

Crop Diversification as a Policy to Alleviate Rural Poverty in Birbhum District, West Bengal

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Abstract

Increasing agricultural production and ensuring food security has been the key concern for agricultural growth in the last five decades or so. The diversification of crops plays an important role in ensuring food security, adequate nutrition, and health among poor households. In the study area, it is trying to analyze the crop diversification as a measure to eradicate poverty among the rural household. To assess the present study required data collected from the Census of India-2001 and 2011, District Statistical handbooks, 2008 and 2014. The magnitude of crop diversification in north and eastern C.D. blocks are more complex than those of the other division in Birbhum. With the assistance of crop diversification, the existing market infrastructure, road networks, irrigation systems that are currently the key constraints and can be revitalized to build strong infrastructure can help reduce poverty. The diversification of crops has a tremendous potentiality to grow people's income in rural area creating jobs and earnings sources. The government may come forward and have to build adequate infrastructure to eliminate poverty at local level.

KEYWORDS : Crop diversification; poverty; Birbhum district

Introduction

From the 1970s, poverty reduction was at the top of the international debate (Feliciano, 2019). Since then, poverty analysis in rural areas has become a well accepted issue for the researchers. People in developing countries who are mostly dependent on agriculture for their livelihood are usually much poorer than other sectors.

United Nations has assess that every day about 25,000 people die of starvation or hunger-related causes that are translated every three and a half seconds into one person. Sorry to mention, it's children it's children who die most a lot. The report of Talukdar Committee report is used to measure the goods and services instead of measuring people's calorie intake to calculate poverty. A new approach has been taken for drawing the 'poverty line' resulting in a rise of people living below the poverty line in India, from 27.5 percent to 37.2 percent, i.e. a 10 percent rise since 2004-05.

The Below Poverty Line (BPL) estimation has been a controversial topic for quite some time. Abhjit Sen a member of Union Planning Commission (UPC) opined that if per day per capita calories intake in rural area is 2400 kcal and in urban area 2100 kcal per person per day subsequently 80 percent of the rural households and 64 percent of the urban households living under below the poverty level.

Poverty is one of the most contemporary societal problems particularly in India. Nearly about 80 percent of poor people live in rural India. In West Bengal, nearly

19.98 per cent inhabitants are living under the poverty line. Most of the poor people in rural India mainly depend upon agriculture. Agriculture plays an important role in India. Single monoculture has as well made the farming performance multifaceted and costly. Single monoculture has also made the farming performance multifaceted and dear. As a result, it decreases the cultivator's net margin that leads the cultivators to urge reluctant to cultivating and permit them to urge curious about non-agriculture activities that are an immeasurable worry for West Bengal in term of food security. Due to high transportation costs, poor infrastructure and the remote rural areas, many rural people are forced to consider on their farm-auctions or locally produced crops to satisfy their nutritional needs. Under these conditions, crop diversification is often a crucial to reduce food insecurity in rural India.

To reduce poverty-related problems crop diversification is one among the main feature. "It's also seen as an impactful alternative to the use of limited land and precious water resources, making agriculture productive and environmentally sustainable. The diversification of crops is thus seen as a commonly recommended method of agricultural development and rural advancement" (Vyas 1996; Acharya, 2011; Pingali and Rosegrant, 1995). "It provides significantly high crop returns by minimizing the cost and production uncertainty generated by climate fluctuations and agricultural product market volatility. Often, it also provides higher efficiency of labor, maximizes resource utilization, and effectively utilizes the land" (Mukherjee, 2012; Ashfaq et al. 2008; Mehta, 2009). Diversification of crops is an absolutely essential mechanism for health and nutrition safety, revenue growth, alleviating poverty, and job generation. Accordingly, crop diversification may be a socially beneficial practice.

