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Patterns Of Crop And Agricultural Regionalisation: A Case Study From Bankura District, West Bengal

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Abstract

The Indian Economy hinges on Agriculture. Over 58% of the Indian population is directly or indirectly dependent on agriculture, and West Bengal is the most important agricultural state in India. Bankura District is not exceptional. In this district, from the western to eastern parts, the variation of physiography, climate, Nature of soil, and soil fertility give rise to different patterns of crops, concentration of crops, number of crops cultivated, and all-over Agricultural productivity. The present study has been carried out solely using secondary data. Using the District Statistical Handbook (2014) of Bankura and the Report of the Deputy Directorate of Agriculture, Bankura (2021–22), an attempt has been made to find out the suitable crop combination, crop concentration and diversification, cropping pattern, and Agricultural productivity of Bankura District.

Keywords: Cropping pattern, Crop concentration, Crop Combination, Diversification Index, Agricultural Productivity.

1. Introduction

Agriculture is the backbone of developing economies, specially involving the rural sector [1-5] Agricultural growth in India has been erratic over the last ten years, ranging from 5.8% in 2005-06 to 0.2% in 2014-15 and in West Bengal 28.8 % growth has been noticed in the last decade [6]. For systematic agricultural regionalisation, it is critical to clarify the ideas of Crop ranking, cropping patterns, crop concentration and diversification, crop combination, and in-depth look at agriculture production [7-8]. Agriculture ensures food security, which has been inscribed in the researches made by several scholars siting examples from the trend of agricultural development in different parts of the world[9-18] Many scholars investigated the nature of agricultural development in different countries of the world, their constrains [19-25] and particular role of specific groups in solving those issues [26]. [27-31] discussed the importance of technological innovations in agricultural development. Bankura being one of the most drought prone districts of West Bengal has always been centre of research for its patterns, problems and prospects in terms of agriculture and allied activities. The contrasting topography between the Eastern and Western portion, coupled with availability of fertile land, irrigation facilities has led to diversified cropping

triggering the level of regional level disparities and patterns [32-33]. The 12th Five Year Plan (2012-2017) aimed of achieving 4 percent agricultural growth rate with increased sustainability and decreased rate of regional scale disparities [34]. Despite the plans and programmes, there exists regional level of disparities in crop production, which can be attributed to the admixture of availability of productive land, suitable geo-climatic environment, size of land holdings, stable politics, efficient policies and the application of science and technology in marketing situations that are favourable [35]. Bankura lies in the top indexed category among districts of West Bengal in relation to composite index of productivity matrix [36]. Most of the studies are broad region based, so in the present study the crop combination, crop concentration, cropping pattern and crop diversification has been statistically and graphically analyzed to assess the level of agricultural regionalisation in Bankura District at Community Development (C.D.) Block level.

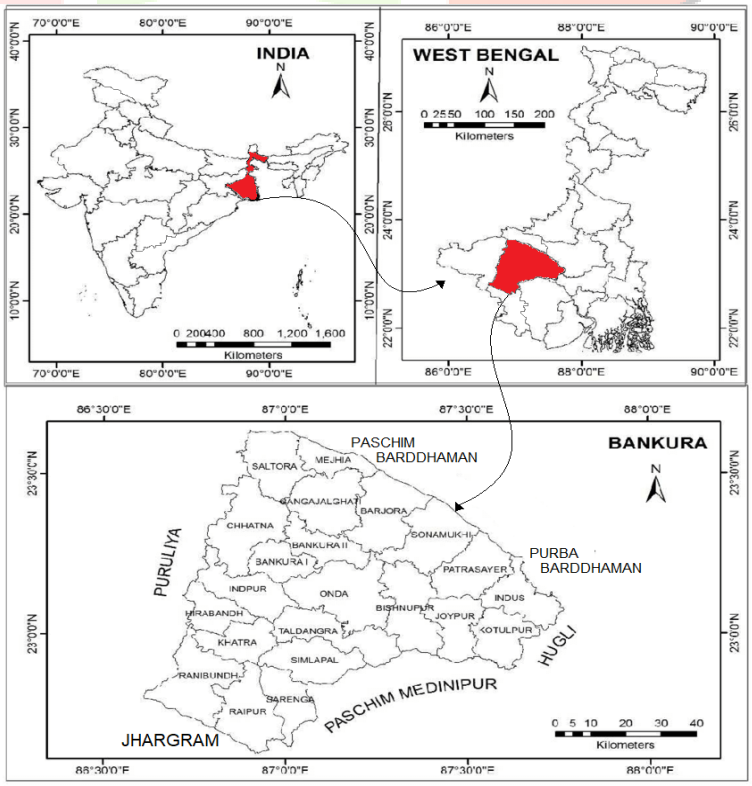
2. Objectives

a. To study about the existing cropping pattern of the study area
b. To do the crop ranking, crop concentration, crop diversification and crop combination in the district.
c. To identify the crop combination regions at block level in Bankura district.

