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Impact of Irrigation Intensity on Cropping Intensity in Dakshin Dinajpur District, West Bengal, India

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Abstract:
Agriculture, in most developing economics, is the core sector providing livelihood to a significant proportion of the population, especially in rural area. India is an agrarian economy and Indian's agriculture is mainly dependent on monsoon season. Which is highly erratic and variable in nature . So, irrigation is a proper way of supplying water to the dry areas and dry seasons as a supplement of rain water. Most of the rainfall is in India is concentrated during June to September and rests of the months face acute shortage of water. Thus, irrigation is one of the main factors influencing cropping intensity – providing, adequate and timely supplies of water for increasing agricultural production. Dakshin Dinajpur will eventually lead to the growth of agriculture at state level and also the growth of the State economy. The present study is based on secondary data and interview of farmers of some selected blocks. Cropping intensity & Irrigation Intensity is measured by general formula and compiled data have been processed, computed in tabulated from and finally mapped by QGIS tool and relevant statistical diagrams. Out of 8 blocks 4 blocks have been showing increase in cropping intensity and 5 blocks have registered increasing irrigation intensity in between 2010 -11 & 2020 -21. In many cases it has shown negative relationships due to infrastructural deficient and acquisition of land for non agricultural purposes etc.

Keywords: Cropping intensity, Irrigation Intensity, Cropping intensity zone, Relationship.

Introduction:

Indian economy depends on agriculture. Over 58 percent of Indian population is directly or indirectly dependent on agriculture. Succesful cultivation is depending on proper, regular and well maintained irrigation systems. Iuurrigation system is on of the most important agricultural infrastructural facilities. Timely and adequately rainfall is considered is on of the most important sources of irrigation. But rain fall in India as well as Dakshin Dinajpur district is uncertain, uneven and periodic in nature. So, proper irrigation is must for developing agriculture. Crop concentration, diversification, intensity and combination depend on availability and suitable mode of irrigation system. According to large number of farmers 'without water nothing else matters' Kautilya described in his Arthashastra in 37 B.C. ' Agriculture cannot be made solely dependent on a rain which amounts to Grambling with nature'(Kurukshetra, 2017). Hoque (2015) highlights that cropping intensity dependent on the irrigation and others infrastructural facilities with the expansion in the irrigation the ground water abstraction has very high resulting ground water depletion as well as unavailability of ground water in Murshidabad district. Ahlawal and Renu (2016) highlights that enhancement of cropping intensity is possible by improved irrigation facilities, use of proper fertilizers, seeds and adoption of modern agricultural techniques and by

improving the cropping patterns. So, proper irrigation facility must be ensured to achieve and retain better cropping intensity.

The present study is discussing about impact of irrigation of irrigation intensity on cropping intensity and their relationship in Dakshin Dinajpur district in West Bengal and also suggests for an alternative methods of irrigation rather than highly water intensive method of irrigation.

Study area :

The study area covers Dakshin Dinajpur district in West Bengal. The district West Dinajpur came into existence in August 1947 with the partition of Bengal. The Province of Bengal was divided into two parts in accordance with the partition. The dividing line passed through the district of Dinajpur, the portion lying to the west of the line named as West Dinajpur. In 1992, it was divided into two districts, namely Dakshin Dinajpur and Uttar Dinajpur. The study areas, Dakshin Dinajpur District District is located in the middle east part in West Bengal. Dakshin Dinajpur District belongs to the Barind Tract which is the largest Pleistocene physiographic unit of the Bengal Basin; covering an area of about 7770 sq k.m. The study area extended from $25^0 10' 55''$ North to $26^0\ 35' 15''$North latitudes and $87^0 48' 37''$ East to $89^0\ 00'\ 30''$ East longitudes. It is surrounded in the north, east and south-east by Bangladesh, on the south – west by Malda district and on the West- Uttar Dinajpur district of West Bengal. The area of the district is 2219 sq. kms.(857 sq. mile) and its rank in respect of area in the state is sixteenth. The district comprises two subdivisions Balurghat and Gangarampur. Balurghat consists of Balurghat municipality and four community development blocks, namely Hilli, Balurghat, kumarganj and Tapan. Gangarampur subdivision consists of Gangarampur municipality and four community development blocks, namely Gangarampur, Banshihari, Harirampur and kushmundi. Total population of 1676276 persons and population density 755/ sq. k.m. as per census 2011. The district lies mainly four rivers, viz Atrayee, Punarbhaba, Yumuna and Tangon.

