

## Chapter IV

### 4.0 CROPPING INTENSITY IN KOCH BIHAR DISTRICT

#### 4.1 Introduction

Cropping Intensity is defined as the ratio between Net Sown Area (NSA) and Gross Cropped Area (GCA), which indicates the additional percentage share of the area sown more than once to NSA (S. Singh, 1967). It is also known as farming intensity.

#### 4.2 Methodology

The ratio of gross cropped area (GCA) to net cropped area (NCA) has been used for many years as a traditional method of cropping intensity. However, it has some drawbacks, as this method does not consider the length of period those lands under cultivation. As the maturity periods of different crops are different, this traditional method fails to interpret the cropping intensity of the region. For example, a piece of land that is used for two or three short duration crops one after the another, and those may together occupy the field for say, six or seven months, is counted as two or three hectare whereas a hectare of land occupied by one crop for whole year, treated as one hectare. So this traditional method has led to misleading about intensity of cropping.

To apprehend the spatial variation in cropping intensity among the different blocks of Koch Bihar district the following two methods (Eq. no. 4.1 and 4.2) have been selected.

i) Traditional method (as applied by S. Singh, 1967):

$$\text{Gross cropped area} \times 100 / \text{Net sown area} \dots\dots\dots 4.1$$

ii) Alternative method by C.R. Rao and H.C. Brookfield (1977-78):

$$I_c = \frac{\sum_{i=1}^n A_{ci} \cdot d_i + A_{cij} \cdot d_{ji} + \dots\dots\dots A_{cn} \cdot d_n}{Q} \dots\dots\dots 4.2$$

Where,  $I_c$  = Cropping intensity index,  
 $A_{ci}$  = the area under crop  $i$ ,  
 $d_i$  = duration of  $i^{\text{th}}$  crop in the field,  
 $Q$  = Net Sown Area in the areal unit concerned

### 4.2.1 Determinants of cropping intensity

Intensity of cropping depends on a number of factors, such as:

- i) Nature & fertility of land
- ii) Quality of seeds
- iii) Introduction of HYVs and its availability
- iv) Availability of irrigation facility & assured supply of water
- v) Consumption of fertilisers & green manures
- vi) Timely application of pesticides & insecticides to save the crops
- vii) Population pressure on land
- viii) Marketability of crops
- ix) Attitude of farmers, whether they leave the land to regain the fertility or practice double or triple cropping in a year.

### 4.3 Temporal variation of cropping intensity

Cropping intensity of an area often reflects its overall agricultural efficiency. Koch Bihar is traditionally agricultural district with a mean cropping intensity of 157 in 1980-81 as compare to 139 of the state of West Bengal. Over the past two and a half decades the cropping intensity of both Koch Bihar district and West Bengal state increased steadily to 194 and 177 respectively. However, the year-wise trend of cropping intensity has been tabulated in table no. 4.1 and diagrammatically in figure 4.1. The block wise change of cropping intensity has been tabulated in table no. 4.2 and diagrammatically in figure 4.2.