3. Study Area

Bankura District is located in the western part of West Bengal. It has varied landscape with wide relief variation. The north western and south-western part of the district (Specially Jangalmahal) has rugged topography consisting of the Archean –Proterozoic series Granite, Gneiss and Schist and it is the Eastern fringe of the Chhotanagpur Plateau (Figure 1). So the soil is basically lateritic red soil, which is not so suitable for agriculture. Moreover, the Western part of the district receives very sparse rainfall only during the monsoon seasons, so only some Aman paddy cultivation takes place. Some Rabi crops are cultivated in the areas that are fed by irrigation canals. On the other hand the Eastern part of the district is enriched with fluvial sediments of Quaternary period brought down by the rivers like Damodar, Darakeswar, Shilaboti, Shali, Kangsabati etc. This part is also well connected with fine network of irrigation canals, which facilitates the growing of crops mostly throughout the year.

Figure 1: Location Map of the Study Area



4. Database and Methodology

The present study is based on secondary sources of data collected from "Annual Target Plan, Bankura" 2021-2022 from Office of the Deputy Director of Agriculture, (Administration), Bankura and District Statistical Handbook published by "Bureau of Applied Economics and Statistics" 2014-15.

Methodology

a. Crop Concentration: Location Quotient Method by S. S. Bhatia (1965) [37]

{(Area of X crop in the component areal unit) ÷ (Area of all crops in the component areal unit)} ÷ {(Area of X crop in the entire region ÷Area of all crops in the entire region)}

b. Crop Diversification: Gibbs-Martin Index (1962) [38]

$1-\{\Sigma X^2 \div (\Sigma X)^2\}$ (1)

Where, X is the percentage of total cropped area occupied by each crop, or hectareage under the individual crop.

c. Crop Combination: Maximum positive deviation method by **S.M. Rafiullah (1956) [39]** has been used here to make the crop combination types.

$d=\Sigma D^2_P - D^2_n / N^2$ (2)

Where,

d is the deviation, **Dp** is the positive difference, **Dn** is the negative difference from the median value of the theoretical curve value of the combination. **N** is the number of crops in the combination.

d. Cropping Pattern:

(Area covered by x crop÷Total cropped area)×100percent (3)

Where, x refers to individual crop.

e. All the data are statistically analysed in Microsoft Excel and Maps are prepared in Q.GIS version 3.14.

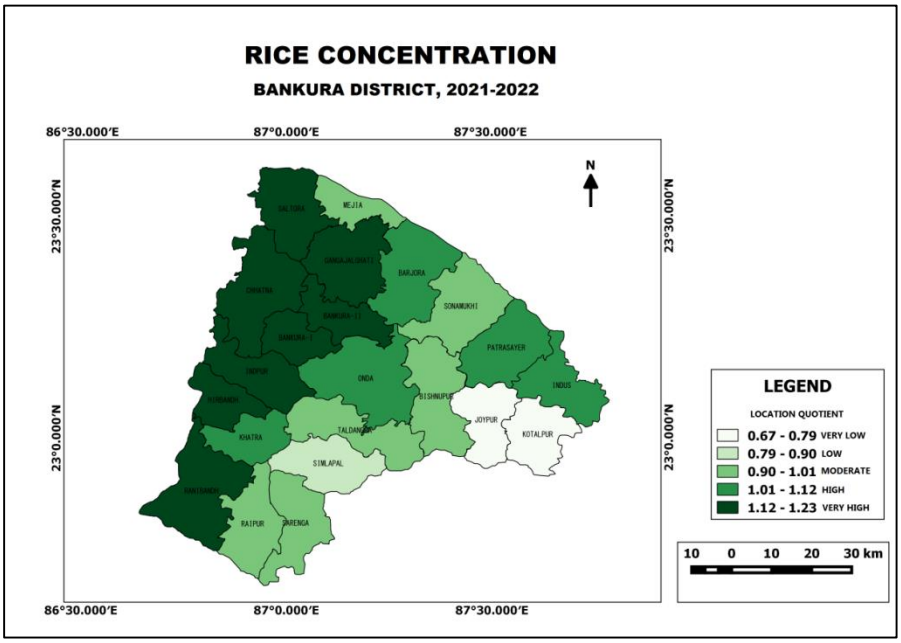
5. Results and Discussions

5.1 Crop Concentration

5.1.1 Crop concentration: Crop concentration is the variance of areal density of each crop at a specific region [40]. In the 1st half of the twentieth century Bankura lied in the highly specialised category in terms of crop concentration and in the later half trend of diversification started increasing [41].