LOCATION MAP OF STUDY AREA

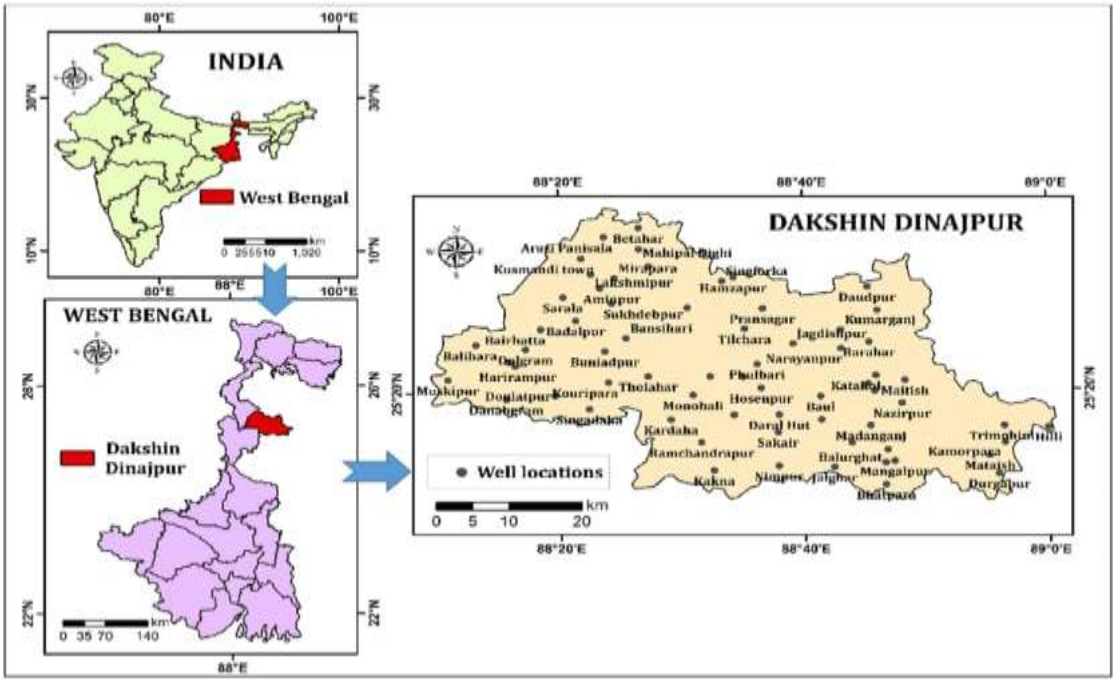

Fig – 1 – Location Map of the study area

Objectives :

The main objectives of the paper are as below –

1. To find out impact of irrigation intensity on cropping intensity in Dakshin Dinajpur District.
2. To make a comparative analysis of relationship between irrigation intensity and cropping intensity in Dakshin Dinajpur District.

Methodology:

The study is based on mainly secondary data. The data has been collected from following sources.

1. Report on National Aquifer Mapping & Management Plan in Dakshin Dinajpur District –2010 & 2020,
2. District statistical Hand book 2010 & 20
3. Interview of farmers of some selected blocks in Dakshin Dinajpur district. The collected data have been compiled, computed and tabulated by using following formula:

For cropping intensity :

$$\frac{\text{Gross Cropped Area}}{\text{Net Cropped Area}} \times 100$$

For irrigation intensity :

$$\frac{\text{Gross irrigated area}}{\text{Gross croped area}} \times 100$$

4. To show relationship between irrigation intensity and cropping intensity at C.D. blocks level for the year 2010- 11 & 2020 -21.
5. Report on Agricultural Census, Ministry of Agriculture and Irrigation .
6. Department of Agriculture, W.B. – Kolkata.
7. Statistical diagrams have been used for this purpose.