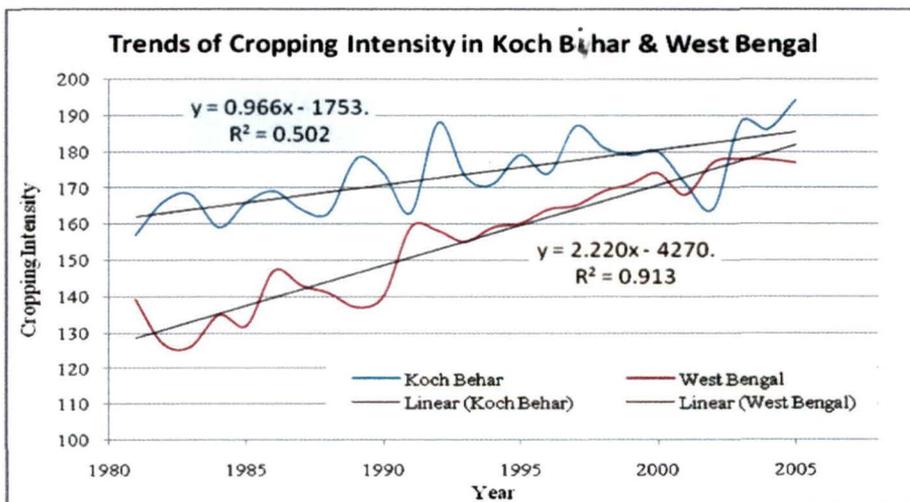


Figure 4.1 Trend of cropping intensity in Koch Bihar and West Bengal

Table 4.1

Trend in cropping intensity of Koch Bihar and its comparison with the state of West Bengal

Year	Koch Bihar District (in 000 ha)			West Bengal State (in 000 ha)		
	Net sown area	Gross cropped area	Cropping Intensity	Gross cropped area	Net sown area	Cropping Intensity
1980-81	264.44	415.181	157	7661.60	5508.15	139
1981-82	253.58	420.12	166	7021.60	5509.24	127
1982-83	254.0	425.65	168	6751.10	5354.59	126
1983-84	266.73	423.00	159	7369.20	5440.81	135
1984-85	258.30	429.80	166	7286.40	5515.51	132
1985-86	254.98	431.12	169	8037.16	5474.39	147
1986-87	265.7	435.45	164	7750.80	5405.89	143
1987-88	248.95	406.2	163	7784.60	5510.40	141
1988-89	259.75	461.6	178	7608.60	5560.85	137
1989-90	256.25	446.4	174	7854.25	5625.45	140
1990-91	258.75	422.5	163	8662.28	5463.42	159
1991-92	246.49	464.3	188	8666.26	5476.88	158
1992-93	252.70	436.7	173	8540.25	5494.17	155
1993-94	251.65	430.8	171	8680.49	5459.43	159
1994-95	248.9	446.06	179	8718.17	5463.59	160
1995-96	259.0	450.2	174	8972.54	5461.93	164
1996-97	246.0	460.3	187	9032.94	5463.13	165
1997-98	249.1	449.8	181	9233.03	5465.06	169
1998-99	248.07	443.3	179	9309.64	5440.25	171
1999-00	246.12	443.3	180	9545.36	5471.71	174
2000-01	264.92	453.6	171	9116.60	5417.38	168
2001-02	270.03	442.79	164	9778.815	5521.576	177
2002-03	253.54	477.19	188	9510.423	5354.196	178
2003-04	257.0	478.62	186	9660.000	5427.672	178
2004-05	254.16	494.28	194	9522.930	5374.104	177

Source: i) District Statistical Hand Book, Bureau of Applied Economics & Statistics, and  
ii) Agriculture Annual Plan, Koch Bihar District, Principal Agriculture Office, Govt. of W.B.

#### 4.4 Spatial variations in cropping intensity

An attempt has been made to assess the block-wise spatial variations of cropping intensity of Koch Bihar district for two different base period i.e., 1980-81 and 2004-05 by applying both the traditional and alternative methods.

##### 4.4.1 Traditional methods

###### 4.4.1.1 Cropping intensity regions (1980-81)

By using the traditional formula after S. Singh (1967 & 1994), calculation is done and a picture of spatial variation in the cropping intensity is obtained. Sitalkuchi is reported to have the lowest cropping intensity value of 132.88 and Dinhata II recorded the highest cropping intensity value of 245.22. Block- wise cropping intensity in Koch Bihar district has been tabulated in table 4.1. Based on the result a worksheet of index scale has been prepared to distinguish High, Moderate & Low intensity rating in the blocks and mapped the same.

