



A GEOGRAPHICAL ASSESMENT ON SPATIAL DISTRIBUTION OF MAJOR CROPS DAKSHIN DINAJPUR DISTRICT USING REMOTE SENSING AND GIS TECHNIQUES.

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Abstract :

Agriculture plays a dominant role in economic development through supplying food for the nation, generating opportunities of employment, and sharing of national GDP as well as providing raw materials for agro based industries. Being the most backward district in the state in terms of agricultural output Dakshin Dinajpur District need a special attention. Because, as compared to the neighbouring districts, Dakshin Dinajpur appears to be good in terms of crop productivity, but at the same time the district is lagging behind so far as the development of agriculture is concerned. The district is predominantly agro based and majority of the people are engaged in agriculture. But the small land holdings hampering the growth in agriculture and allied sectors. Also inadequate management system, low crop diversification, improper crop planning with inadequate irrigation and drainage systems has led to the stagnation in agricultural development. The extent of stagnation in agriculture also varies from one block to another. Thus a spatial analysis of each block was in need to know the exact causes of this agricultural backwardness. Bhatia's method has been used to find out the crop diversification of South Dinajpur. The district also plays an important role in production of commercial crops like jute and food crop production.

KEYWORDS:

Crops concentration, Crops intensity, Crops Combination, Crops Diversification

INTRODUCTION :

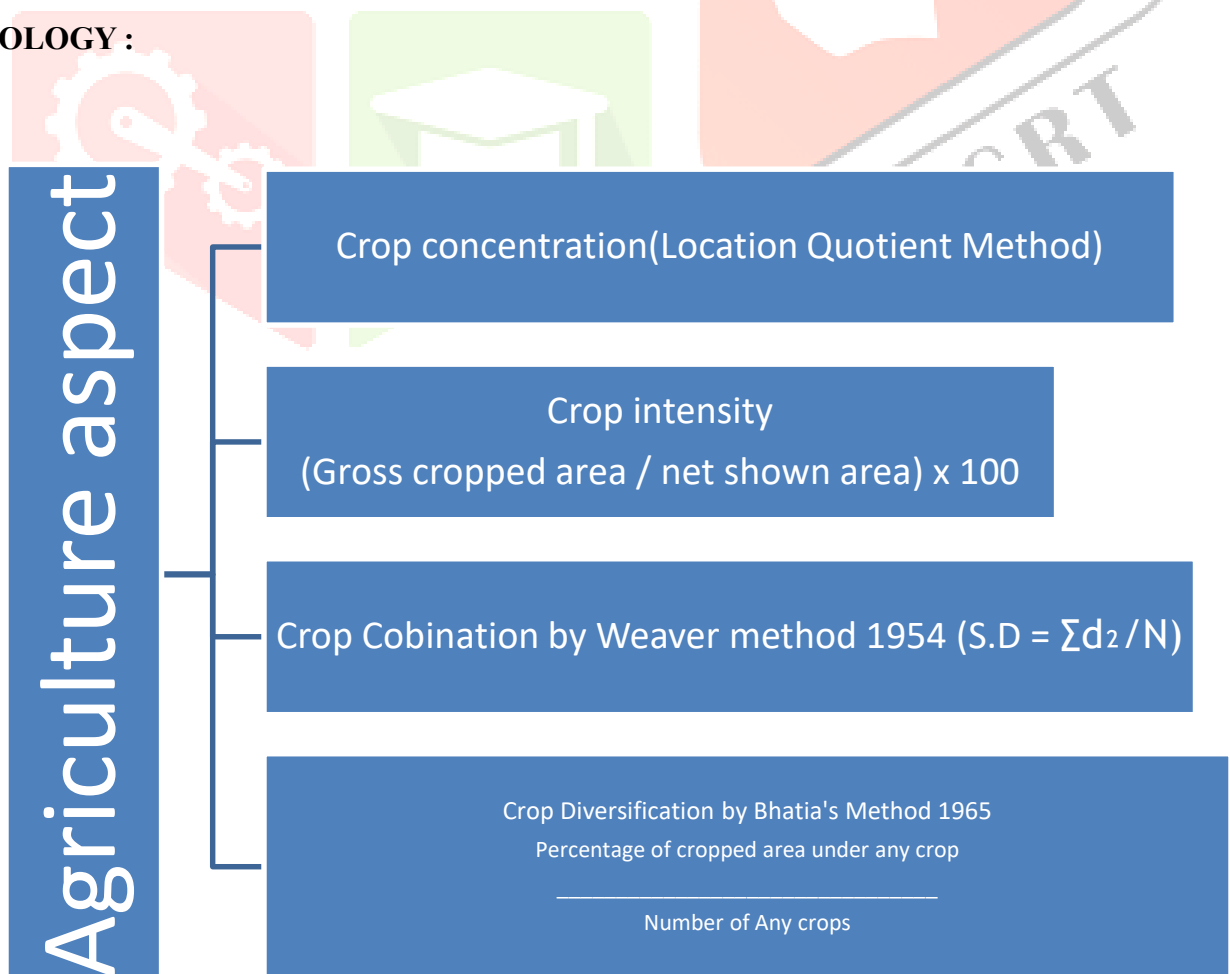
Agriculture plays a crucial role in the economy and sustenance of South Dinajpur district. Here are some reasons why agriculture is important in this region. Agriculture is one of the major sources of employment in South Dinajpur district, providing livelihoods to a large percentage of the population. Farmers, agricultural laborers, and other workers depend on agriculture for their income. Agriculture ensures food security by producing crops for consumption within the region

as well as for sale to other areas. The cultivation of various food crops such as rice, wheat, maize, pulses, vegetables etc., helps in meeting the nutritional needs of the local population. Agriculture contributes significantly to the economic growth of South Dinajpur district through its output value and contribution to GDP. It also supports related industries like agro-processing and agribusinesses which further boost economic development. Agriculture is closely linked with rural development in South Dinajpur district as it provides opportunities for income generation and poverty alleviation among rural communities. Sustainable agriculture practices help protect natural resources such as soil and water while promoting biodiversity conservation in South Dinajpur district. Overall, agriculture plays a vital role in ensuring socio-economic development, food security, employment generation and environmental sustainability in South Dinajpur district.