Result and Discussions :

Irrigation and cropping intensity in 2010-11 data bases :

From table no. 1 & 3, it is clear that the highest irrigation intensity is found in Harirampur (93.38) and lowest irrigation intensity is recorded in Hilli (11.92) C.D. block. Therefore, on the basis of cropping intensity , highest intensity is registered in Hilli (177.14) C.D. block and lowest intensity is found in Harirampur (60.50) C.D. block. Cropping intensity of Dakshin Dinajpur can be classified as below.

1. Low cropping intensity zone (< 100)
   It is seen only 1 C.D. block- Harirampur (60.50) .
2. Medium cropping intensity zone (100 - 150)It is found in Balurghat(139.76) , Banshihari (142.24) C.D. blocks .
3. High cropping intensity zone (> 150)
   This scenario is observed only four C.D. blocks. These are Gangarampur (151.01), Kushmundi (153.71), Kumargange (160.59) , Tapan (163.02), Hilli (177.14)

Irrigation and cropping intensity in 2020-21 data bases :

From table no. 2 & 3, it is clear that the highest irrigation intensity is found in Tapan (61.89) and lowest irrigation intensity is recorded in kumargange (32.29) C.D. block. Therefore, on the basis of cropping

intensity, highest intensity is registered in kumargange (189.65) C.D. block and lowest intensity is found in Haririampur (54.27) C.D. block. Cropping intensity of Dakshin Dinajpur can be classified as below.

1. **Low cropping intensity zone (< 100)**
   It is seen only 1 C.D. block- Haririampur (54.27) .
2. **Medium cropping intensity zone (100 - 150)**
   It is found in Tapan(128.54) Balurghat(137.33) , Banshihari (141.15) C.D. blocks .
3. **High cropping intensity zone (> 150)**
   This scenario is observed only four C.D. blocks. These are Gangarampur (155.01), Kushmundi (176.74) , Hilli (185.93), kumargange (189.65)

Changing trends of irrigation intensity in between 2010-11 and 2020-21

From table no 3 & 4 , it is clear that changing trends of cropping intensity are observed in two ways. First on is positive change another is negative change. This is analysis as below.

Positive growth of irrigation intensity in between 2010-11 and 2020 – 21 cropping year:

It is observed only six C.D. blocks (Table no – 4). The main causes of such changes are financial conditions of farmers are improved, Drip irrigation is implementation, Governmental initiative in respect oof irrigation is increasing, improved crop diversification practices, farmers can use better technological systems & already installed and adopt and tailor cropping patterns for lower water demand and usage.

Negative growth of irrigation intensity in between 2010-11 and 2020 – 21 cropping year:

It is observed only two C.D. blocks (table no – 4). The main causes of such changes are ground water over drafting, erratic nature of monsoon, unsuitable for irrigation system, lesser development of water management, lack of infrastructural facilities, unfair pricing of water, depletion of ground water, increasing practices of water extensive crops.

Changing trends of cropping intensity in between 2010-11 and 2020-21

Positive growth of cropping intensity in between 2010-11 and 2020 – 21 cropping year:

Only four C.D. blocks (Table no – 4) is found it, due to rural infrastructural development , improvement of modern agricultural technologies and irrigation facilities. NAS implementation, agriculture is moved toward profitable business, changes of agricultural systems.

Negative growth of cropping intensity in between 2010-11 and 2020 – 21 cropping year:

It is observed only four C.D. blocks (table no – 4). The main causes of such changes are adverse effect of urbanization, aquation of land for non agricultural purposes and over all infrastructural deficiency.