The cropping intensity with value above 220 has been classified as high which is identified only in Dinhata II. Three blocks namely Haldibari (206.95), Sitai (199.14), and Tufanganj I (194.11) have been categorized as moderately high cropping intensity zone. Majority of blocks namely Dinhata I (177.96), Koch Bihar I (183.78), Tufanganj II (187.06), Mathabhanga I (187.34), Koch Bihar II (188.90) have been identified as the moderate to low cropping intensity. Low cropping intensity with values less than 160 has been identified in Sitalkuchi (132.88), Mathabhanga II (146.30) and Mekhliganj (154.92). Figure 4.3a and table 4.2 demonstrates the spatial distribution of cropping intensity in the Koch Bihar district for the year 1980-81.

Table No. 4.2 Block-wise cropping intensity in Koch Bihar district

Blocks	1980-81 (in hectare)			2004-05 (in hectare)			Change
	Net sown area	Gross cropped area	Cropping intensity	Net sown area	Gross cropped area	Cropping intensity	
Mekhliganj	19010	29450	154.92	23371	35005	149.78	-5.14
Haldibari	9500	19660	206.95	10269	22376	217.90	10.95
Mathabhanga-I	20610	38610	187.34	23059	44295	192.09	4.75
Mathabhanga-II	26460	38710	146.30	28461	45136	158.59	12.29
Sitalkuchi	21230	28210	132.88	22210	34151	153.76	20.88
Koch Bihar I	25090	46110	183.78	27491	57135	207.83	24.05
Koch Bihar II	22340	42200	188.90	24081	51611	214.32	25.42
Tufanganj- I	20710	40200	194.11	23226	49183	199.96	5.85
Tufanganj- II	18850	35260	187.06	19678	36160	197.52	10.46
Dinhata I	20700	36980	179.96	22811	42391	185.84	5.88
Dinhata II	17780	43600	245.22	19214	49206	256.09	10.87
Sitai	8120	16170	199.14	9992	21013	210.30	11.16
Total	230400	415180	180.40	253863	487678	192.10	11.7

Source: i) District Statistical Hand Book, Bureau of Applied Economics & Statistics; and ii) Agriculture Annual Plan, Koch Bihar District, Principal Agriculture Office, Govt. of W.B.

