

## CROP DIVERSIFICATION OF BIRBHUM DISTRICT: A SPATIO TEMPORAL ASSESSMENT

Surajit Let\*

### Abstract:

For balanced agricultural development, agricultural diversification is necessary in the technologically backward countries like India. Entropy and Berry's measure values of crop diversification in the Birbhum district about 0.37 and 0.32 respectively but that is quite low in west Bengal ( $DI_E=0.48$  and  $DI_B=0.49$ ) in 2006-07. This is found in great disparities in inter block administrative units. Miserable backwardness of agricultural diversification in different blocks is because of hydro-physical, economic barriers, lack of cultural motivation and pro-active and post harvesting technological supports with associated cultivation technologies. The lop sided tendency of rice mono culture due to ignorance about the need of agricultural diversification is basically responsible for such situation. This paper tries to attempt a spatio-temporal study of crop diversification in Birbhum District of West Bengal.

**Key Words:** *Technology, Monoculture, Economy, Irrigation, Development*

### Introduction:

In the Third World Countries like India, where man-land ratio is high enough, agricultural diversification especially in term of crop diversification is very much necessary. At the same time, Indian agriculture is the gamble of monsoon i.e., to get rid of from helpless dependency on seasonal monsoon rainfall, irrigation facilities – one of the most efficient infrastructure technological aids is earnestly required so that agricultural economy is established in the strong relative platforms. If different High Yielding Verities (HYV) of seeds, proper fertilization, automation in agriculture, information, banking facilities are dully provided according to justified pattern of land use, agricultural diversification is possible to achieve.

In India, through declining over the years, agriculture with a 19.8% contribution to the Gross Domestic Products (GDP) still provides livelihood support to about two thirds of the country's population. (San, & Pathak, 2007). The sector provides employment to 56.7% of the country's work force and is the single target private sector occupation. So, proper nutrition should be provided to this sector even up to micro level to dynamically stabilize the agricultural economy. Crop diversification with the aid of proper technological guidance is to be a good approach to sustain the economy.

But due to severe paucity of seasoned harmony of different technological modes, inadequate of different acknowledgement abut justified crop chart, lop sided tendency to have involved in rice monoculture collectively have given a miserable decelerating status of crop diversification to W.B. where the picture is too miserable in Murshidabad district.

### Location:-

Birbhum district is one of the largest districts in W.B. carrying 4545.00 sq. km. of geographical area and is located in the western part of West Bengal. The absolute location of this district is ranging from  $23^{\circ}32'30''N$  latitude to  $24^{\circ}35'0''N$  latitudes and from  $87^{\circ}5'25''E$  to  $88^{\circ}01'40''E$  longitude (Fig. 1).

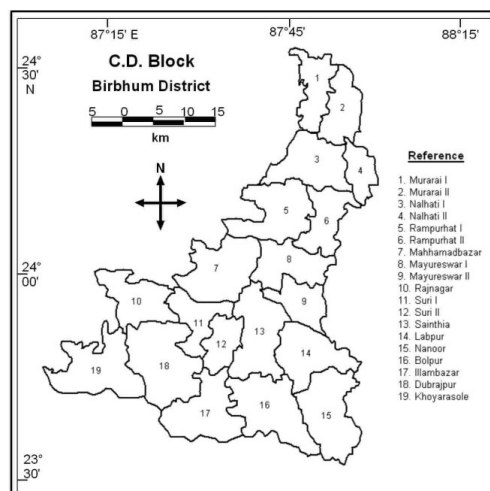


Fig. 1

\* Research scholar, Dept. of Geography, Visva-Bharati, Santiniketan, West Bengal

#### **Geo-economic condition of the study area:-**

Birbhum, studded with bushy shrubs offers an undulating landscape and physiographically it is an adjacent to the plateau fringe of Chottanagpur. The region is a dual blend of rolling plateau made up of laterite and gangetic alluvial plains, which is highly conducive for cultivation. Hence the economy of the district is mainly agriculture based and about 3,329.05sq.km. of land is cultivated here. The dry weather of Birbhum is highly adverse to the agriculture therefore the irrigation projects have been undertaken to induce the agricultural development which is the backbone of the rural economy.

As most of the land is dry and the rivers are only rainfed, the agriculture is supported neither by rain nor by rivers during non monsoon period. Hence irrigation is the only way out of this problem. Land with irrigation facilities in 2001-02 was 2763.9 sq. km. Rice is the major crop, cultivated here. Apart from rice, legumen, wheat, corn, etc are also produced. In recent times, the government has opened up a number of avenues for the expansion of horticulture, thereby making it an important source of the gross income of the district.