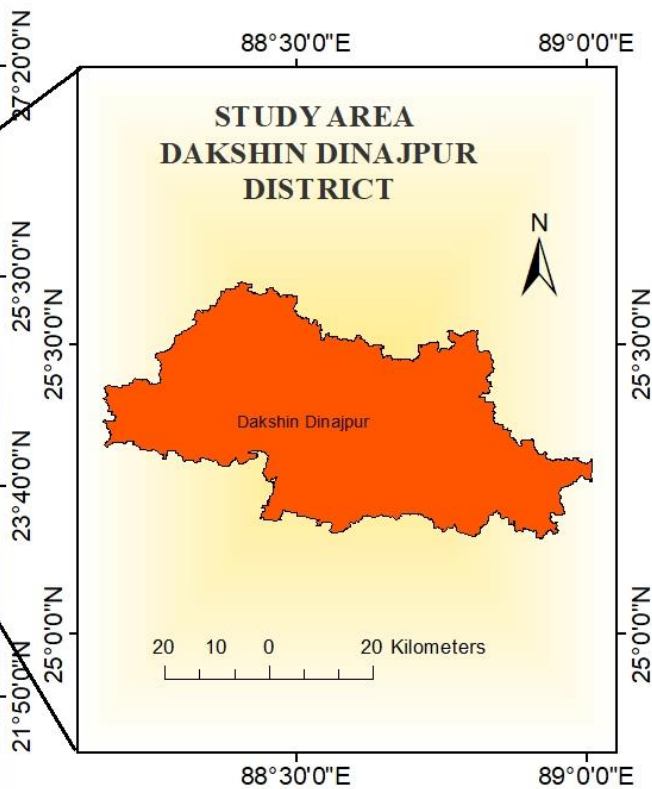
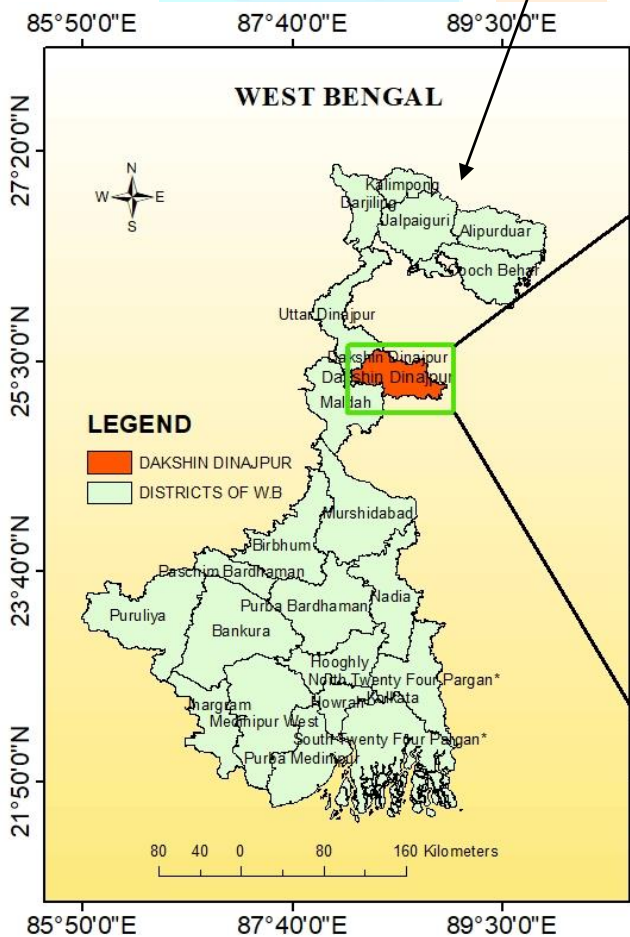
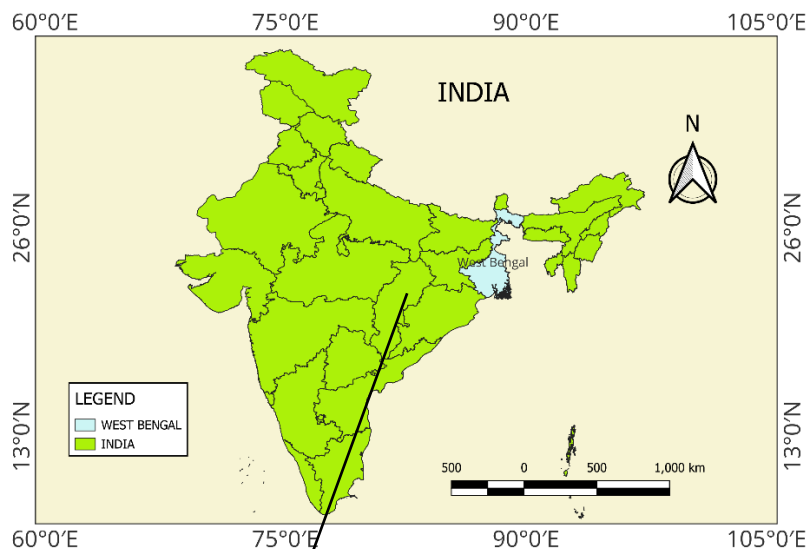
OBJECTIVE:

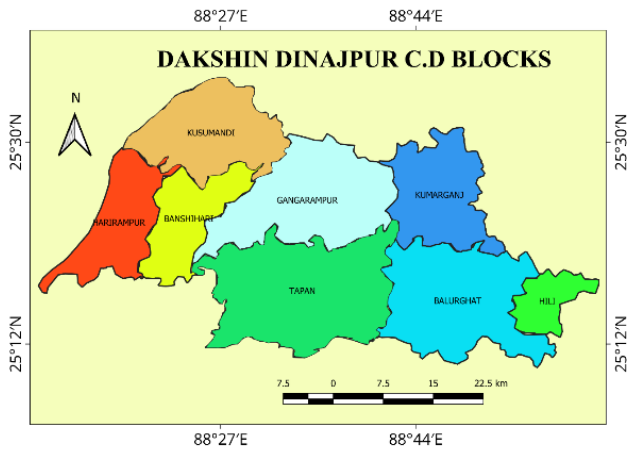
- i) To understand the land use pattern in South Dinajpur district.
- ii) To analyse the concentration of principle crops in the study
- iii) Estimate the cropping intensity and irrigation intensity and find out their relation .
- iv) Delineation of crop diversification region.
- v) Bring out the crop combination.

METHODOLOGY :



STUDY AREA





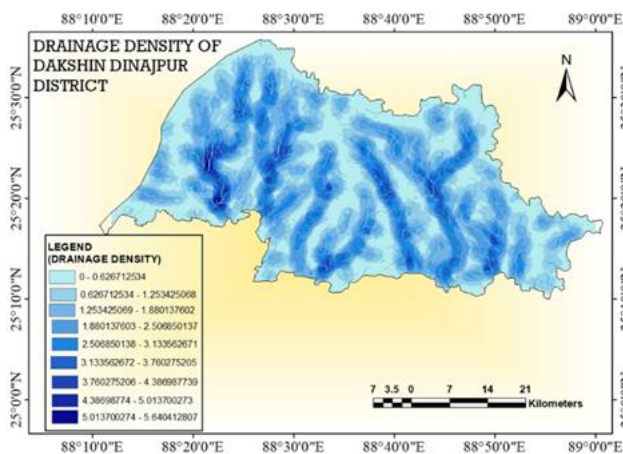
STUDY AREA :

Dakshin Dinajpur, also known as South Dinajpur, is a district in the Indian state of West Bengal. It was created on April 1, 1992, through the division of the erstwhile West Dinajpur District. The district's headquarters (sadar) is located in

Balurghat. Dakshin Dinajpur comprises two subdivisions: Balurghat and Gangarampur. According to the 2011 census, it is the third least populous district in West Bengal out of a total of 23 districts. The original Dinajpur District was split into West Dinajpur and East Dinajpur during the partition of India. The East Dinajpur district, now known as Dinajpur, became part of East Pakistan (now Bangladesh). The West Dinajpur district was enlarged in 1956 by incorporating some areas of Bihar following the implementation of the States Reorganisation Act recommendations. On April 1, 1992, the district was bifurcated into Uttar Dinajpur (North Dinajpur) and Dakshin Dinajpur (South Dinajpur). Dakshin Dinajpur is primarily an agricultural district, with a significant area of land under cultivation.