Literature review

Crop diversification plays a big role to make sure food security, proper nutrition, and health among poor households. A study was conducted in 52 developing countries where 89 out of 208 agricultural projects like vegetable cultivation on rice bunds, home gardening growth with vegetable, trees or other crops, fish farming in the paddy fields, cows for dairy and trees in farm shows an increase of per hectare food grain production (Pretty et al., 2003). The influencing capacity of crop diversification over food production is very high and it also determined successfulness of any implemented project. The influencing capacity of crop diversification over food production is extremely high and it also determined successfulness of any implemented project. Ensuing to apply crop diversification scheme, It is observed that on an average increasing of 93 per cent more food production per hectare of its previous periods by applying this method.

Malawi a country of East Africa reveals that "there is a positive correlation exist between crop diversification and people's diversified dietary" (Snapp and Fisher, 2015). The author found that "a unit changes in average numbers of intercrop food grains per maize farm, the household diversified dietary score was increased by 2 percent from its actual and so increase of one unit of non-maize production was associated with 1 percent of the increase in the household food consumption score". In Zimbabwe, a big direct correlation observed between crop diversification, food security, and nutrition indicators (Makate et al., 2016).

In West Africa, households having diversified vegetables production have 40 percent more food security as compared to the people with farming and households with farming activities like crops with livestock were 59 percent more food secure life as compared to those households with extensive, diversified and farming (Douxchamps et al., 2015).

Emana et al. (2015) observed that about 65 percent of the major vegetables are sold to the local market and a few proportion of the produced vegetables was consumed by the family members in humid regions of tropical Ethiopia during the study. It has been observed by the authors that “households investing their income (that coming from selling vegetables) for purchasing foods with vitamins, minerals to satisfy the required nutritional requirement.

Mukherjee narrated in his research that “per day per capita calorie intake has an inverse relation with crop diversification in West Bengal” (Mukherjee, 2015). It's estimated that places with inadequate irrigation water don't facilitate intensive irrigation-based subsistence agriculture as a result people produce high-value cash crops under diversified cropping pattern to sustaining their families which determined the financial condition of the poor and marginal farmers and it's very difficult for them to interrupt the vicious circle of poverty and malnutrition.

To assess the impact of crop diversification on gender equality, it's obvious to estimate the impact of crop diversification over food security ascertained by Dolan and Sorby (Dolan and Sorby, 2003).

Teclwold has tried to establish that in Ethiopia implementation of recent technologies (like high yielding maize seeds) and diversified cropping strategy increases the stress of average women work participation on agricultural sectors. It's suggested that it's going to adversely affect the high percent of households because it diverts significant proportion of time from household cooking and childcare (Teclwold et al., 2013).

There are six policy interventions major components that determined the implementation of crop diversification in any region. These are transports and market facilities, availability of irrigation water, size of land holdings, chronic poverty and rights related to land and water.

Mukherjee in her article described that a region with proper transport and market facilities, developed infrastructure make sure the abundance of agricultural inputs at reasonable prices promote diversification in crops and even have the power to sell the agricultural products at a remunerative price, and that ultimately helps to alleviate rural poverty (Mukherjee, 2015).

Extensive irrigation facilities have a positive relation with crop diversification in India which helps to increase net income. The purchasing power and consumption level are also associated along with these two variables. In compare to the districts with the developed transport system and irrigation facilities, the under developing region having an adverse condition to construct irrigation facilities, transport system, small landholdings (less than 0.5 and 0.5-1 hectares) were expected to supply more crops like fruits, jute, fibers, and oilseeds for fulfilling their cash needs (Mukherjee, 2015).

Study Area

The district of Birbhum lies between 23° 32' 30" and 24° 35' 0" north latitudes and between 87° 05' 25" and 88° 01' 40" east longitudes (Figure 1). It is the northernmost district of Bardhaman division. The district is bounded on the north and west, by the district of Jamtara, Dumka and Pakur districts of Jharkhand, on the east by the districts of Murshidabad and Purba Bardhaman and on the south by Paschim Bardhaman and Purba Bardhaman from which is separated by the Ajoy river (figure-1). The average annual rainfall is 1131 mm while the maximum and minimum temperatures are 45° and 7° Celsius. The district contains 19 Community Development blocks, 2242 villages, 6 Municipal towns and 14 census towns. According to 2011 census, district has a total population of 35,02,404 of which rural and urban constitute 30,52,956 (87.17 %) and 4,49,448 (12.83 %) respectively, with an area of 4,545 km² having a density of 777 persons per km². According to 2011 census, 38.02 per cent is returned as workers. Of the total workers, Cultivators and agricultural labourers constitute 17.07 and 49.92 respectively. The scheduled caste and scheduled tribes account 33.84 and 7.94 respectively. The total cropped area is 7,27,010 ha where as irrigated area to Cultivated area accounts 74.46 per cent. The overall literacy of the district is 70.9 per cent .