#### **Objectives of the study:-**

- i. To examine spatio-temporal pattern of agricultural diversification in the district.
- ii. Relational analysis between technological status and crop diversification prioritizing irrigation facilities.
- iii. Comparative stratigraphic analysis of crop diversification of West Bengal and Birbhum in temporal fashion.

#### **Database and Methodology:-**

The work is mainly based on secondary data, obtained from Statistical Abstracts, Govt. of India, and Centre for Monitoring Indian Economy Govt. of West Bengal, Agricultural Development Office of Birbhum district.

Simple statistical tools have been used to analyze the data. To estimate the level of crop diversification Hart's Entropy Index and Berry's Index have been used. Two indices have been computed to measure the extent of diversification, viz.

- i. Berry's Index (DIB) based on Berry(1971) and
- ii. Entropy Index(DIE) as suggested by Hart(1971)

DIB is computed by using the equation  $DIB = 1 - \sum P_i^2$

DIE is computed by using the formula

$$DIE = \sum [P_i \times \ln (1/P_i)]$$

Where  $P_i$  stands for proportion of area under the  $i$  th crop at time point.?

DIB or DIE is expected to increase in the extent of diversification and vice-versa.

$DI_B$  is computed by using the equation  $DIB = 1 - \sum P_i^2$

DIE is computed using the formula  $DI_E = \sum [P_i^2 \times \ln (1/P_i)]$

Where,  $P_i$  stands for proportion of area under the  $i^{\text{th}}$  crop at time point  $t$ .

$DI_B$  or  $DI_E$  is expected to increase with increase in the extent of diversification and vice-versa.

Actual degree of diversification to maximum diversification possible for a given number of crops is measured for Berry's Index as  $DI_B/[1-(1/n)]$ , while for Entropy Index as  $DI_E/\ln(n)$  More the Entropy or Berry's measures value expected is the result or otherwise.

#### **Status of Crop Diversification in Birbhum District, West Bengal:**

The main crop of West Bengal is rice which carries more than 60 per cent of the Gross Cropped Area. But, tendency of rice dominance has increased to some extent since 1994-95 to 2006-07 because rice covered area has increased

from 67% to 70% (table 1). Therefore, no significant change is happening for areal proportion occupied by other crops.

Table 1: Gross Area (G.A.) and percentage of gross area under different crops in West Bengal. (in thousand hectares)

Crops	1994-1995		2000-2001		2006-2007	
	G.A.	%	G.A.	%	G.A.	%
Rice	352.5	85.25	318.2	76.32	383.4	77.74
Wheat	15.1	3.65	26.9	6.45	31.7	6.43
Pulses	9.3	2.25	20.2	4.84	20.7	4.19
Oil seeds	27.4	6.63	37.4	8.97	38.3	7.76
Jute	0.3	0.07	0.1	0.02	0.4	0.08
Sugarcane	1.6	0.39	0.8	0.19	1.5	0.30
Potato	6.9	1.67	12.8	3.07	16.5	3.34
Dry chilly	0.4	0.09	0.5	0.12	0.7	0.14
Gross Cropped Area	413.5	100	416.9	100	493.2	100

Source: i. Directorate of Agriculture, Govt. of West Bengal  
ii. Bureau of Applied Economics and Statistics, Govt of W.B.

Table 2: Gross Area (G.A.) and percentage of gross area under different crops in W.B. (in thousand hectares)

Crops	1994-1995		2000-2001		2006-2007	
	G.A.	%	G.A.	%	G.A.	%
Rice	5773	67.63	5435	59.61	5687	70.25
Wheat	326	3.82	544	5.96	350.6	4.33
Pulses	227	2.66	259	2.84	219.6	2.71
Oil Seeds	531	6.22	599	6.57	703.4	8.69
Jute	508	5.95	613	6.72	594.9	7.35
Sugar Cane	11	0.13	22	0.24	16.6	0.21
Tea	100	1.17	108	1.18	114.8	1.42
Potato	232	2.72	300	3.29	407.9	5.04
Dry Chilly	54	0.63	62	0.68	NA	-
Gross Cropped Area	8536	100	9117	100	8094.8	100

Source: i. Directorate of Agriculture, Govt. of West Bengal  
ii. Bureau of Applied Economics and Statistics, Govt of W.B.