TABLE NO – 1 RELATIONSHIP BETWEEN CROPPING INTENSITY AND IRRIGATION INTENSITY IN 2010- 2011

SL.NO.	NAME OF THE BLOCK	GROSS CROPPED AREA	NET SOWN AREA	CROPPING INTENSITY	GROSS IRRIGATED AREA	IRRIGATION INTENSITY
1	KUSHMUNDI	35538	23120	153.71	6786.8	19.09
2	HARIRAMPUR	9118	15071	60.50	8514.4	93.38
3	BANSHIHARI	22174	15589	142.24	11805	53.23
4	GANGARAMPUR	39440	26116	151.01	8423	21.35
5	KUMARGANGE	33083	20600	160.59	11108	33.57

6	TAPAN	40567	24884	163.02	12948	31.91
7	BALURGHAT	38301	27403	139.76	14243	37.18
8	HILLI	11757	6637	177.14	1402.5	11.92

Sources : i) Report on National Aquifer Mapping & Management Plan in Dakshin Dinajpur District – 2010 - 2011 ,
ii) District statistical Hand book 2010-11 iii) Calculated by authors.

TABLE NO – 2 RELATIONSHIP BETWEEN CROPPING INTENSITY AND IRRIGATION INTENSITY IN 2020 - 2021

SL.NO.	NAME OF THE BLOCK	GROSS CROPPED AREA	NET SOWN AREA	CROPPING INTENSITY	GROSS IRRIGATED AREA	IRRIGATION INTENSITY
1	KUSHMUNDI	54892	31058	176.74	24320	44.30
2	HARIRAMPUR	10118	18643	54.27	4990.32	49.32
3	BANSHIHARI	23353	16544	141.15	12407	53.12
4	GANGARAMPUR	42866	27653	155.01	19012	44.35
5	KUMARGANGE	41268	21759	189.65	13328.44	32.29
6	TAPAN	48698	37883	128.54	30144	61.89
7	BALURGHAT	42100	30654	137.33	22472	53.37
8	HILLI	12677	6818	185.93	5091	40.15

Sources : i) Report on National Aquifer Mapping & Management Plan in Dakshin Dinajpur District – 2020 - 2021 , Distric statistical Hand book 2020-21 iii) Calculated by authors.

Fig – 2 Cropping intensity zone in 2010-11 of Dakshin Dinajpur district.

TABLE NO. 3 CHANGING TRENDS OF CROPPING INTENSITY & IRRIGATION INTENSITY IN DAKSHIN DINAJPUR DISTRICT (WEST BENGAL)

SL.NO.	NAME OF THE BLOCK	CROPPING YEAR 2010-2011		CROPPING YEAR 2020-2021		Change in crroping intensity in between 2010-11	Change in crroping intensity in between 2020-21
		Cropping intensity	Irrigation intensity	Cropping intensity	Irrigation intensity		
1	KUSHMUNDI	153.71	19.09	176.74	44.30	23.03	25.21
2	HARIRAMPUR	60.50	93.38	54.27	49.32	- 6.23	- 44.06
3	BANSHIHARI	142.24	53.23	141.15	53.12	- 1.09	- 0.11
4	GANGARAMPUR	151.01	21.35	155.01	44.35	4	23
5	KUMARGANGE	160.59	33.57	189.65	32.29	29.04	- 1.28
6	TAPAN	163.02	31.91	128.54	61.89	- 34.48	29.98
7	BALURGHAT	139.76	37.18	137.33	53.37	- 2.43	16.19
8	HILLI	177.14	11.92	185.93	40.15	8.79	28.23

Sources : i) Report on National Aquifer Mapping & Management Plan in Dakshin Dinajpur District – 2010 & 2020 , ii) District statistical Hand book 2010 & 20 iii) Calculated by authors.

TABLE NO - 4 Positive and Negative growth of cropping and irrigation intensity 2010-11 & 2020-21

SL.NO.	NAME OF THE BLOCK	Positive Growth of irrigation intensity & Cropping intensity in between 2010-11 & 2020-21		Negative Growth of irrigation intensity & Cropping intensity in between 2010-11 & 2020-21	
		Cropping intensity	Irrigation intensity	Cropping intensity	Irrigation intensity
1	KUSHMUNDI	23.03	25.21		
2	HARIRAMPUR			-6.23	-44.06
3	BANSHIHARI			-1.09	-0.11
4	GANGARAMPUR	4	23		
5	KUMARGANGE	29.06	1.28		
6	TAPAN		29.98	-34.48	
7	BALURGHAT		16.19	-2.43	
8	HILLI	8.79	28.23		

Sources : i) Report on National Aquifer Mapping & Management Plan in Dakshin Dinajpur District – 2010 & 2020 , ii) District statistical Hand book 2010 & 20 iii) Calculated by authors.