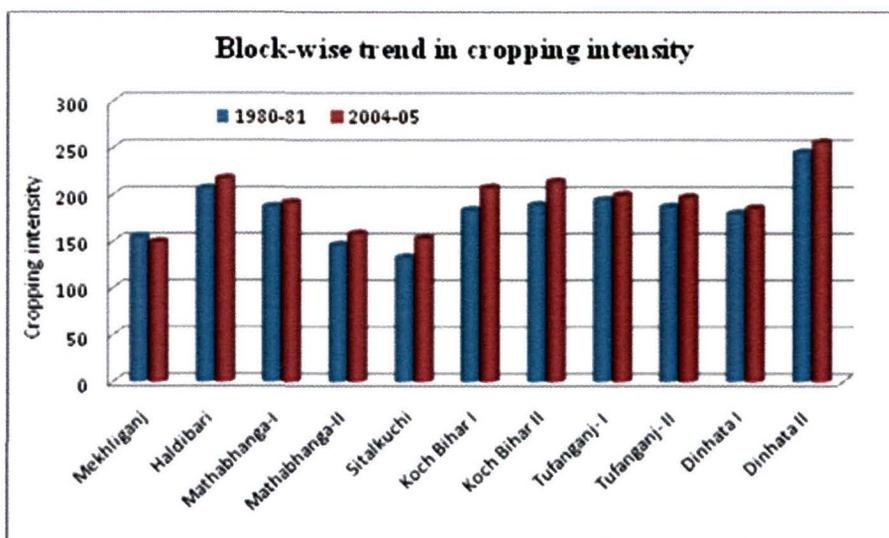


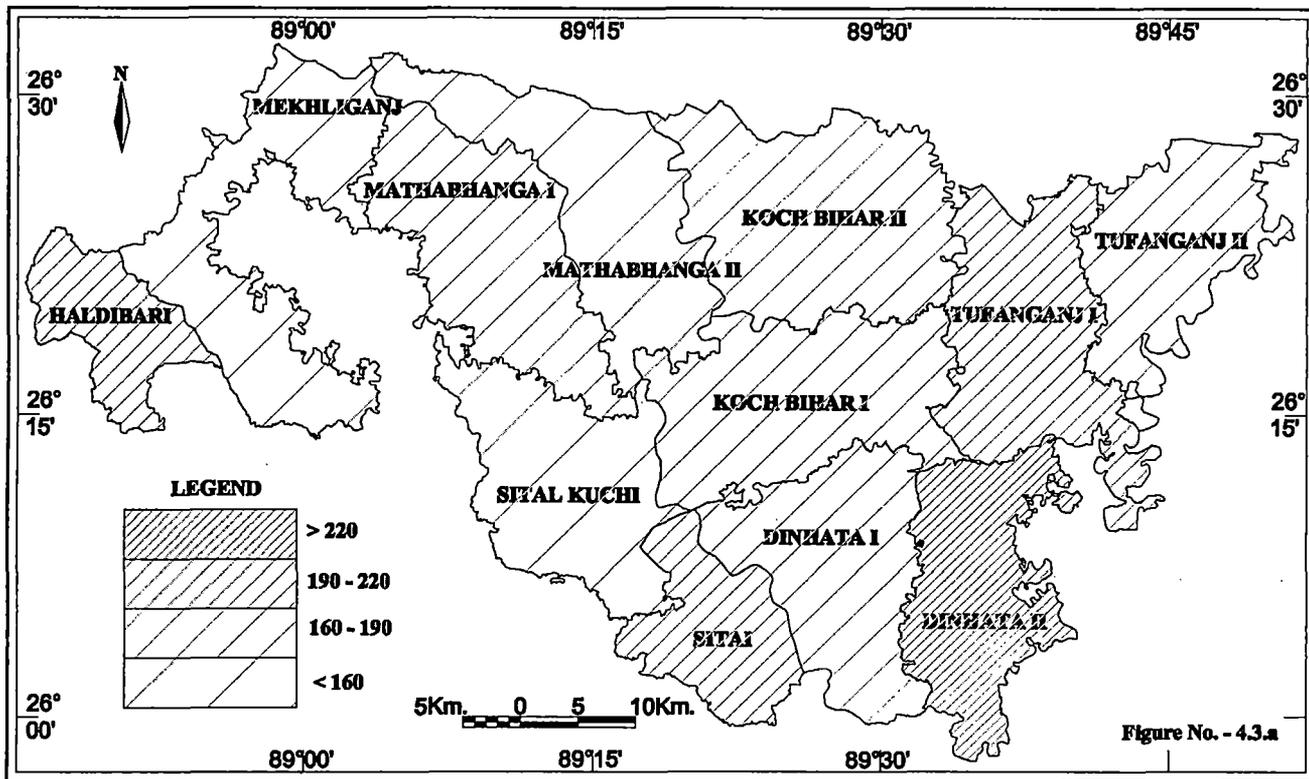
Figure 4.2 Block-wise trend of cropping intensity in Koch Bihar district