In case of entire Birbhum district, the trend of rice concentration is similar but the intensity is quite less. Here, percentage of rice covered area is more than 85% and with time, the percentage is gradually declining. In 2000-01 calendar years the percentage proportion of rice covered area was dropped down to 76.32 %. Massive flood was recorded just at the commence period of the same year which probably damaged the rice pre-field and the infant rice crop. To compensate this kind of loss, farmers intensively practiced other crop culture after flood phase. The increase of areal proportion to other crops from 3% to 5% provides evidences in favour of the above statement. The comparative pattern of crop diversification between West Bengal and Birbhum district gives some clear result i.e. degree of crop diversification is gradually increasing both in Birbhum district in particular and West Bengal as a whole as per Entropy Index since 1994-95 to 2000-01, but it again declined in 2006-07. The rate of diversification is comparatively large in West Bengal than Birbhum district (table 3). In 2006-07 the rate of diversification is only 40.42%. It is because of large scale attention of people toward rice cultivation both during monsoon and pre-monsoon times.

**Table 3: Comparative Pattern of the extent of crop diversification among West Bengal and Birbhum district during different years.**

Crops	1994-95		2000-2001		2006-2007	
	W.B.	Birbhum	W.B.	Birbhum	W.B.	Birbhum
Entropy Measures	0.44	0.27	0.50	0.39	0.48	0.37
Degree of Diversification	46.3	30.16	52.4	43.04	53.36	40.42
Barry's Measures	0.53	0.27	0.63	0.40	0.49	0.32
Degree of Diversification	59.9	30.86	70.9	45.95	55.79	36.57

Source: Calculated by Researcher

**Block Wise Status of Crop Culture in Birbhum District:**

Inter block variation of areal crop share is significant in Birbhum district. Out of 19 blocks, 15 blocks are characterized by rice dominance where areal proportion is more than 70%. Some blocks like Md.Bazar, Dubrajpur, Rajnagar, Suri-I, Suri-II, Bolpur-Sriniketan, Labpur, Ilambazar etc. are highly concentrative in rice mono culture where the areal proportion is more than 80%.

**Table 4: Gross area under different crops in different blocks of Birbhum district. 2006-2007(Area in hectares)**

Name of Block	Rice	Wheat	Pulses	Oil Seeds	jute	Potato	Gross Area
Nalhati-I	21442	3188	2684	2372	-	1286	30972
Nalhati-II	12293	3544	743	2417	-	492	19489
Murarai-I	16648	2637	2864	3103	61	886	26199
Murarai-II	20010	3626	2453	2134	12	208	28443
Mayureswar-I	20762	1477	1276	2325	236	1143	27219
Mayureswar-II	13425	1105	1234	1763	27	2614	20168
Rampurhut-I	22471	1850	1483	2290	-	77	28171
Rampurhut-II	21288	2399	1716	3448	-	715	29566
Md.Bazar	21514	1679	527	1643	-	1022	26385
Sainthia	28492	2293	539	2102	12	2551	35989
Dubrajpur	23658	960	321	901	-	706	26546
Rajnagar	12451	305	126	343	-	135	13360
Suri-I	9230	433	342	766	-	315	11145
Suri-II	13557	250	235	946	1	319	15308
Khoyrasol	17879	1689	331	1209	-	442	21550
Bolpur-Sriniketan	26394	1225	908	2097	-	1045	31669
Lavpur	28317	946	620	2286	-	1031	33200
Nanoor	30720	1396	774	4949	4	1084	38927
Ilambazar	22855	699	503	880	-	466	25403

Table 6: Level of agricultural diversification

Name of the block	Entropy value	Degree of diversification in %	Berry's Measures	Degree of diversification in %
Nalhati-I	0.45	64.05	0.50	61.88
Nalhati-II	0.47	66.91	0.55	68.94
Murarai-I	0.50	63.75	0.56	67.09
Murarai-II	0.42	53.28	0.48	57.08
Mayureswar-I	0.39	49.82	0.40	48.47
Mayureswar-II	0.47	60.69	0.53	63.08
Rampurhut-I	0.32	45.61	0.35	43.75
Rampurhut-II	0.41	58.77	0.46	57.19
Md.Bazar	0.31	44.65	0.33	40.68
Sainthia	0.34	43.47	0.37	43.86
Dubrajpur	0.21	30.28	0.20	25.31
Rajnagar	0.15	20.90	0.13	16.26
Suri-I	0.29	41.88	0.30	38.06
Suri-II	0.21	27.45	0.21	25.32
Khoyrasol	0.29	41.02	0.30	37.7
Bolpur-Sriniketan	0.29	41.76	0.29	37.21
Lavpur	0.26	37.48	0.27	33.21
Nanoor	0.32	41.61	0.36	43.03
Ilambazar	0.20	28.64	0.19	23.49

