

# Impact of Irrigation on Agricultural Productivity of Jalpaiguri District

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## ABSTRACT

The success of the agriculture depends on various factors, and irrigation is one of them. India is an agrarian society, a large proportion of population rely on agriculture for their livelihood and it's also incorporate with the economic development of the concern society. The productivity of cultivable crops also relay on irrigation facilities. Formally the cultivators relay only on groundwater for irrigation by using, Tube Well, STW, DTW, Dug Well etc. for extracting water. But with the advancement of time the development of canal irrigation helps to change the irrigation system as well as cropping patterns. Modern agriculture depends on irrigation because modern technologies have been changed the crops production which is maximum high yielding variety seeds and its necessary irrigation. Indian agriculture mostly depends on monsoon climate. So there is a need of irrigation for the production of high yielding varieties crops. The researcher has studied the Jalpaiguri district and its agricultural and irrigational pattern for understanding the present scenario of cropping pattern and production. From the study I have found Sadar, Mal, Rajganj, and Maynaguri blocks already get help of irrigation from Teesta canal project. So farmer of these blocks can practice various types of crops by the help of Teesta canal irrigation. But on the other hand, Matiali, Nagrakata, Dhupguri blocks have not received any canal irrigation. They actually relay on underground water for irrigation. Due to presence of Canal irrigation (Surface water) certain blocks like Jalpaiguri Sadar, Mal, Rajganj, Maynaguri have get benefits and the productivity of crops also affected. Rest of the blocks largely depends on Underground Water for irrigation, so there are lots of problems in agricultural practice. They are used Jharna canal irrigation and Tube well, shallow Tube well, Dug well, Deep tube well, etc. In present total gross irrigated area of Jalpaiguri districts is 109378 hectare, total net irrigated area is 72129 hectare and total canal length is approximately 284 km many farmer has been gain and they used chemical fertilizer, pesticide etc. the farmer also used the high yielding varieties seeds and they get high productivity of crops. The high yielding crops is potato, tomato, Boro, paddy, radish, cabbage, coneflower, wheat etc.

## 1. Introduction

Irrigation is an art of supplying water to the fields for rising crops in areas where the rainfall is either limited or not properly distributed throughout the crops season. (Chandrasekhara, 1965). Throughout the crop period adequate quantities of water is required near the root zone of the plants for their growth (Basak, 1999). It plays vital role in the productivity of agricultural crops. India is a monsoonal country; the production of crops largely depends on the rainfall in the monsoon season. But the irregularities in monsoonal rainfall may hamper the agricultural output. Thus the success of agricultural productivity largely depends on Irrigation. The farmers having better irrigation facilities like tube-wells, canals and other sources are not unduly depend on vagaries of monsoon (Siddiqui, 2007), which leads to the improvement in agricultural productivity. The Jalpaiguri district washes by several rivers like Teesta, Mahananda, Karala, Torsa etc. which helps the agricultural production by the surface canal irrigation. But it covers certain tract of land of the district, thus Groundwater is also major source of irrigation. The blocks like Jalpaiguri Sadar, Rajganj, Maynaguri and Dhupguri has cover with Canal irrigation; on the other hand rest of the blocks totally relay on groundwater for agricultural activities. The present study emphasizes on the

development of irrigation process and its effects on agricultural productivity.

### 1.1 Objectives

The main Objectives of this study are –

- To assess the present scenario of Irrigation system of the district
- To understand the cropping pattern of the district
- To measure the agricultural productivity of various crops

### 1.2 Study area

The study area (Jalpaiguri District) is bounded by Bhutan and Darjeeling District in the north, Alipurduar District in the East, Bangladesh and Cooch Behar District in the south and Darjeeling District in the West. The district shares two international boundaries. The Latitudinal and Longitudinal Extent of the study area are 26°15'47"N to 26°59'34"N and 88°23'02"E to 89°07'30"E. administratively it comprises with Seven CD Blocks, these are – Jalpaiguri Sadar, Rajganj, Mal, Matiali, Nagrakata, Dhupguri and Maynaguri. Its geographical area is 3386.18 sq. km, which occupies 80 Gram Panchayats with 1,177 Gram Sansads. Geologically the area is important because coal, dolomite and enormous deposits of construction

materials e.g. gravel sand, brick earth etc. The district is entirely underlain by alluvium except its northern border where hard rocks are exposed (Pawde and Saha, 1982). Inhabitants of the district according to 2011 census are 2381596 persons of which 51.12% is male and 48.88% female.

**2. Methodology**

- 1) To accumulate primary data from the direct field survey has been done with local people.

- 2) Secondary data collect from different office mainly agriculture development office in Jalpaiguri and irrigation development of Jalpaiguri.
- 3) Investigation of irrigation of Teesta Barrage project and Talma kartwa link canal project and Jarna canal which is made by local people.
- 4) Other methodology for investigation of irrigation facility is shallow tube well, deep tube well, tube well, dug well, etc. It has been used both the primary field survey method and also collect the secondary data from different office of the Jalpaiguri district.