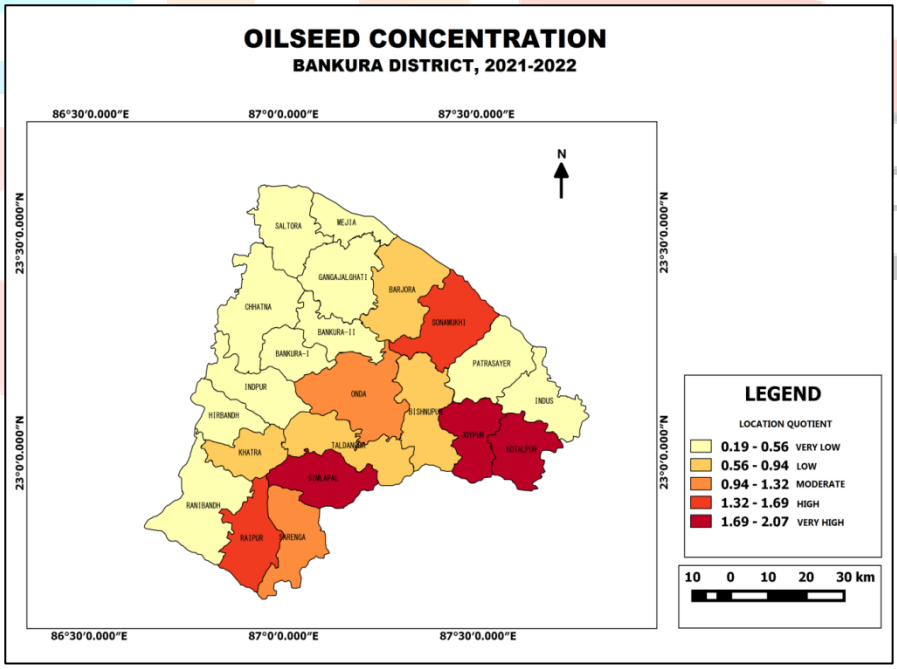
a. **Rice Concentration:** The Western and South-western blocks of Bankura district have high concentration of rice cultivation. The rugged topography, harsh dry climate and absence of proper irrigation facilities only facilitate the growth of Monsoon rice in most of the C.D. blocks. The rice concentration zones with Very high location quotient are 8 blocks, namely Saltora, Gangajalghati, Bankura I, Bankura II, chatna, Indpur, Hirbandh, Ranibandh. The five High concentration zones are Barjora, Onda, Khatra, Indus and Patrasayer. Mejia, Sonamukhi, Bishnupur, Taldangra, Raipur and Sarenga are the six blocks with moderate rice concentration. Low concentration of rice is concentrated only to Simlapal. Joypur and Kotalpur are the two blocks with least rice concentration (Figure 2), which proves that these two blocks have diverse variety of agriculture.

Figure 2: C.D. Block Wise Rice Concentration, Bankura District, 2021-22



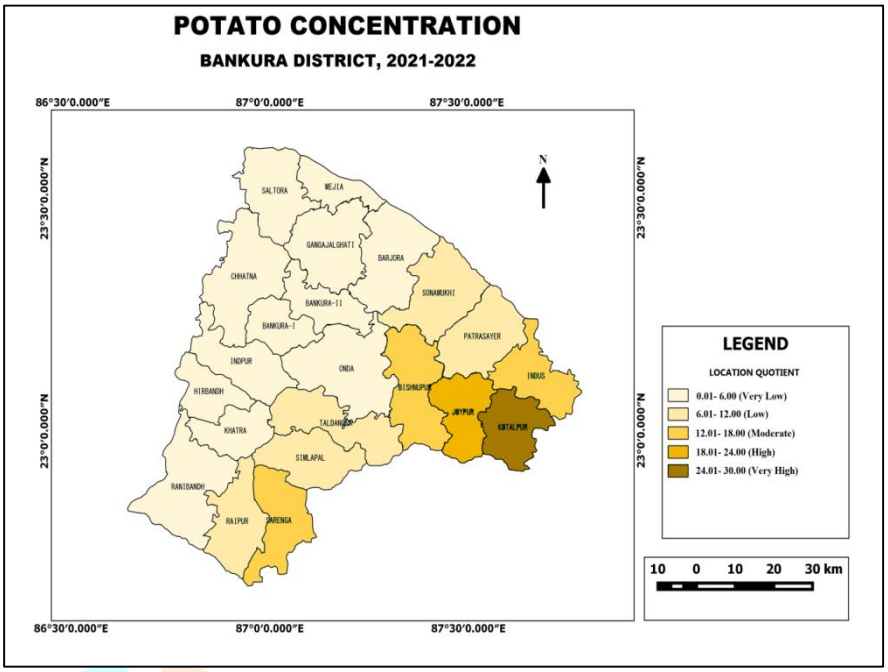
b. **Oilseed Concentration:** Joypur, Kotalpur and Simlapal have the highest concentration of oilseed, followed by Sonamukhi and Raipur, which have high concentrations. Onda and Sarenga have moderate concentrations, Barjora, Bishnupur, Taldangra, Khatra has low concentrations, while the lowest concentrations are seen in Indus, Patrasayer, Mejia, Saltora, Gangajalghati, Bankura I, Bankura II, Indpur, Hirbandh and Ranibandh have lowest concentrations of oilseeds (Figure 3).

Figure 3: C.D. Block Wise Oilseed Concentration, Bankura District



c. **Potato Concentration:** Kotalpur has the highest concentration of potato, followed by Joypur with high concentration, Indus, Bishnupur and Sarenga with moderate concentration. Raipur, Simlapal, Taldangra, Sonamukhi and Patrasayer have low concentration of potato (Figure 4). Rest 12 blocks have very low potato concentration.

Figure 4: C.D. Block Wise Potato Concentration, Bankura District



d. **Vegetable Concentration:** Mejia and Bishnupur have very high vegetable concentrations, followed by Bankura II, Kotalpur and Taldangra with high concentration and (Figure 5) Gangajalghati, Barjora, Onda, Bankura I, Simlapal, Khatra have moderate concentrations. Saltora, Chatna, Indpur, Hirbandh, Ranibandh, Raipur, Sarenga and Joypur, Patrasayer, Sonamukhi, Indus has the low and very low concentration of vegetables (Figure 5).

e. **Wheat Concentration:** Wheat is not the staple food of the people of Bankura District. So, Wheat is cultivated in negligible amount round the district. Mejia and Bishnupur have high concentration of wheat cultivation, followed by Saltora, Onda and Simlapal. Out of 22 C.D. Blocks, 10 blocks have very little concentration of wheat (Figure 6).