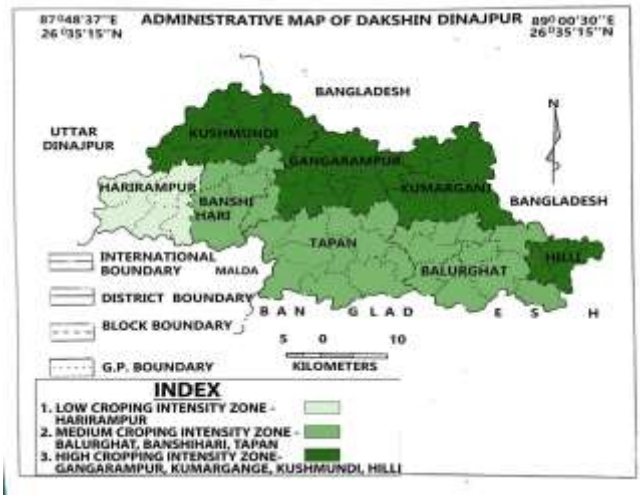

Fig – 3 Cropping intensity zone in 2020-21 of Dakshin Dinajpur district.

Impact of irrigation on cropping intensity :

Irrigation plays a vital role for increasing cropping intensity in Dakshin Dinajpur district. We discuss relationship between irrigation on cropping intensity.

Only four blocks have improved their cropping intensity due to increasing irrigation intensity. These C.D. blocks are Kushmundi, Gangarampur , kumargange and Hilli etc.

Only two C.D. blocks have shown their decreasing cropping intensity with improved their irrigation facilities. These are Tapan and Balurghat blocks . Main cause farmers may switch to crops like paddy, instead of multiple cropping, farmers grow only one major crop, reduces soil fertility, less availability of agricultural labour, cost of seeds, fertilizers, labour is high, irregular rainfall or temperature changes, better profit from one commercial crop.

Only two C.D. blocks have registered decreased irrigation intensity and decreased. cropping intensity .This C.D. blocks are Banshihari and Harirampur blocks. Due to its condition – less rainfall, decline in ground water level, less irrigation available, high cost of irrigation, irregular monsoon, agricultural land converted into housing, low profitability. The main causes of such negative impact of irrigation intensity are rapid growth of urbanization, acquisition of land in non agriculture purposes, agriculture deficient, rice crop concentration and low to medium crop diversification is observed (Day & Mistri, 2018).

Conclusion:

Dakshin Dinajpur is a predominantly agricultural district in West Bengal, formed in 1992, with its headquarters at Balurghat. Through careful observation, it is found that there exists a negative relationship between irrigation intensity and crop intensity. The root of this causes lies in socio-economic issues, like growth of settlement density , urban growth, infrastructural development, acquisition of agricultural land for non agricultural purposes and also the attitude of the young generation those are being less interested and dependent on agriculture as before.From above analysis and comparative study of 8 blocks of Dakshin Dinajpur district, it is clear the most of the blocks (2) have registered negative impact of cropping intensity on irrigation intensity, due to changing character of land use, Main cause farmers may switch to crops like paddy, instead of multiple cropping, farmers grow only one major crop, reduces soil fertility, less availability of agricultural labour, cost of seeds, fertilizers, labour is high, irregular rainfall or temperature changes, better profit from one commercial crop. Therefore, only (4) blocks have recorded positive

relationship between irrigation and cropping intensity. It is hopped that if these negative relationship are minimized with proper care in future this blocks will create the new vista of agricultural growth and development in the Dakshin Dinajpur district.

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