Table 7: Entropy value zoning

Category	Entropy Value	No. of Blocks	Name Of the Block	Area in Sq. Km.	% of Area
Low	<40	5	Dubrajpur, Rajnagar, Suri-2, Lavpur, Ilambazar	1231.68	27.10
Moderate	40-60	10	Murarai-2, Mayureswar-1, Rampurhat-1, Rampurhat-2, Md Bazar, Sainthia, Suri-1, Khoyrasol, Bolpur-Sriniketan, Nanoor	2622.38	57.70
Good	60-80	4	Nalhati-1, Nalhati-2, Mayureswar-2, Murarai-1	690.94	15.20

Crop diversification rate varies from 20% to 67% as per the calculation of Entropy index. Crop diversification rate as per Berry's measures varies from 16% to 69% in entire district (Table 5). Rajnagar, Suri-II, Dubrajpur, Ilambazar and Labpur have very least crop diversification rate because Rajnagar, Suri-II, Dubrajpur, Ilambazar are physiographically quite rough plateau fringe with unfertile stony and sandy soil. Irrigation scarcity and agricultural aids are so challenging that create barrier against non monsoon cultivation of varieties of crops. Labpur block is very fertile area and water is available through irrigation from deep tube well and rivers like Mayurakshi, Kopai etc. On

the other hand, there are four blocks e.g. Nalhati-I, Nalhati-II, Murarai-I and Mayureswar-II where crop diversification rate is high (>60%) because of greater canal irrigation density. About 50% of the total blocks have moderate rate of crop diversification as per the calculation of Entropy index (Table 7).

Low level acknowledgement about scientific, profit making land use, frequent flood during monsoon period, lack of proper information services, inheritance traditional perception of agriculture are mainly responsible to have such feel bottom interest for agricultural diversification.

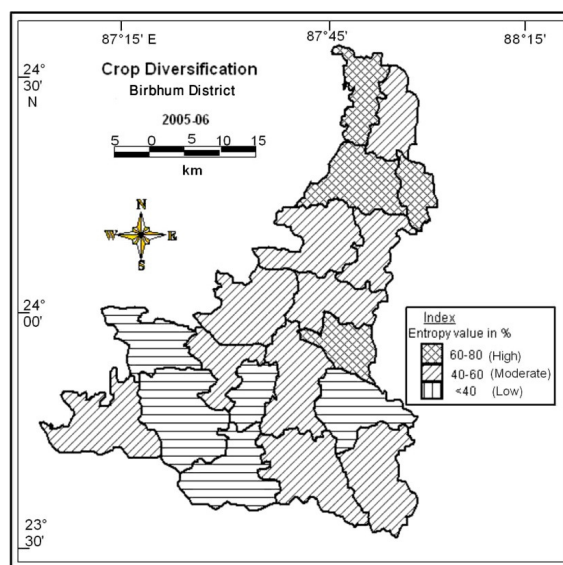


Fig. 2

### Results and Analysis:

1. In most of the periods, the rate of crop diversification both in terms of Entropy measures and Berry's measures is fairly low in Birbhum district than the average value of state level (West Bengal).
2. In case of state level, the rate of crop diversification has increased from 1994-95 to 2000-01 i.e. from 46.3% to 53.36% as per the degree of diversification calculated from entropy measures. There is same trend in case of the degree of diversification values calculated from Berry's measures.
3. In case of district level scenario, the picture is quite different. Here, the degree of diversification value has increased from 30.16% to 43.04 % from 1994-95 to 2000-01 and again it has reduced to 40.42 % in 2006-07. The significant decline of crop diversification is probably due to massive flood aftermath in this area.
4. Physical landscape has distinct impact on crop diversification, relatively plateau areas record low crop diversification but it is quite high in plain area. Similarly, socio-economic condition, literacy rate etc. have clear cut impact on crop diversification in Birbhum district. The western part of the district is characterized by such collective impact of bare topography, land and soil erosion and mass illiteracy and economic backwardness.

Therefore efforts should be paid to achieve greater degree of crop diversification in this district. Diversification of crop chart from food grain to high value products like varieties of vegetables, oil seeds, jute etc. should be implemented. With increase in the number of middle class people and rise of per capita income, the extent of diversification in the diet basket is expected to be enhanced further. If diversification is fully possible, this district will also expect to be a rich granary for different crops inspite of having physical or socio-economic barrier.

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