Figure 5: C.D. Block Wise Vegetable Concentration, Bankura District

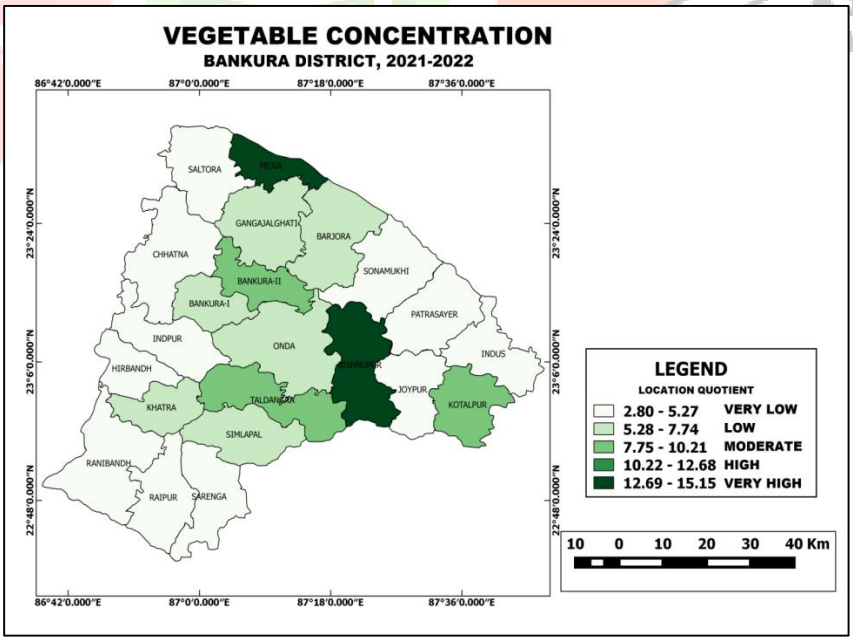


Figure 6: C.D. Block Wise Wheat Concentration, Bankura District

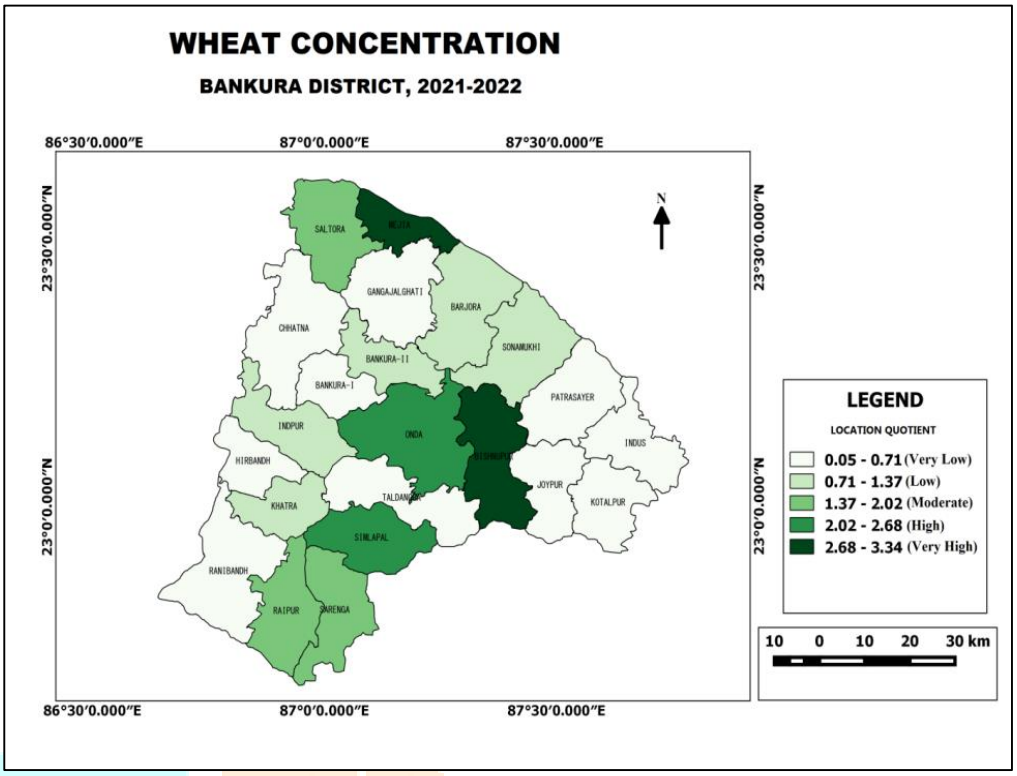
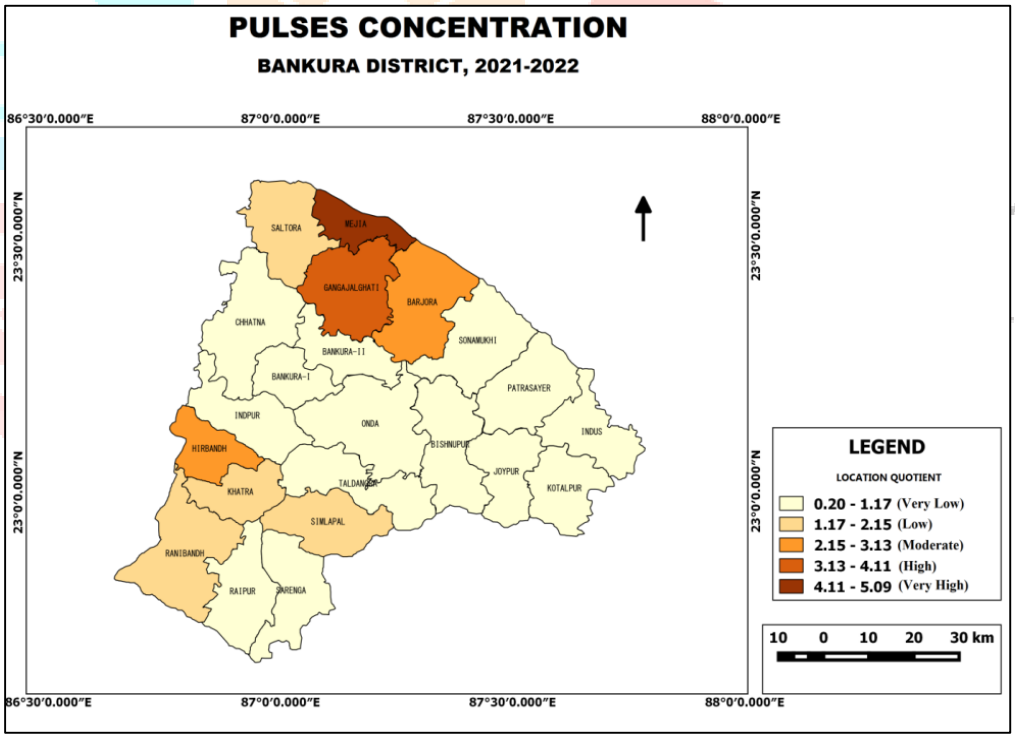