RELIEF :

The district is generally flat, slightly sloping southwards. The region appears to be a continuation of 'Barind' tract – a geographical formation of old alluvium. The surface ground is undulating though there is no existence of hill. The elevation of the district from mean sea level is 15 metres.

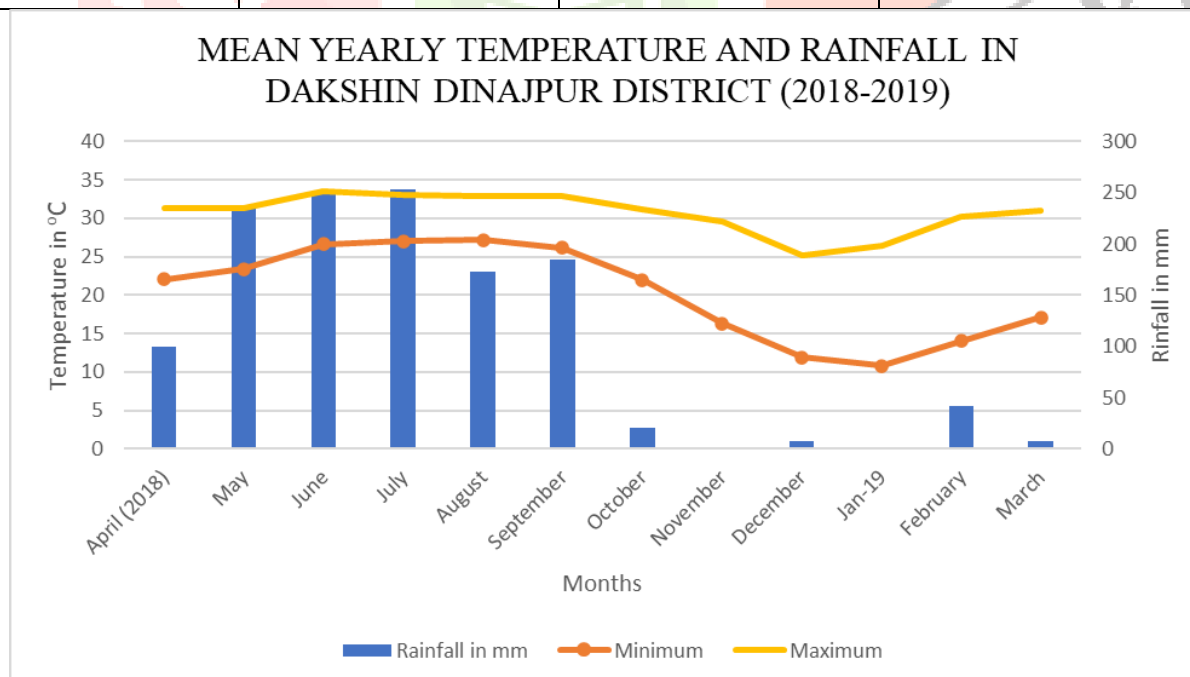


DRAINAGE :

The general direction of the main rivers of Dakshin Dinajpur flow from north to south. The main river of the district is Punarbhaba, which is the tributary of Mahananda. Atrai, which is the important offshoot of Tista and it flows through the town Balurghat. Apart from this there are more rivers named as Tangon, Chhiramati, Baliakhari, Brahmani, Kesiani and Ghagra.

MEAN YEARLY TEMPERATRE AND RAINFALL OF DAKSHIN DINAJPUR DISTRICT (2018-2019)

Months	Rainfall in mm	Temperature Degree in C	
		Minimum	Maximum
April (2018)	99.8	22.1	31.4
May	235.8	23.4	31.3
June	251.4	26.6	33.6
July	253.2	27.0	33.1
August	173.4	27.2	32.9
September	185.2	26.2	32.9
October	20.8	22.0	31.2
November	0.0	16.3	29.6
December	7.8	11.9	25.2
January 2019	0.0	10.8	26.4
February	41.8	14.0	30.2
March	8.0	17.1	31.06



Source : India Meteorological Department, Ministry of earth science (2018-19).

The agricultural patterns of our study area are closely controlled by the physical factors. Climate (temperature, rainfall, humidity, sunshine) is the vital determinants of agricultural activities and cropping patterns. Climate change in Dakshin Dinajpur district can be observed through the increase in average temperature and decreasing rainfall day by day. As a result the productive capacity of the land decrease, and the yield of crops also decreases.

MAJOR CROP CONCENTRATION ZONES OF DAKSHIN DINAJPUR DISTRICT:

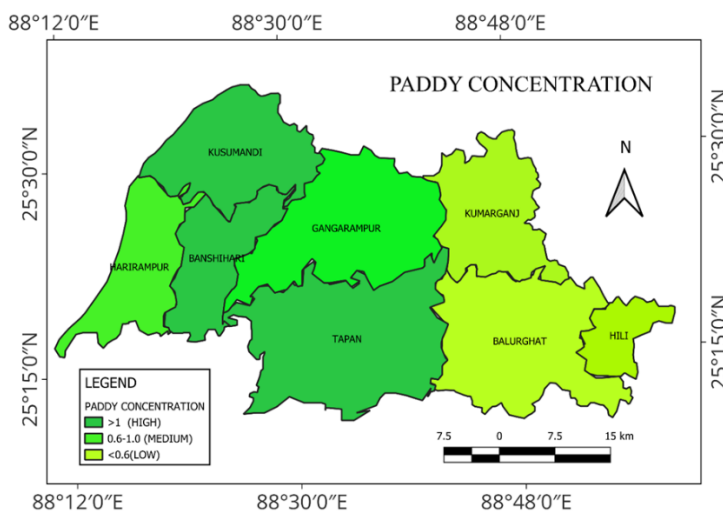
Crop concentration refers to the variations in the density of any crop in an area or region at a given point in time. It is influenced by factors such as terrain, temperature, moisture, and soil conditions. Each crop has a maximum, minimum, and optimum temperature for growth, and tends to have a high concentration in areas with ideal agro-climatic conditions¹. Understanding crop concentration is important for agricultural development and planning, as it helps identify regions where specific crops grow well with minimal inputs.

$$\text{Determination of crop concentration} = \frac{\text{Area of x crop in the component areal unit}}{\text{Area of all crops in The component areal unit}} \div \frac{\text{Area of x crop in the entire region/ country}}{\text{Area of all crops in the entire region/country}}$$

CROP CONCENTRATION OF DAKSHIN DINAJPUR DISTRICT, 2011

Sl. no	Name of the Block	Paddy	Wheat	Jute	Potato	Pulses	Oil seed
1	Kushmandi	1.10	0.87	1.09	1.01	0.69	0.21
2	Bansihari	1.09	0.34	0.26	1.08	0.86	1.23
3	Harirampur	0.64	8.33	0.98	0.54	0.48	0.61
4	Gangarampur	0.89	0.51	0.66	1.12	1.27	2.30
5	Kumarganj	0.57	1.69	4.34	1.47	3.50	0.91
6	Tapan	1.26	0.22	0.28	0.20	0.01	0.26
7	Balurghat	0.46	2.18	3.75	2.70	2.56	1.70
8	Hili	0.56	1.67	3.12	2.00	4.68	1.80