Birbhum is a part of the *Rarh* area and the landscape is very much akin to the *Rarh* areas of Bankura and Medinipur. The western portion of the district is descent from the Chotonagpur Plateau to south and south east (Mondal et al., 2018). Almost the entire district, the land surface is broken by a succession of undulations. To the south and southeast the river valleys become shallow and gradually merge into the broad alluvial plains of the Gangetic Plains. The western upland ridges are covered with low *Sal* forests. The general slope of the district is from northwest to southeast. The district is well drained by the Mayurakshi and the Ajoy rivers along with other numerous streams. The district has geological structures of recent, Pleistocene, Jurassic – Cretaceous, Carboniferous-Permian and Archaean times. The soils found in the district are Aqualfs - Ustalfs, Aqualfs – Othents, Aqualfs – Fluvents – Aquepts, Aqualfs – Ochrepts – Fluvents, Aqualfs – Ochrepts – Aquepts, Fluvents – Aquepts – Aqualfs (Figure-2).

On the basis of its physio-geographic considerations, the district has been divided into 4 sub-micro regions. These are Nalhati Plain, Brahmani-Mayrakshi Basin, Suri-Bolpur Plain and Bakreswar Upland (Figure-3).

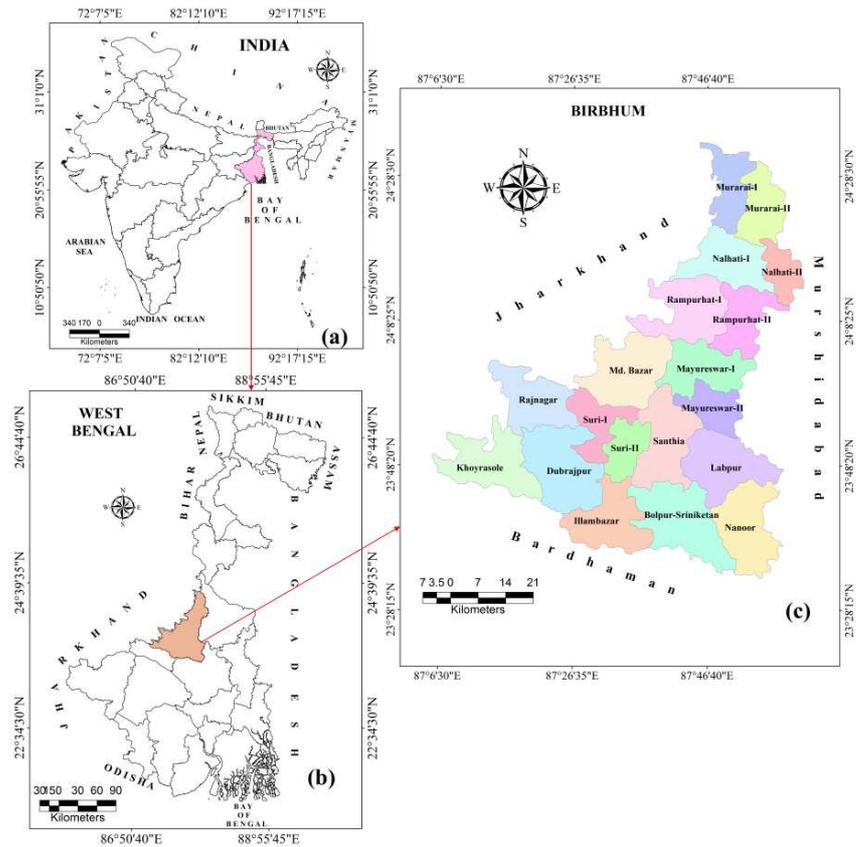


Figure 1: Location map: (a) India, (b) West Bengal, (c) Birbhum District

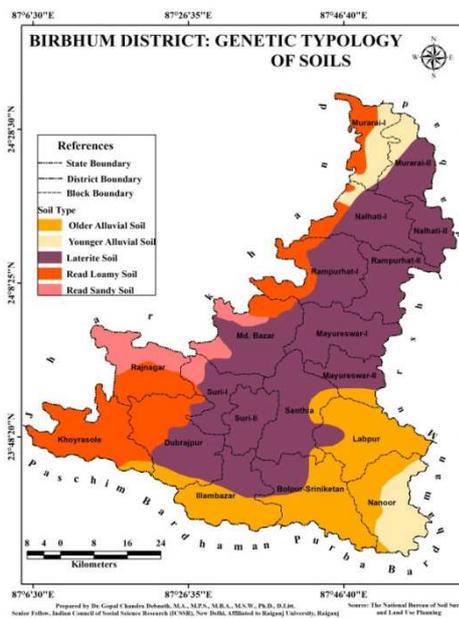


Figure 2: Soil map of Birbhum district

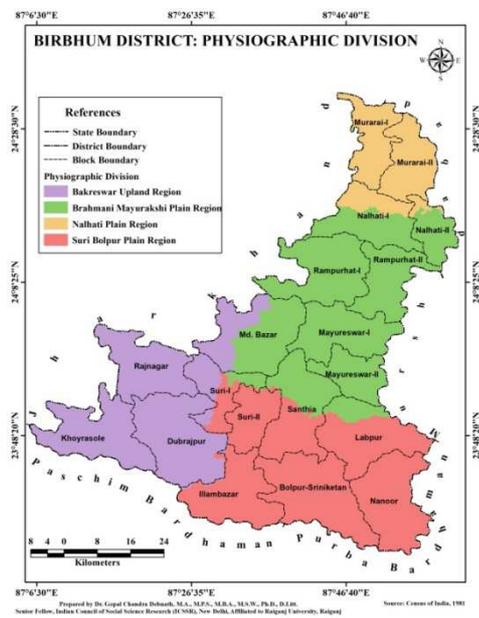


Figure 3: Physiographic division of Birbhum district

Data Source and methodology

The study area of crop diversification in Birbhum district is based on secondary data obtained from the following official sources:

1. Census of India-2001, District Census handbooks, Birbhum district, selected tables
2. Census of India-2011, District Census handbooks, Birbhum district, selected tables
3. Data on area and crop production by Community development Blocks for 2008 and 2014 from District Statistical Handbook, Bureau of Applied Economics and Statistics, Government of West Bengal.

Population projection for 2018 is calculated applying exponential growth rate during 2001 and 2011. The area and crop production for 2018 has been calculated by applying linear growth rate during 2004-05 and 2013-14. After suitable processing, these data have presented in tables, graphs and diagram and maps.

The extent of crop diversification at a given point in time may be examined by using different indices namely, (1) Herfindahl Index (HI), (2) Simpson's Index (SI), (3) Ogive Index (OI), (4) Entropy Index (EI), (5) Modified Entropy Index (MEI), (6) Composite Entropy Index (CEI) etc. Among these indices, the Simpson's Index (SI) has been used for agricultural diversification.

Simpson Index (SI) is defined as the differentiation between one and sum of squares of all the proportion of farm acreage involved in a particular project. The index is represented as:

$$SI = 1 - \sum_{i=1}^N p^2$$

Where

$$P = \sum_i^n a_i/A$$

a_i = area of a particular crop in a given year and A is annual gross cultivated area (equal to the sum of all crop areas in all seasons). The value of the SI ranges between zero to one, denoting zero for perfect specialization, and one for perfect diversification.

Apart from these, various software as MS Word, MS excel and mapping software like Arcgis10.5 (evaluation copy) and open source GIS software QGIS have been used for this study.

