

India Population-2017. Population of West Bengal- 2017 http://indiapopulation2017.in/population-of-west-bengal-2017.html

Joshi, P.K., Joshi, Laxmi and Birthal, Pratap S. 2006. Diversification and Its Impact on Smallholders: Evidence from a Study on Vegetable Production, *Agricultural Economics Research Review*, Vol. 19, pp. 219-236

Velavan, C. and Balaji, P. 2012. Crop Diversification in Tamil Nadu-A Temporal Analysis, *Agriculture situation in India*, Vol. 78, No 12, pp. 655-658.

Wooldridge, Jeffrey, M. 2012. Instrumental variables and two stage least squares, Chapter 15, *Introductory Econometrics: A Modern Approach*, Fifth Edition, 2012. http://fmwww.bc.edu/ec-c/F2003/2/EC228.s2003.nn15.pdf

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