(Source: Computed from data derived from Statistical Handbook of Dakshin Dinajpur, 2011)

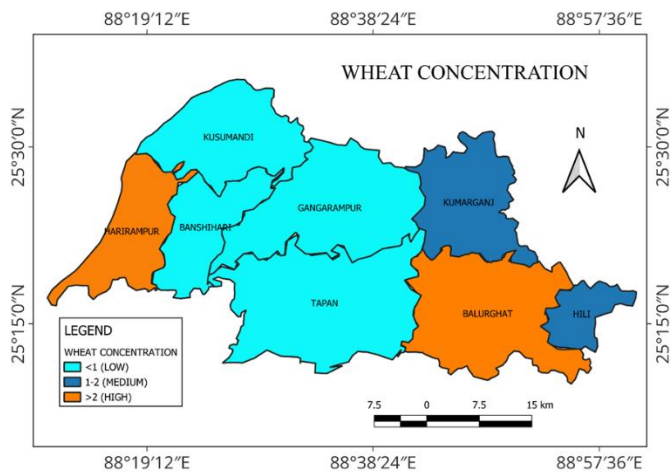


PADDY :

Paddy crop needs a hot and humid climate. It is best suited to regions which have high humidity, proionged sunshine and an assured supply of water. The average temperature and rainfall required throughout the life period of the crop ranges from 21°C to 37°C and >100 cm. Clayey loam soil in monsoon land is considered to

be the best for paddy cultivation as water retention capacity of this soil is very high. In Dakshin Dinajpur the majority of the soil is clayey and loamy. On the basis of crop paddy concentration value Dakshin Dinajpur District can be divided into three zones. The Higher paddy concentration zone (more than 1) has been shown in the blocks of Tapan (1.26).Kushmandi (1.10) and Bansihari (1.09). The medium paddy concentration (0.06-1.0) has been shown in the

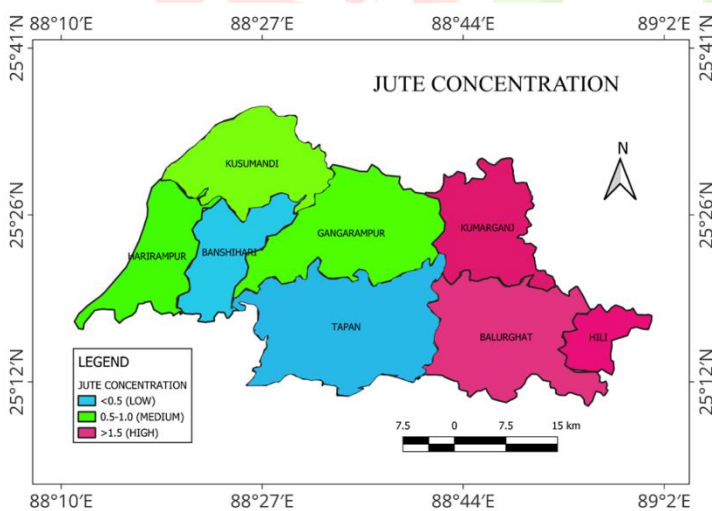
Gangarampur (0.89) and Harirampur (0.64) blocks. And the Kumarganj (0.57), Hili (0.56), and Balurghat (0.46) blocks are categorized as The Low Paddy Concentration (less than 0.6). The Highest percentage of paddy concentration observed in North – Western and Middle- southern part of the district. Whole Eastern part of the district shows the low concentration of paddy. The medium percentage of concentration is found in Western most part and Northern-Middle part of the district.



WHEAT :

The higher concentration of wheat (more than 2) has been shown in Harirampur (8.33) and Balurghat (2.18) blocks in Dakshin Dinajpur District. The Kumarganj (1.69) and Hili (1.67) blocks shows Medium Wheat concentration (1-2). While kushmandi (0.87), Gangarampur (0.51), Bansihari (0.34) and Tapan (0.22) blocks are categorized as The Lowest in Wheat concentration with a value lower than 1. The percentage of Highest

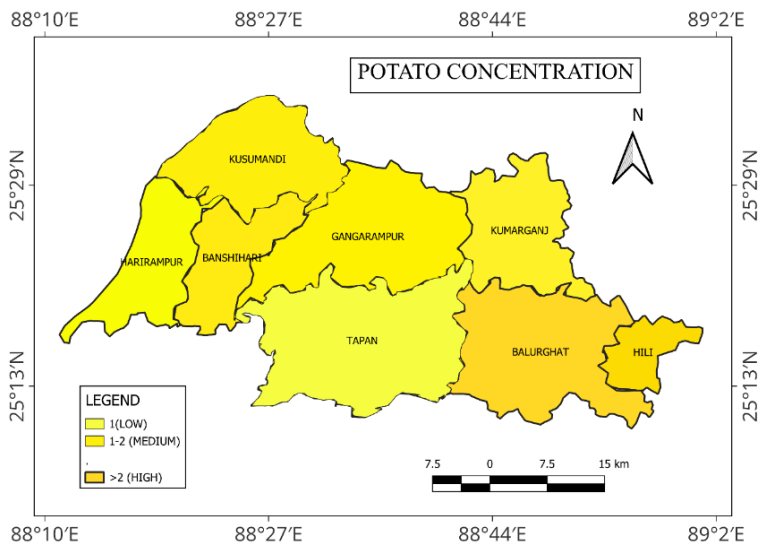
wheat concentration observed only a small portion of western part and south eastern part of the district. A small part of east and north – east exhibit the medium concentration of wheat. The lowest wheat concentration stretches from North to South of the middle part of the district.



JUTE :

In Dakshin Dinajpur district the high concentration jute (more than 1.5) are found in the blocks of Kumarganj (4.34), Balurghat (3.75) and Hili (3.12). The Medium jute concentration (0.5-1.0) are found in Kushmundi (1.09), Harirampur (0.98), Gangarampur (0.66) blocks. The Lowest jute concentration (less than 0.5) blocks are Tapan (0.28) and Bansihari (0.26). The high percentage of jute concentration is found in the eastern part of the

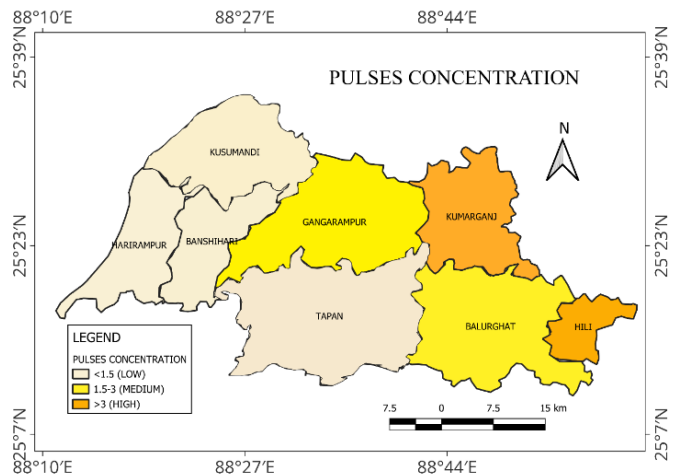
district. The north and north-western portion shows us the Medium concentration of jute. The low percentage of jute concentration observed in only a south part of the region.