Result and Discussion

Spatial pattern of Crop diversification

The average does not provide a entirely realistic image. It conceals many areal dissimilarity. Even a broad inter-block assessment regarding crop diversification reveals a range from 0.12 to 0.84 score point crop diversification index in 2018 (table-1 and figure-4) in Birbhum district. It is observed from table-AA that eight C.D blocks which are lying below the district average while rest 11 CD blocks are above the average (0.53) in 2018 while in 2008 it was 0.44 CDI. It tells that about 18.6 per cent increased during the period of 2008 and 2018.

It is revealed from table-1 and figure 4 that how far the changing status of crop diversification index lies from 2008 to 2018. In 2008, Rajnagar and Khoyrasole blocks were in low position. But in 2018, Rajnagar C.D,block has moved to moderate

position and Khoyrasole in high position. Moreover, Khoyrasole, *Dubrajpur*, *Suri-II*, Labpur, Murarai-I, Murarai-II, Nalhati-I and *Mohammad Bazar* blocks have moved to high and very high position in 2018 which were in moderate position in 2008. On the other hand, Rampurhat-I, Rampurhat-II, Suri-I and *Bolpur-Sriniketan* blocks came in low position in 2018 which were in moderate and high position in 2008. This is due to the practice of rice based monoculture in these C.D.blocks..

Table-1: Distribution of Crop diversification Index, 2008 and 2018

Blocks	Crop diversification 2018	Crop diversification 2008
Suri-I	0.12	0.4
Rampurhat-I	0.21	0.34
Bolpur-Sriniketan	0.29	0.44
Rampurhat-II	0.32	0.54
Rajnagar	0.39	0.04
Mayureswar-I	0.4	0.46
Illambazar	0.41	0.46
Sainthia	0.48	0.5
District Average	0.53	0.44
Mayureswar-II	0.54	0.63
Labhpur	0.55	0.51
Nanoor	0.56	0.5
Nalhati-II	0.62	0.6
Khoyrasol	0.67	0.28
Dubrajpur	0.68	0.33
Suri-II	0.71	0.47
Nalhati-I	0.76	0.43
Murarai-II	0.77	0.5
Mohammad Bazar	0.8	0.4
Murarai-I	0.84	0.46

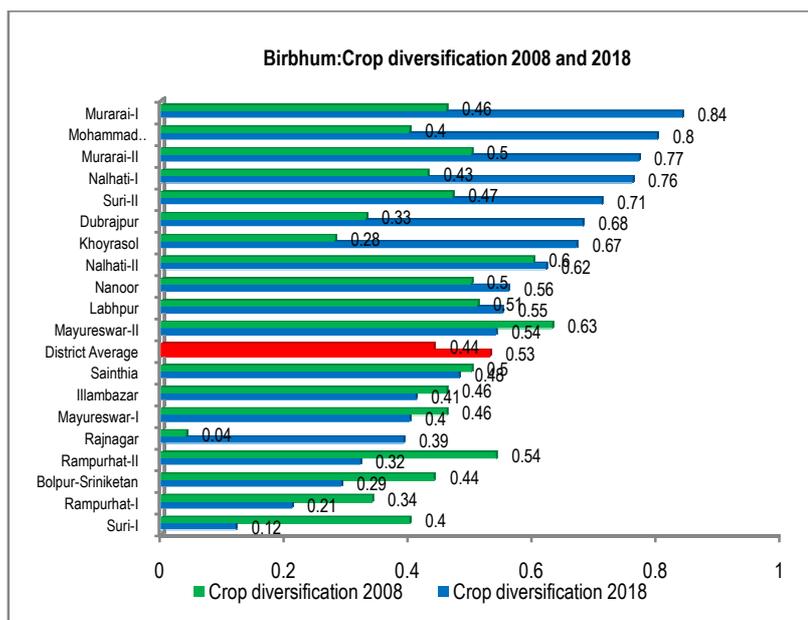


Figure 4: Birbhum: Crop diversification 2008 and 2018

The discussion that follows on the spatial pattern of crop diversification is based upon two choropleth maps showing the situation of crop diversification at C.D. blocks in 2008 and 2018. These maps depict the distribution of diversification of agriculture.