#### 4.4.1.2 Cropping Intensity Regions 2004-05

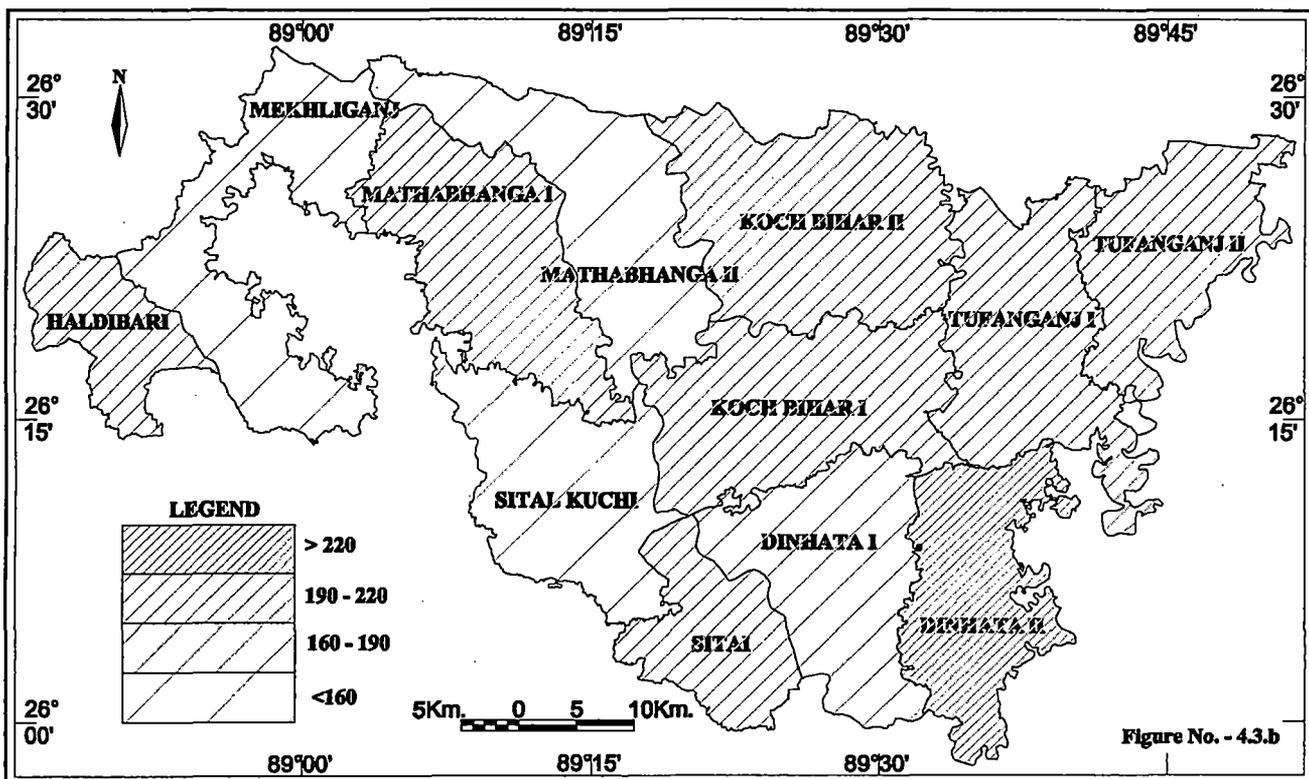
Figure 4.3b and table 4.2 demonstrates the spatial distribution of cropping intensity of different blocks of Koch Bihar district in the year 2004-05. In all blocks of this district multiple cropping are often adopted and hence cropping intensity of the district is high (192.10 percent). However, for a better understanding of geographical distribution of intensity the following cropping intensity zones have been identified:

- High cropping intensity region with  $> 220$ ; only Dinhata II block in Koch Bihar district.
- Moderately high cropping intensity region with intensity index between 190 to 220; identified in Haldibari, Mathabhanga I, Koch Bihar I & II, Tufanganj I & II and Sitai blocks of Koch Bihar district.
- Moderately low cropping intensity region with intensity index in between 160 to 190; identified only in Dinhata I block.
- Low cropping intensity region with intensity index less than 160; recorded in Mekhliganj, Mathabhanga II and Sitalkuchi blocks in Koch Bihar district.

### CROPPING INTENSITY REGION 1980-81



### CROPPING INTENSITY REGION 2004-'05



Mekhliganj is reported to have the lowest cropping intensity value of 149.78 & Dinhata II recorded the highest cropping intensity value of 256.09. Block wise cropping intensity in Koch Bihar district has been tabulated in table 4.1. Based on the result a worksheet of index scale has been prepared to distinguish High, Moderate & Low intensity rating in the blocks and mapped the same.