POTATO :

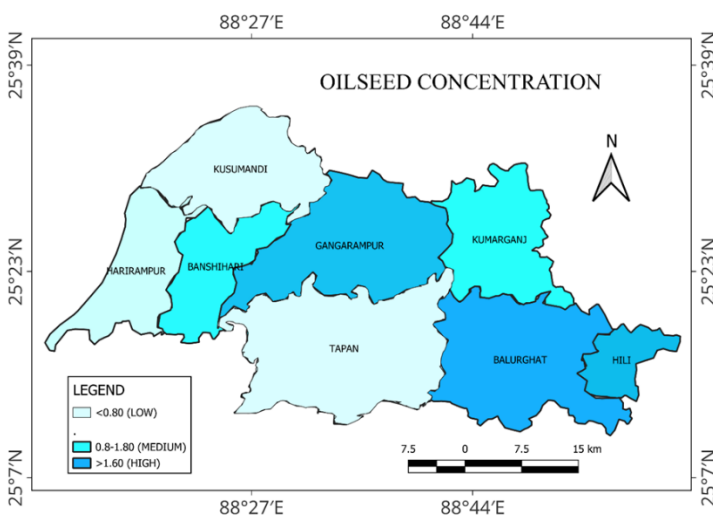
The blocks Balurghat (2.70) and Hili (2.0) shows higher concentration of potato (more than 2).The Medium potato concentration (1-2)has been shown in the Gangarampur (1.12),Kushmandi (1.01),Bansihari (1.08) and Kumarganj (1.47) blocks.Harirampur (0.54) and Tapan (0.20) has the Lowest potato concentration (less than 1).The High

percentage of potato concentration is found in South-Eastern part of the district. The northern portion shows the medium concentration of potato stretches from east to west. And the Lowest concentration of potato observed in west and south portion of the district.



PULSES :

The percentage of High pulses concentration is observed in a small portion of north-eastern part.The medium pulses concentration developed on north and south-western part of the district while the whole western portion shows the low concentration of pulses.



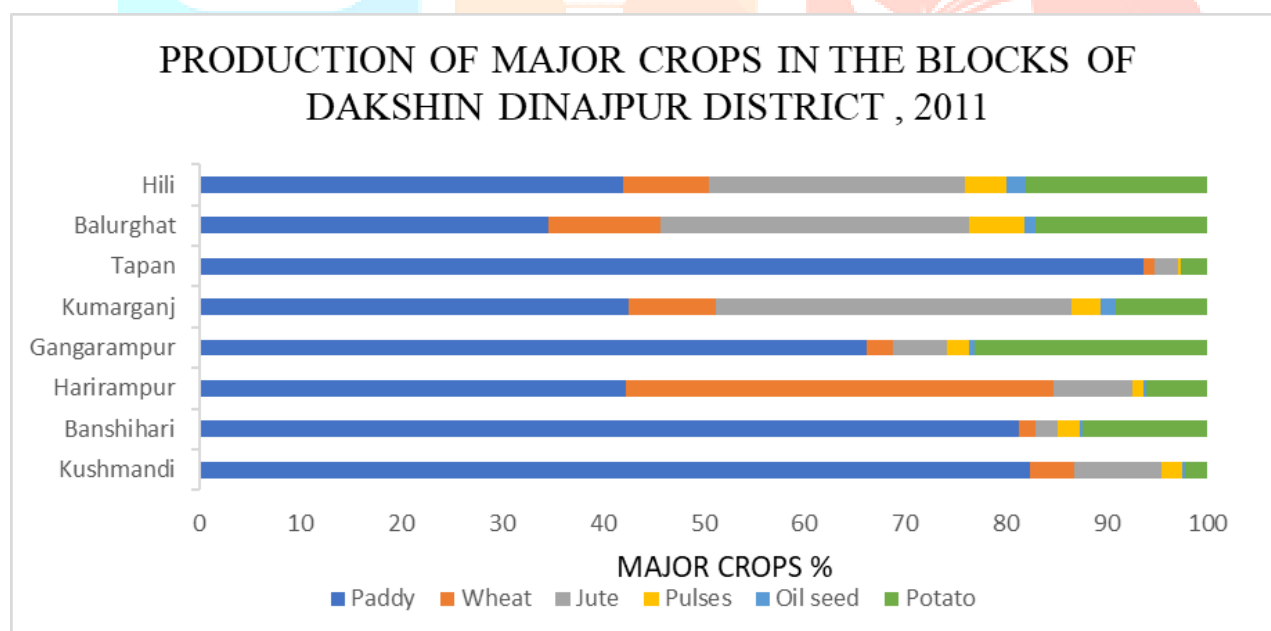
OIL SEED :

High oil seed concentration is observed in eastern part of the district.North-Eastern and south-western part shows the medium oil seed concentration.And Low percentage of oil seed concentration found in south,western part of the district.

PRODUCTION OF MAJOR CROPS OF DAKSHIN DINAJPUR DISTRICT (%)

Sl. no	Name of the blocks	Paddy	Wheat	Jute	Pulses	Oil seed	Potato	Total
1	Kushmandi	82.36	4.39	8.73	2.04	0.28	2.20	100.00
2	Banshihari	81.27	1.74	2.16	2.16	0.35	12.33	100.00
3	Harirampur	42.30	42.41	7.91	1.09	0.20	6.10	100.00
4	Gangarampur	66.24	2.56	5.34	2.25	0.52	23.09	100.00
5	Kumarganj	42.55	8.62	35.31	2.94	1.42	9.16	100.00
6	Tapan	93.63	1.11	2.28	0.41	0.00	2.56	100.00
7	Balurghat	34.64	11.14	30.56	5.53	1.04	17.09	100.00
8	Hili	42.06	8.51	25.42	4.11	1.90	18.00	100.00

(Source: District statistical Hand Book, Dakshin Dinajpur,2014)



(Source: District statistical Hand Book, Dakshin Dinajpur,2014)

PRODUCTION OF MAJOR CROPS:

From the above diagram and data table it is clearly shows that production of paddy and jute plays a dominant role in Dakshin Dinajpur District. Almost 80% production comes from paddy and jute in the district. The main crop production for every block is paddy and jute.