Figure 7: C.D. Block Wise Pulses Concentration, Bankura District



f. **Pulses Concentration:** Pulses also do not hold significant concentration in Bankura District. Mejia is the only district with very high concentration, followed by Gangajal Ghati with high concentration, Barjora and Hirbandh with moderate concentrations. Other 18 C.D blocks (Figure 7) come under the low and very low category.

5.2 Crop Diversification: Crop diversity refers to a variety of measures that can assist preserve or improve agriculture's long-term viability. A multi-criteria systematic synthesis can be used to investigate the effects of diversifying simplified systems as well as simplifying diverse systems [42].

Blocks like Bankura I,Bankura II, Chhatna, Saltora, Gangajal Ghati. Indpur, Hirbandh, Ranibandh have highly concentrated type cultivation (Table 1). As we move eastwards, the diversity increases. Barjora, Onda, Khatra, Taldangra, Raipur, Sonamukhi, Patrasayer, Indus are moderately diversified and five blocks namely, Jaypur, Kotulpur, Bisnupur, Simlapal and Sarenga are most diversified blocks of Bankura District

(Figure 8). This variety is due to the availability of fertile riverine alluvium, water from rivers, irrigation facilities and implementation of improved technologies.

Figure 8: C.D. Block Wise Crop Diversification of Bankura District

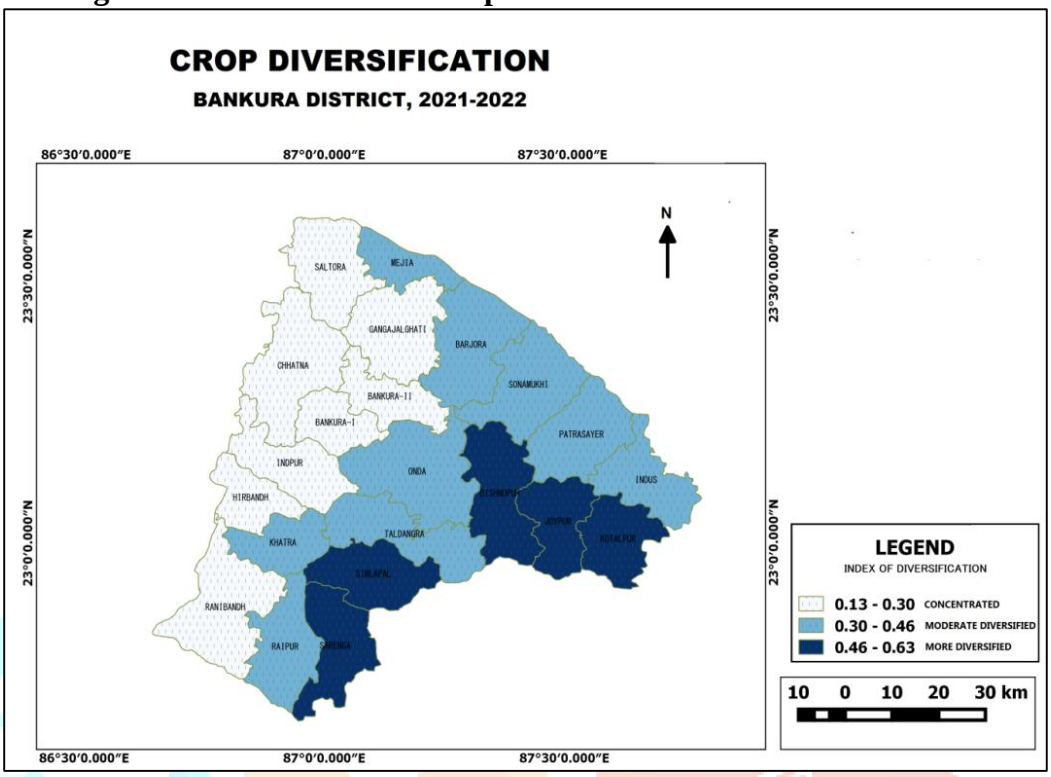


Table 1: Classification of C.D. Blocks based on Crop Diversification

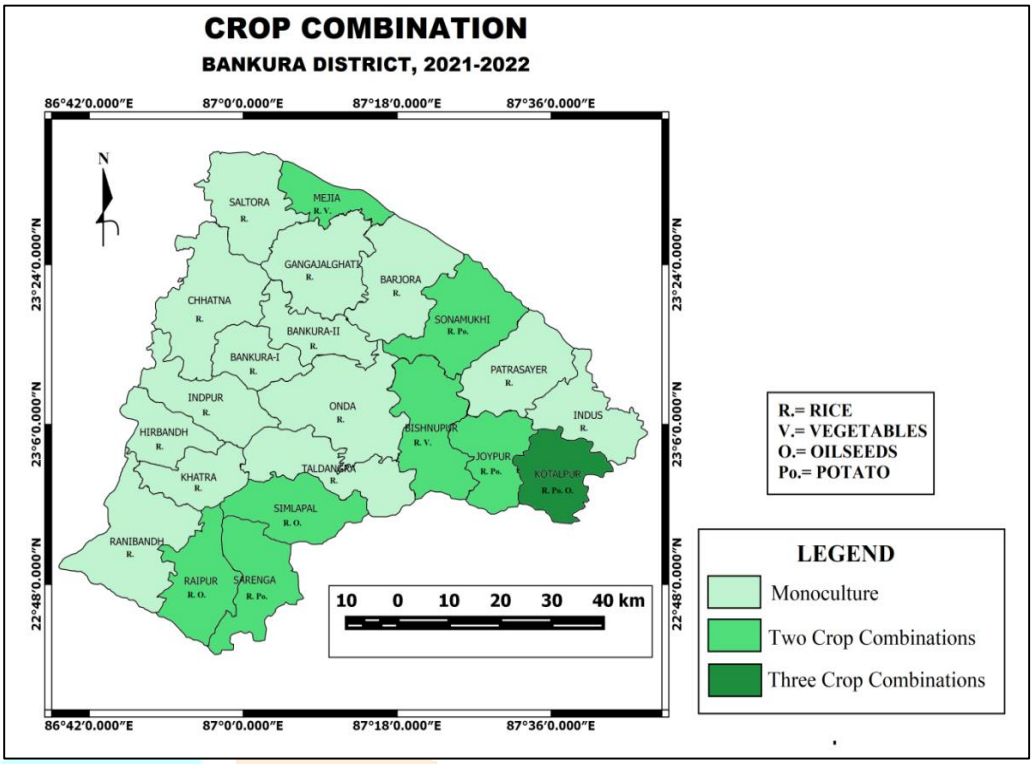
Sl No	Category	Name of the Blocks	Percentage