The intensity having >220 has been classified as high which is concentrated in one block namely Dinhata II and the corresponding intensity values is 256.09. The factors mentioned above are positively associated for such high degree of Cropping Intensity. Maximum numbers of blocks such as Mathabhanga I (192.09), Tufanganj II (197.52), Tufanganj I (199.96), Koch Bihar I (207.83), Sitai (210.30), Koch Bihar II (214.32) and Haldibari (217.90), have been categorized to mark the moderate high cropping intensity with values ranging between 190-220. Only one block namely Dinhata I is identified as the moderate low cropping intensity (160-190) with the value of 185.84. Low cropping intensity with values < 160 is identified in three blocks namely Mekhliganj (149.78), Sitalkuchi (153.76) and Mathabhanga II (158.59). The low level of cropping intensity is due to limited availability of water for irrigation, partly infertile sandy soil and greater chances of inundation due to flood.

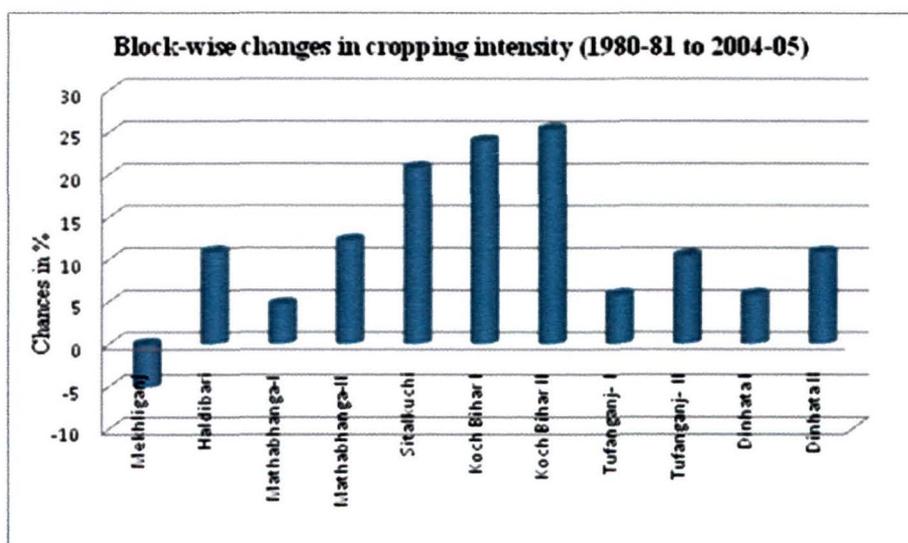


Figure 4.4 Block-wise changes in cropping intensity in Koch Bihar district

Except Mekhliganj (- 5.14%) all blocks attributed to a positive change ranging 4.75% in Sitalkuchi to 25.42% in Koch Bihar II. These changing values are categorized into

five intensity classes. Mekhliganj block experienced negative growth of cropping intensity over the period of 1980-81 to 2004-05. Low positive growth (0 - 6%) has been observed in Mathabhanga I, and Dinhata I. Moderate low growth (6 - 12%) identified in Tufanganj II, Dinhata II, Haldibari and Sitai blocks. Mathabhanga II show moderate positive growth of 12-18 percent. High positively growth i.e. >18% is observed in three blocks such as Sitalkuchi, Koch Bihar I and Koch Bihar II (Figure 4.4).

#### 4.4.2 Alternative method

C. R. Rao and H.C. Brookfield (1971-72) formulated alternative method for assessing cropping intensity where importance of crop duration under field condition has been taken into consideration. The longer a crop stays in the field the larger will be the inputs of land, labour and irrigation water, intensity of cropping would be the ratio of sum of crops area under various crops which are multiplied by duration of the crops in the field to the net sown area. These indices give crop months per hectare of net sown area. It is better method of cropping intensity than the traditional one (Table 4.3).