CROPPING INTENSITY :

Crop intensity is a measure of how intensively a piece of land is used for crop production. It's calculated as the ratio of the gross cropped area to the net sown area, expressed as a percentage. A higher cropping intensity indicates that a field is used to grow crops more frequently throughout the year, which can be achieved through multiple cropping and the use of short-duration varieties. This practice can lead to increased productivity but may also require more inputs like water, fertilizers, and pesticides

Cropping intensity = (Gross Cropped Area/ Net shown Area) x 100

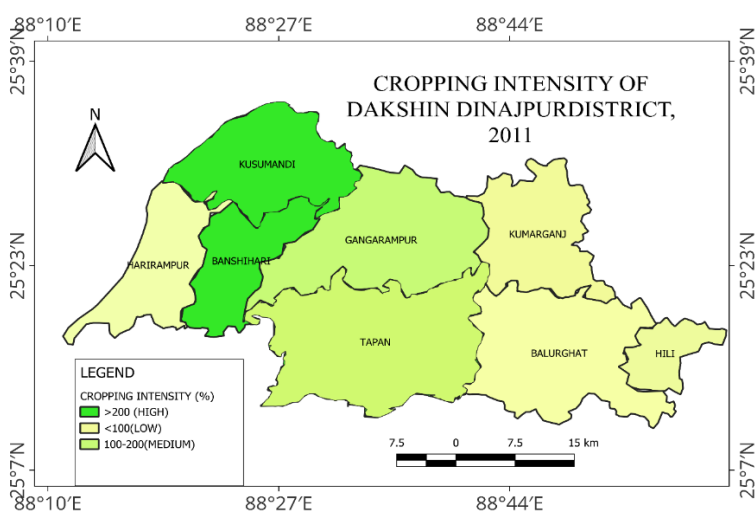
CROPPING INTENSITY OF DAKSHIN DINAJPUR DISTRICT (2011)

Sl. no	Name of the Block	Gross cropped area (In hectare)	Net sown Area (In hectare)	Crop Intensity
1	Kushmandi	54892	23120	237.42
2	Bansihari	55151	15589	353.78
3	Harirampur	10118	16071	62.96
4	Gangarampur	42866	26166	163.82
5	Kumarganj	9359	20600	45.43
6	Tapan	48698	24884	195.70
7	Balurghat	16374	27403	59.75
8	Hili	4677	6636.9	70.47

(Source : Computed from Data derived from Statistical Handbook of Dakshin Dinajpur 2014)

CATEGORY	NO.OF BLOCKS	NAME OF THE BLOCKS
High cropping Intensity (>200)	2	Kushmundi and Bansihari
Moderate cropping Intensity (150-200)	2	Gangarampur and Tapan
Low cropping Intensity (<150)	4	Harirampur, kumarganj, Balurghat and Hili.

Source : Computed by Author

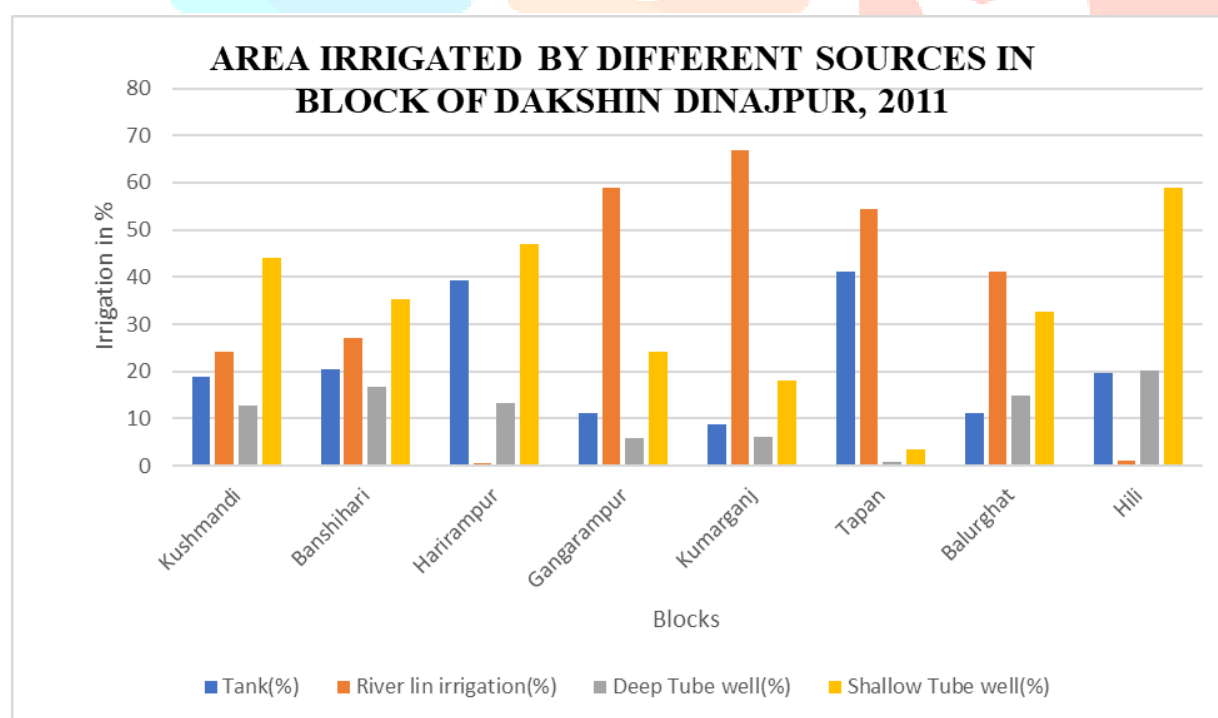


Highest cropping intensity is found western part of the district. Moderate cropping intensity is found Tapan and Gangarampur blocks. Low cropping intensity is focused in the four blocks that are the Hili, Harirampur, Balurghat and Kumarganj blocks respectively.

**AREA IRRIGATED BY DIFFERENT SOURCES IN BLOCKS OF DAKSHIN DINAJPUR
DISTRICT, 2011**

Sl. no	Name of the Block	Tank (%)	River in irrigation (%)	Deep Tube well (%)	Shallow Tube well (%)	Total (%)
1	Kushmandi	18.97	24.24	12.75	44.05	100.00
2	Banshihari	20.58	27.02	16.84	35.36	100.00
3	Harirampur	39.18	0.51	13.40	46.91	100.00
4	Gangarampur	11.07	58.84	5.84	24.26	100.00
5	Kumarganj	8.74	66.95	6.27	18.05	100.00
6	Tapan	41.05	54.44	0.91	3.60	100.00
7	Balurghat	11.27	41.15	14.96	32.62	100.00
8	Hili	19.74	1.08	20.33	58.84	100.00

(source: District statistical Hand Book Dakshin Dinajpur, 2011)



SOURCES OF IRRIGATION:

From the table it is found that river lift irrigation and shallow tube well is the main sources for irrigation. Almost 50% of irrigation is done by these sources. Tank irrigation also very important source for irrigation in this district. As it is an agricultural district so irrigation is very important. River punarbhaba and River Atrai flows over the Kumarganj, Balurghat, Gangarampur and Tapan blocks so that River Lift Irrigation in these blocks. In Hili, Kushmundi and Bansihari block the main source of irrigation is shallow Tube well.