Four types of areas can be distinguished regarding the crop diversification index in the district:

1. Areas of low crop diversification (0.33)
2. Areas of moderate crop diversification (0.33-0.53)
3. Areas of high crop diversification (0.53-0.73)
4. Areas of very high (More than 0.73)

It is revealed from Figure 5 and 6 that a sharp crop diversification index is pronounced in Birbhum district between 2008 and 2018 respectively. In 2008, a low crop diversification having an index score less than 0.33 observed in the two blocks of the western part of this district, i.e. Khyrasole and Rajnagar. It comes under Bakreswar up land region. The area is composed of red loamy soil to red sandy soil. There are three seasons in Birbhum district. Due to elevation of land and several other problems, the cultivable land is not suitable to use all the seasons for crop cultivation. The majority of the gross cultivated land in Rajnagar (95.76%) and Khyrasole CD block (76.85%) cultivated aman rice in a year. The paddy is mainly monsoon dependent. The gross irrigated area in Rajnagar is only 36.75 per cent only.

On the other hand, a high crop diversification index score more than 0.53 pronounced in four C.D. blocks on the eastern face of the district. The CD blocks are Nanoor, Mayureswar-II, Rampurhat-II, Nalhata-II respectively. These areas are having better quality of soil and having very good irrigational facilities particularly installation of shallow tube well that lead cultivators to produce varieties of crop throughout the year. Out of these four CD Blocks, except Nanoor CD block are composed of laterite soil while Nanoor is lying under younger and older alluvial soil. The remaining blocks of these districts lie between 0.33 to 0.53 index values.

But a crop diversification index is being noticed in 2018. The crop diversification index of Bolpur-Sriniketan, Suri-I, Rampurhat-I and Rampurhat-II blocks have

shifted to the low category i.e. less than 0.33. This is due to lack of irregular supply of canal water for irrigation. In 2018, A very high crop diversification index is more pronounced in Murarai-I, Murarai-II, Nalhati-I and Md. Bazar blocks of this district with CDI value of 0.73. The cultivators of these areas have relied on deep tube well for proper irrigation to get plough more crops throughout the year. The Moderate crop diversification index reflected between 0.33 to 0.53 in Mayureswar-I, Sainthia, Illambazar and Rajnagar blocks. Apart from these, rest blocks of this district are high crop diversification 0.53 to 0.73.