To describe this method of cropping intensity for 12 blocks of Koch Bihar district where measure and mapped by choropleth, using data during 1980-81 and 2004-05. Thirteen major crops such as *aus*, *aman*, *boro*, wheat, jute, pulses, oilseed, mustard, potato, tobacco, vegetables and spices have taken into consideration and these are multiplied by the average duration of crops. By summing all figures for each block, is divided by the net sown area of the blocks.

During 1980-81, the highest cropping intensity is observed in Sitai (12.21%) and lowest in Sitalkuchi Block (6.34%). High intensity cropping pattern is mainly concentrated in Stai (>12%) and moderate high intensity zone in Haldibari Block (10-12%). These concentrations correspond with the densely populated flood plains of Tista and Mansai rivers, which either received plenty amount of rainfall or have adequate irrigation facilities or well fertile alluvial soil in the above mentioned river basin. Moderate low intensity zone (7-10%) is identified in Dinhata II (7.93%), Dinhata I (7.97%), Tufanganj I (8.12%), Mathabhanga I (8.41%), Koch Bihar II (9%) and Koch Bihar I (9.27%). Low intensity of cropping (<7%) is observed in Sitalkuchi (6.34%), Mekhliganj (6.61%), Tufanganj II (6.69%) and Mathabhanga II (6.98%).

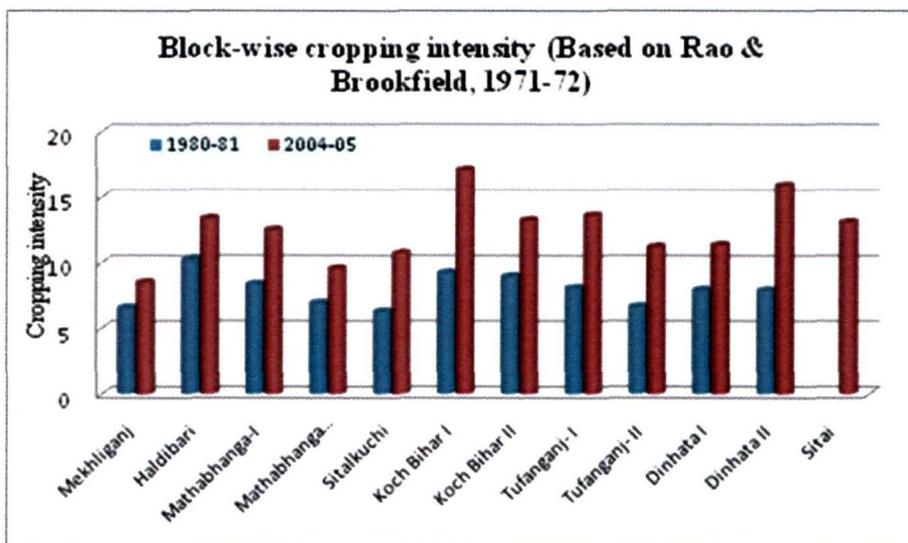


Figure 4.5 Changing pattern of cropping intensity in Koch Bihar district

Cropping intensity of 2004-05 has also categorised into four classes such as low (<10), moderate low (10-12), moderate high (12-14) and high (>14). During 2004-05, the highest cropping intensity is observed in Koch Bihar II (17.13) and lowest in Mekhliganj Block (8.57). Area of high intensity cropping pattern is mainly concentrated in Sitai (13.15) and moderate high intensity zone in Mathabhanga I (12.55), Koch Bihar (13.30), Haldibari (13.42) and Tufanganj I (13.68). Moderate low intensity zone (10-12) is identified in Sitalkuchi (10.77), Tufanganj II (11.27), Dinhata I (11.41). Low intensity of cropping (<10) is observed in Mekhliganj (8.57) and Mathabhanga II (9.61). Low intensity of cropping is due to cropland remain unused for five to seven months throughout the entire district. Insufficient rainfall, low irrigation facilities and infertile soil are largely responsible for low intensity.