IRRIGATION INTENSITY OF DAKSHIN DINAJPUR DISTRICT, 2011

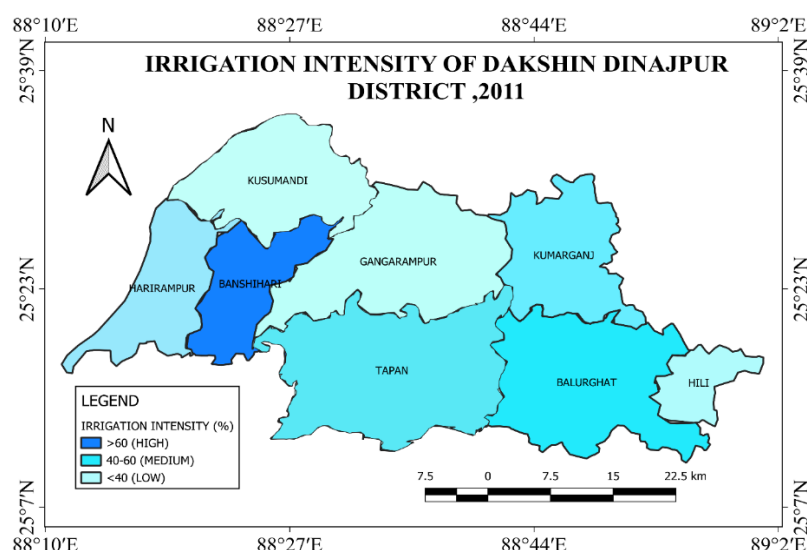
Sl. no	Name of the Block	Net sown Area (In hectare)	Net Irrigated Area (In hectare)	Irrigation Intensity
1	Kushmandi	23120	6786.8	29.35
2	Bansihari	15589	11805	75.73
3	Harirampur	16071	8514.4	52.98
4	Gangarampur	26166	8423	32.19
5	Kumarganj	20600	11108	53.092
6	Tapan	24884	12948	52.03
7	Balurghat	27403	14243	51.98
8	Hili	6636.9	1402.5	21.13

(Source: Computed from Data derived from Statistical Handbook of Dakshin Dinajpur 2011)

Distribution of Irrigation Intensity

Category	No. of Blocks	Name of Blocks
High irrigation intensity(>60)	1	Bansihari
Medium irrigation intensity (40-60)	4	Kumarganj, Tapan, Harirampur and Balurghat
Low irrigation intensity(<40)	3	Kushmundi, Gangarampur and Hili

Source : Computed by Authors



The high irrigation intensity found in only one block i.e Bansihari (75.73). Medium irrigation intensity is found Kumarganj, Tapan, and Balurghat respectively. Low irrigation intensity is found Gangarampur, Kushmundi, and Hili blocks. potato cultivation practices in all the blocks. The production of pulses is very negligible.

CROP DIVERSIFICATION OF DAKSHIN DINAJPUR DISTRICT:

Crop diversification refers to the practice of growing a variety of different crops in the same area over time. It's a strategy used by farmers to reduce risk and increase sustainability. Diversification can be horizontal, involving the cultivation of different crops at the same time, or vertical, which includes different types of agricultural activities like livestock or aquaculture. The benefits of crop diversification include improved soil health, reduced pest and disease pressure, and increased resilience to market and climate fluctuations.

MEASUREMENT OF CROP DIVERSIFICATION:

Bhatia (1965) has evolved a simple formula by taking into account of the total cropped area to make an objective measurement of crop diversification. He has taken the ratio between the areas under all those crops which cover up to 10% of the cropped area. The formula is:

$$\frac{\text{Percentage of Total cropped area under "n" crops}}{\text{Number of "n" crops}}$$

Index of Crop Diversification of Dakshin Dinajpur District, 2014

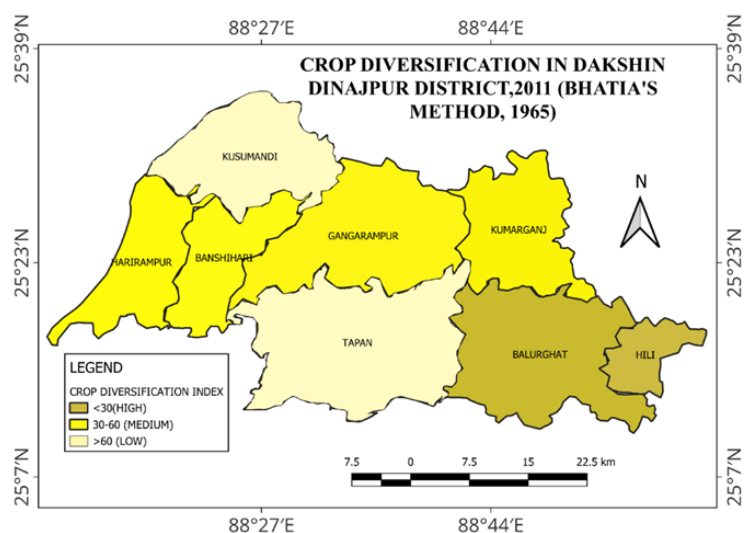
Sl. no	Name of the Block	No. of crops	Area In %	Index of Diversification
1	Kushmandi	1	82.36	82.36
2	Bansihari	2	93.6	46.80
3	Harirampur	2	84.7	42.35
4	Gangarampur	2	89.33	44.67
5	Kumarganj	2	77.86	38.93
6	Tapan	1	93.63	93.63
7	Balurghat	3	82.29	27.43
8	Hili	3	85.48	28.49

(source: computed from Data derived from District statistical Handbook,2014)

Distribution of crop Diversification

Category	No.of Blocks	Name of Blocks
High Diversification (<30)	2	Hili and Balurghat
Medium Diversification (30-60)	4	Kumarganj,Gangarampur,Harirampur and Bansihari
Low Diversification (>60)	2	Kushmundi and Tapan

Source: Computed by Authors



High crop diversification (<30) is found Hili and Balurghat block. Medium crop diversification (30-60) is found Harirampur, Banshihari, Gangarampur, and Kumarganj blocks respectively. Low crop diversification (>60) is found Kusumandi and Tapan block.

CROP COMBINATION OF DAKSHIN DINAJPUR DISTRICT :

Crop combination refers to the grouping of dominant crops that are cultivated together in a region during a specific time period, usually a year. This concept is important in agricultural geography as it helps in understanding the natural, cultural, and economic aspects of an area's agriculture. J.C. Weaver is a statistical technique used to delineate agricultural regions based on crop combinations.

$$S = \sum d^2/n$$

Where, S= crop combination

d= difference between actual crops percentage in the study region and the percentage in the theoretical distribution.

n= number of crop in the given combination.