1	Less Diversified (<0.30)	Bankura I, Bankura II, Chhatna, Saltora, Gangajal Ghati. Indpur, Hirbandh, Ranibandh,	40.90%
2	Moderate Diversified (0.30-0.50)	Barjora, Onda, Khatra, Taldangra, Raipur, Sarenga, Sonamukhi, Patrasayer, Indas	40.90%
3	Most Diversified(>0.50)	Simlapal, Bisnupur, Jay pur, Kotulpur	18.2%

Source: Computed by Author (s)from Appendix 1

5.3 Crop Combination

Crop combination refers to the integrated assemblage of crop types grown in a field in an agricultural calendar. It is a scientific device to study the extant relationship that persists in intra crop association and pattern of land utilisation. A systematic study of crop combinations is necessary for clear understanding of agricultural mosaic, as well as for planning and developing its agriculture. Bankura is a district which consists of a rugged terrain and semi-arid condition persists in most part of the district. Most of the agriculture of the region is monsoon based and cultivation in the non-monsoon period largely depends on the availability of irrigation facilities. Monocrop culture is carried out in most of the C.D. Blocks and only a few C.D. Blocks have Bi-Crop culture and Tri-Crop combination. Kotalpur is the only block with tri-crop combination with Rice, Potato and Oilseed cultivation. Mejia and Bishnupur have two crop combinations of rice and vegetables. Sonamukhi, Joypur, Sarenga have rice and potato combination, Simlapal and Raipur have rice and oilseed combination (Figure 9). The rest 14 C.D. blocks of Bankura district have only rice as the major single standing principal crop.