#### 4.5 Discussion

The intensity pattern just described has broad similarities to that produce by the traditional index (Surrender Singh's method) but intensive comparative study show significant difference between the two. Dinhata II for both the study period i.e. 1980-81 and 2004-05 shows the highest intensity in traditional method whereas Dinhata II along with Koch Bihar I and Sitai show highest cropping intensity in alternative method. There were three blocks namely Tufanganj I, Sitai and Haldibari identified as moderate high intensity in 1980-81 whereas only Haldibari block falls under this category in new method. In 2004-05, moderate high intensity areas are Haldibari, Mathabhanga I, Koch Bihar I, Koch Bihar II,

Tufanganj I, Tufanganj II and Sitai in traditional method whereas Mathabhanga I, Koch Bihar II, Haldibari and Tufanganj I in modern method (Fig. 4.5).

Table No. 4.3 Cropping intensity (Based on Rao & Brookfield)

Block	Total area	Net cropped area	Cropping intensity	Total area	Net cropped area	Cropping intensity
	1980-81			2004-05		
Mekhliganj	125739	19010	6.61	200293.5	23371	8.57
Haldibari	97519.25	9500	10.27	137799.5	10269	13.42
Mathabhanga-I	173426	20610	8.41	289470	23059	12.55
Mathabhanga-II	184776.5	26460	6.98	273536	28461	9.61
Sitalkuchi	134668.25	21230	6.34	239231.5	22210	10.77
Koch Bihar I	232471.4	25090	9.27	470847.5	27491	17.13
Koch Bihar II	201157.6	22340	9.00	320364.5	24081	13.30
Tufanganj- I	168197.1	20710	8.12	317672.5	23226	13.68
Tufanganj- II	126164.5	18850	6.69	221853	19678	11.27
Dinhata I	165017.5	20700	7.97	260245.5	22811	11.41
Dinhata II	141072.25	17780	7.93	306374	19214	15.95
Sitai	99120.65	8120	12.21	131427.5	9992	13.15
Total	1807330	230400	7.84	3057760	253863	12.04

Source: Source: i) District Statistical Hand Book, Bureau of Applied Economics & Statistics; and ii) Agriculture Annual Plan, Koch Bihar District, Principal Agriculture Office, Govt. of W.B.

#### 4.6 Conclusions

It is observed that the cropping intensity in the district is higher than the state average for both the periods of study. In the state, the cropping intensity was 139 and 177 during the period 1980-81 and 2004-05 respectively. As the district is characterised by no industry district of West Bengal, the maximum numbers of people are mainly depended on agriculture either directly or indirectly. This high dependency on agricultural pursuits is to be considered as one of the higher cropping intensity in the district than the state average.

It is also clear that during the study period spatial variation at block level is observed. It is revealed that there is no change in high cropping intensity region as for both the period Dinhata II block ranked the highest cropping intensity (>220) in the district.

There were three moderate high cropping intensity blocks namely Tufanganj I, Sitai and Haldibari with values 190-220 in the year 1980-81 where as this number increased to seven such as Haldibari, Mathabhanga I, Koch Bihar I, Koch Bihar II, Tufanganj I, Tufanganj II and Sitai blocks in the year 2004-05. In the year 1980-81, Mathabhanga I, Koch Bihar I, Koch Bihar II, Tufanganj I and Dinhat I were in the category of moderate low intensity zone (160-190) while only one block namely Dinhat I is under this category in the year 2004-05.

There are no spatial change in the category of low cropping intensity zone and the blocks fall under this category are namely Mekhliganj, Mathabhanga II and Sitalkuchi. Hence, it can be mentioned that there are no change in the position of high and low intensity zones; but the blocks of moderate high and low intensity zones have altered their position.

#### 4.7 References

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