CROPS PRODUCTION OF DAKSHIN DINAJPUR DISTRICT ,2014

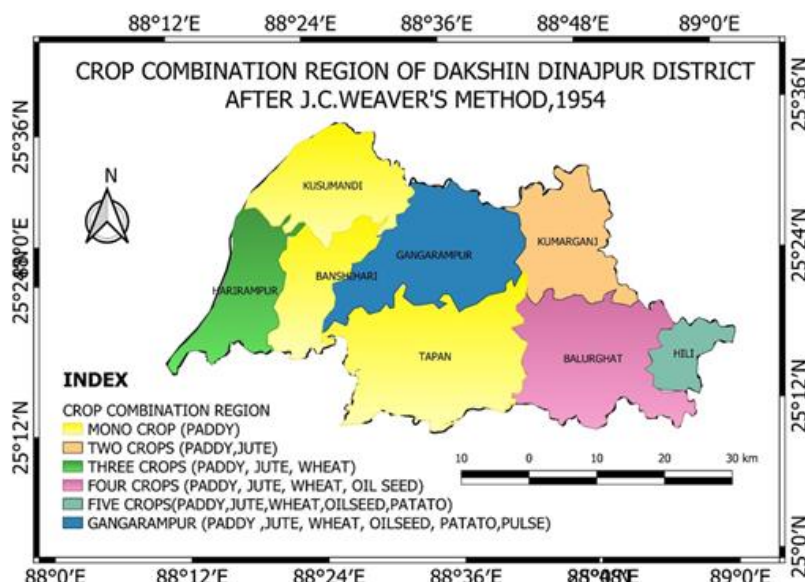
Serial No.	Name of the Blocks	Paddy	Jute	Wheat	Patato	Pulses	Oil seed	Total
1	Kusumandi	45209.00 82.36	4793.00 8.73	2412.00 4.39	1118.00 2.04	154.00 0.28	1206.00 2.20	54892.00 100.00
2	Banshihari	44820.00 81.27	1189.00 2.16	558.00 1.74	1193.00 2.16	193.00 0.35	6789.00 12.33	55151.00 100.00
3	Harirampur	8280.00 42.30	800.00 7.91	4291.00 42.41	110.00 1.09	20.00 0.20	617.00 6.10	10118.00 100.00
4	Gangarampur	28395.00 66.24	2289.00 5.34	1097.00 2.56	965.00 2.25	222.00 0.52	9898.00 23.09	42866.00 100.00
5	Kumarganj	3982.004 42.55	3305.00 35.31	807.00 8.62	275.00 2.94	133.00 1.42	857.00 9.16	9359.00 100.00

Source : Computed from data derived from district statistical handbook 2014

6	Tapan	45597.00 93.63	1110.00 2.28	542.00 1.11	198.00 0.41	2.00 0.00	1249.00 2.56	48698.00 100.00
7	Balurghat	5672.00 34.64	504.00 30.56	1824.00 11.14	905.00 5.53	171.00 1.04	2798.00 17.09	166374.00 100.00
8	Hili	1967.00 42.06	1189.00 25.42	398.00 8.51	192.00 4.11	89.00 1.90	842.00 18.00	4677.00 100.00

Table for significant crop combination for all Blocks

Sl.no	Name of the Blocks	No. of Crops
1	Kusumandi	Mono crop
2	Banshihari	Mono crop
3	Harirampur	Three crops
4	Gangarampur	Six crops
5	Kumarganj	Two crops
6	Tapan	Mono crop
7	Balurghat	Four crops
8	Hili	Five crops



Crop combination by J.C Weaver's method for the six crops such as paddy, jute, wheat, oil seed, papato, pulses, has been shown in the eight blocks of the given district. From the cultivation it can be seen that three blocks that is Kusumandi, Banshihari, Tapan has a prominanace of mono crop cultivation, through this blocks has cultivated four types crops but due to the coverage of higher percentage gross crop area for paddy the mono crop that is paddy suignificant in aforesaid the blocks .Two crop combination is found at the block of Kumarganj. Two crops combination such as paddy and jute. Three crop combination is found at the block of Harirampur. Three crops combination such as paddy ,jute, wheat. Five crops combination is found at the block of Hili. Five crops combination such as paddy, Jute, wheat, oil seed, patato. Six crop combination is found at the block of Gangarampur. Six crops combination such as Paddy, Jute, Wheat, oil seed, patato, pulses. The presence of fertile land, irrigation facility etc may help the cultivate two crops in the given region.

FINDINGS:

- A study cropping intensity reveals that higher cropping intensity means that a higher portion of the net area is being cropped more than once during one agricultural year.
- Paddy, a stable food crop, is grown extensively in the blocks of kusumundi, Banshihari, and Tapan.
- To study Banshihari block has highest cropping density with respect to highest irrigation density.

- The detailed analysis crop combination of the study area reveals that paddy ,jute and oilseed are the maincrops in dakshin dinajpur district.
- At the block level analysis, Balurghat and Hili blocks have some advantage in physical conditions. Therefore ,farmers of these blocks show more than three crops in an agriculture year.
- Low magnitude crop diversification finds in the Northern most and Southern most part of the study area.

SUGGESTIONS :

- Improving irrigation system by providing minor irrigation facilities, as benefit of agricultural irrigation mostly by minor river lift irrigation, deep tube well, shallow tube well and electrically operated shallow tube wells.
- Climate change can negatively affect crop production, increasing the livelihood of food insecurity. Improved sustainable agricultural policies such as greater plant diversity, organic farming, watershed management, seed banks, changing cropping patterns, drone use etc.
- Agroforestry practice of growing both crops and forest trees on the same piece of land. Agroforestry systems increase climate change resilience by preventing crop flooding and higher temperatures.
- If irrigation is done through canals then the water layer will not go down.

CONCLUSION :

Agriculture is a fundamental source of national prosperity. Agriculture plays important role in Indian economy. The role of farmers in Indian economy is very much important. Over 70% of total population of india depends on agriculture sector. The spatial variations in the degree of concentration of crop are found to be the result due to different interaction such as physiographic, climatic, hydrological, socio-economic and technological factors in organizational effects of the study region. The total cropped area and gross production of principal crops depend on the quantum and spread of precipitation and availability of ground water. Paddy ,a staple food crop, is grown extensively in the blocks of kushmundi, Bansihari and Tapan. The detailed analysis of crop combination of them both given time in the study area reveals that Paddy, jute and oilseed are the main crop in Dakshin Dinajpur District. Because most of the part have alluvial (fertile) soil, adequate irrigation facilities and developed agriculture infrastructure. At the block level analysis Balurghat and Hilli blocks have some adverse physical site. Therefore, farmers of these blocks shown more than three crops in both given times. However, in the case of other blocks which has fertile plain. Therefore, farmers have no more choice except paddy, wheat, jute, and pulses. As increase irrigation facilities, awareness about modern technology and changes in food style. Low magnitude crop diversification finds in the Northern most and Southern most part of the study area. Where, fertile plain, gradual slope, irrigation facilities and proper market, promote to paddy, wheat and pulses culture. While farmers struggling with either the adverse

physical environment or less developed agriculture infrastructure or both had witnessed moderate to high magnitude of crop diversification.

Conflicts of interest: The author declare no conflict of interest.

REFERENCE

<http://timesofindia.indiatimes.com/travel/balurghat/weather>

<https://en.m.wikipedia.org/wiki>

<https://cdn.s3waas.gov.in>

Transport network of Dakshin Dinajpur (Esri Map)

River system of South Dinajpur (Esri map)

Dakshin Dinajpur Krishi Vigyan Kendra annual report, 2016-17

Source :IMD, RRS (OAZ),UBKV Majhian , Patiram, Dakshin Dinajpur.

Source: India Meteorological Department, Ministry of Earth Sciences

South Dinajpur (google map) , census of india -1991, 2001, 2011,2014

Source: Field Survey: 2015-17

Source : www.ddinajpur.nic.in