Figure 9: C.D. Block Wise Crop Combination of Bankura District

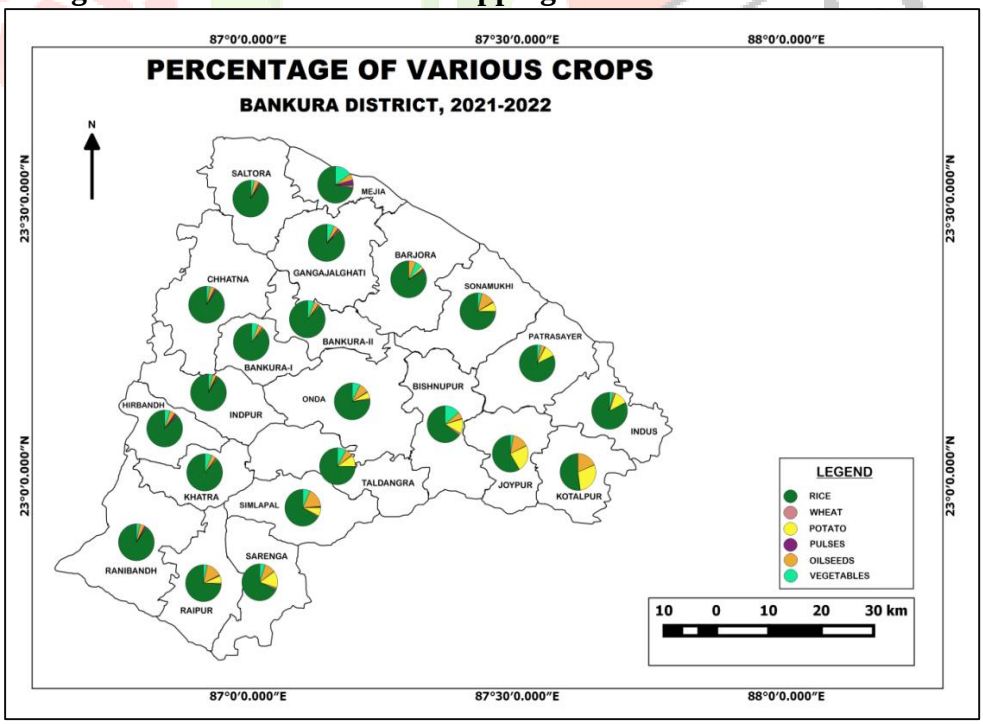


5.4 Cropping Pattern

The proportions of land under various crops at any given section of time are referred to as cropping pattern. Cropping patterns vary from macro to micro regions in spatiotemporal scale, and are mainly influenced by physical, cultural, and technological variables. It is important to split the area/region into homogenous regions on some well-defined basis for agricultural regionalization and planning [8,43]

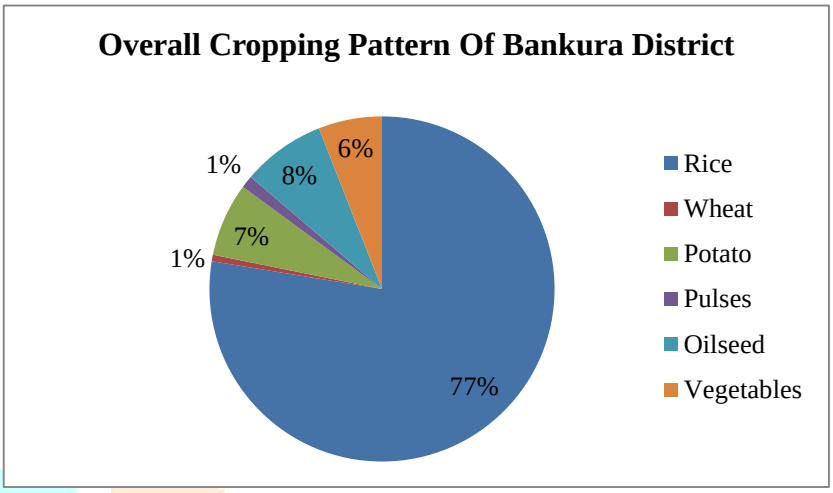
The cropping pattern is dominated by Rice (77%), followed by oilseed (8%), potato (7%) and vegetables (6%), with traces of wheat (1%) and pulses (1%) cultivation limited to some blocks only (Figure 10).

Figure 10: C.D. Block Wise Cropping Pattern of Bankura District



The Western blocks dominantly have rice cultivation, with traces of other crops. As we move towards the Eastern side, the variety in the pattern is more prominent and other crops apart from rice acquire significant percentage in the cropping pattern (Figure 11).

Figure 11: Cropping Pattern of Bankura District



Potato cultivation in the Eastern blocks is mention worthy with highest percentage of potato cultivation in Kotalpur. Vegetable cultivation acquires significant percentage in Mejia (15.16 %) and Bishnupur (13.99 %). Raipur (18.51 %), Kotalpur (18.13 %), Simlapal (16.99 %) and Joypur (14.91 %) have remarkable percentage of oilseed cultivation in its cropping pattern. Mejia (1.84%), Bishnupur(1.84%), Sarenga (1.65%) and Onda (1.15%) have some wheat cultivation in slightly much amount. Mejia (4.5 %), Gangajalghati (2.9%), Hirbandh (2.24%), Barjora (2.15 %) have some noteworthy pulses cultivation.