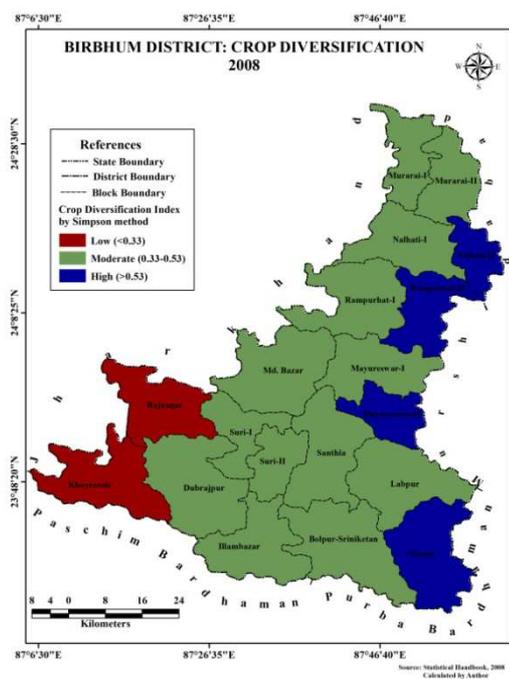


Figure 5: Crop diversification index, 2008

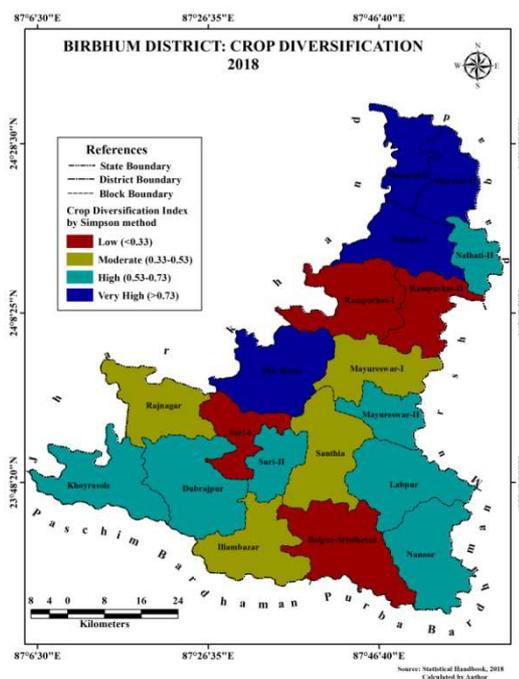


Figure 6: Crop diversification index, 2018

Table 2: Crop diversification index in 2008 and 2018

Name of Block	Crop diversification index for 2018	Antyodaya Anna Yojona (%)	II Mohammad Bazar		
Nalhati-I	0.76	9.79		0.80	7.78
Nalhati-II	0.62	4.42		0.48	13.26
Murarai-I	0.84	10.35		0.68	13.56
Murarai-II	0.77	5.56		0.39	13.29
Mayureswar-I	0.40	11.77		0.12	15.08
Mayureswar-II	0.54	11.24		0.71	13.01
Rampurhat-I	0.21	9.72		0.67	13.15
Rampurhat-II	0.32	10.76		0.29	8.89
				0.55	7.79
				0.56	6.99
				0.41	9.28

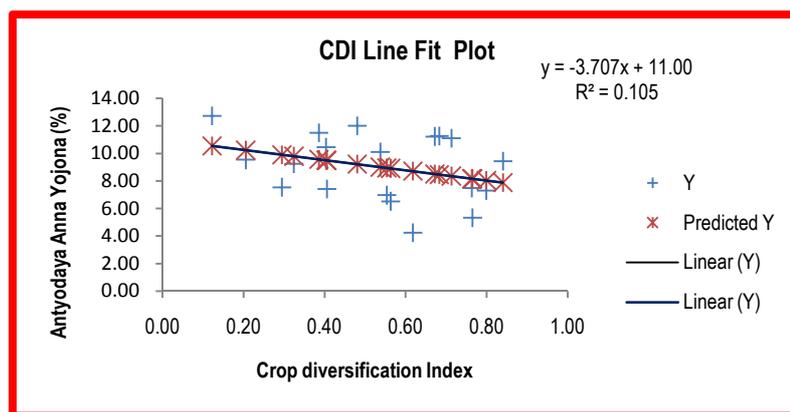


Figure 7: CDI Line Fit Plot

It is observed from table-2 and figure-7 that abject poverty i.e. Antyodaya Anna Yojana (Abject poverty) people and crop diversification is negatively correlated. The R^2 value is 0.105 which shows that 10.5 per cent of the data set explain that higher will be the diversification lower will be poverty.

Conclusion

Distribution of Income has distinct spatial perception as it differs widely between rural and urban area. If we look on rural income distribution, consistently find high frequency of poverty in the rural areas. Most of the people are engaged in unimportant cultivation, some of them are also non-agricultural wage earners and this due to complete absence of small scale industries. These are some of the factors that explain high percentage of people below poverty line in the study area.

Diversification of Crop is a present-day issue within the field of agriculture because it is a well-organized approach of reducing the poverty. It supplements income and employment opportunities within the rural areas where approximately two third of gross crop area is occupied in making a mono crop. From various indicators of determining the quantity of crop diversification, it is often concluded that extent of crop diversification in north and eastern C.D. blocks are more diversified than that of other blocks in Birbhum. The present market structure, road network, irrigation systems which are presently the most constrains. It may be revitalize creating well equipped infrastructure that will help to scale back the poverty with the assistance of crop diversification. Diversification of crop has an enormous prospective of accelerating income generating activities and earnings of the agricultural people. The government may come forward with developed proper infrastructure to eradicate poverty at local level.

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