Conclusion

The research provides insights on the critical significance of agriculture in the Indian economy, with a particular emphasis on Bankura District situated at the Western part of West Bengal. Agriculture continues to be the backbone of emerging economies, employing approximately 58% of the Indian population directly or indirectly. Bankura's physiography, climate, soil type, and fertility vary across the C.D.blocks, resulting in a variety of cropping patterns, crop concentrations, and agricultural production. The study emphasises the need of knowing crop ranking, cropping patterns, crop concentration, crop diversity, and crop combinations in order to achieve sustainable agricultural regionalization. Sustainable agriculture is critical for providing food security, encouraging economic growth, and narrowing regional imbalances. Although agricultural growth in India has been uneven throughout the years, Bankura has recently shown a favourable growth tendency. Bankura district is mostly lying in the plateau fringe of Chhotanagpur region; so it is mostly covered with undulating and rough terrain. 64 % of the blocks have monocrop culture with dominance of rice cultivation. About 32 % have double cropping combination with Rice and Potato, Rice and Oilseed and Rice and Vegetables combinations. The only C.D. Block with triple cropping combination is Kotalpur, demonstrating its agricultural growth potential. The Eastern and South eastern blocks have more diversified crops than the western and northern blocks. The major crop of all the blocks is rice, followed by oilseed, potato and vegetables. Wheat and pulses occupy the least percentage in the cropping pattern of Bankura district. A vast spatial disparity has been noticed between the eastern and western parts of Bankura district, which may be attributed to the difference in terrain characteristics, availability of water, availability of irrigation facilities and technological improvement factors. The results of the study focus on the need of educated agricultural planning and development in addressing regional disparities and increasing production. To boost agricultural growth in drought-prone regions like Bankura, policymakers should focus on promoting sustainable farming practises, improving irrigation systems, and stimulating

technology improvements. Furthermore, crop diversification activities can contribute to increased food security, revenue production, and a more resilient agricultural sector leading to a more prosperous and resilient future.

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Appendices

Appendix 1: Crop Diversification of Bankura District

Name of the Block	$\sum X^2$	$(\sum X)^2$	$1-\{\sum X^2 \div (\sum X)^2$
Bankura I	**7750**	**10000**	**0.225**
Bankura II	**7310**		**0.269**
Chhatna	**8640**		**0.136**
Saltora	**8160**		**0.184**
Mejia	**5700**		**0.430**
G. Ghati	**7510**		**0.249**
Barjora	**6910**		**0.309**
Onda	**5970**		**0.403**
Indpur	**8330**		**0.167**
Khatra	**6840**		**0.316**
Hirbandh	**7680**		**0.232**
Ranibandh	**8180**		**0.182**
Taldangra	**5760**		**0.424**
Simlapal	**4850**		**0.515**
Raipur	**5780**		**0.422**
Sarenga	**5140**		**0.486**
Bishnupur	**4620**		**0.538**
Sonamukhi	**5470**		**0.453**
Patrasayer	**6850**		**0.315**
Indas	**6940**		**0.306**
Joypur	**4230**		**0.577**
Kotalpur	**3730**		**0.627**

Appendix 2: Cropping Pattern of Bankura District

Name of the Block	Rice	Wheat	Potato	Pulses	Oilseed	Vegetables
Bankura I	87.65	0.324	0.486	0.819	4.14	6.56
Bankura II	84.96	0.56	1.281	0.785	4.247	8.17
Chhatna	92.82	0.110	0.146	0.755	2.451	3.706
Saltora	90.15	0.847	0.088	1.280	2.439	5.184
Mejia	72.99	1.836	0.612	4.530	5.866	15.156
G. Ghati	86.25	0.136	0.544	2.948	4.088	6.030
Barjora	82.62	0.557	2.831	2.149	6.355	5.477
Onda	76.58	1.148	5.615	0.602	8.712	7.339
Indpur	91.09	0.459	0.618	0.751	3.387	3.684
Khatra	81.95	0.684	1.101	1.419	7.907	6.967
Hirbandh	87.28	0.319	0.542	2.235	4.758	4.852
Ranibandh	90.23	0.122	0.587	1.468	4.40	3.182
Taldangra	74.51	0.363	9.989	0.526	6.560	8.04
Simlapal	66.73	0.143	7.19	1.274	16.989	6.667
Raipur	69.74	0.773	6.18	0.723	18.507	3.092
Sarenga	69.18	1.597	14.859	0.341	9.846	4.896
Bishnupur	64.96	1.836	12.857	0.497	5.855	13.992
Sonamukhi	72.41	0.733	7.753	0.707	12.238	3.499
Patrasayer	81.92	0.118	10.35	0.403	4.047	3.149
Indas	82.29	0.164	12.35	0.317	1.705	3.171
Joypur	58.68	0.027	23.44	0.239	14.905	2.808
Kotalpur	50.75	0.183	28.50	0.174	18.131	2.247

Appendix 3: Block-Wise Crop Combination of Bankura District

Name of the Block	Category	Principal Crop(s)
Bankura I	Monocrop	Rice
Bankura II	Monocrop	Rice
Chhatna	Monocrop	Rice
Saltora	Monocrop	Rice
Mejia	2 Crops	Rice, Vegetables
G. Ghati	Monocrop	Rice
Barjora	Monocrop	Rice
Onda	Monocrop	Rice
Indpur	Monocrop	Rice
Khatra	Monocrop	Rice
Hirbandh	Monocrop	Rice
Ranibandh	Monocrop	Rice
Taldangra	Monocrop	Rice
Simlapal	2 Crops	Rice, Oilseed
Raipur	2 Crops	Rice, Oilseed
Sarenga	2 Crops	Rice, Potato
Bishnupur	2 Crops	Rice, Vegetables
Sonamukhi	2 Crops	Rice, Potato
Patrasayer	Monocrop	Rice
Indas	Monocrop	Rice
Joypur	2 Crops	Rice, Potato
Kotalpur	3 Crops	Rice, Potato, Oilseds

Source: Based on Appendix 2