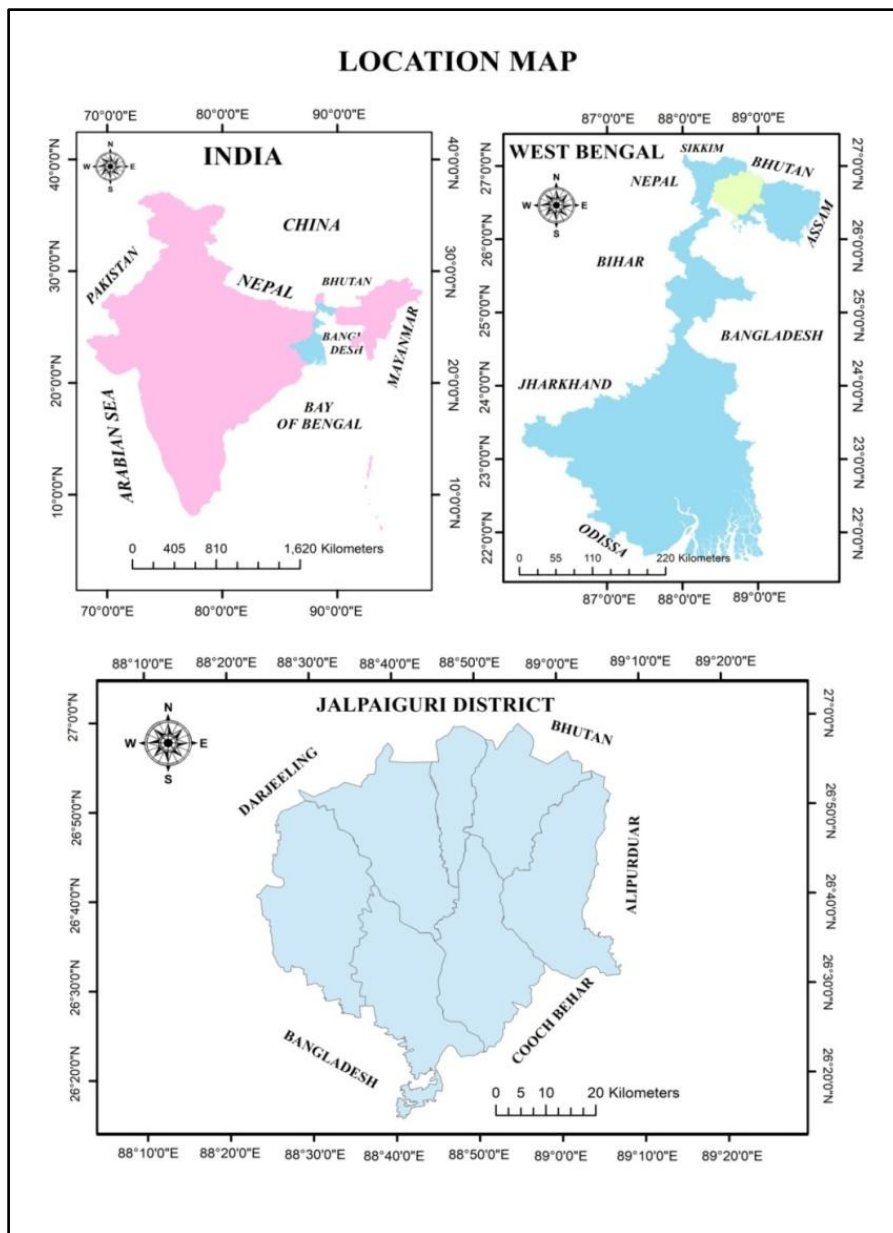


Figure 1 Location Map

**3. Results and Discussion**

**3.1 Present Irrigation Scenario**

The agriculture of the study area largely depends on irrigation. Both type of irrigation have been practiced i.e. Surface irrigation and Ground water Irrigation. The canal

irrigation has not developed in every block rather it is found in Sadar, Mal, Rajganj, and Maynaguri C D blocks. Rest of the blocks like Matiali, Nagrakata, Dhupguri depends on Ground water Irrigation and surface water irrigation.

**Table 1 Block wise Irrigation Status of Jalpaiguri District.**

Sl. No.	Name of the C. D. Block	Irrigated area (hectare)				Rainfed area (hectare)			
		Gross	Percentage	Net	Percentage	Partially Irrigated	Percentage	Un irrigated area	Percentage
1.	Rajganj	20975	19.18	18186	25.21	3111	35.17	5979	9.19
2.	Jalpaigrui	19002	17.37	16415	22.76	950	10.74	7880	12.11
3.	Maynaguri	28285	25.86	12970	17.98	1500	16.96	20290	31.17
4.	Dhupguri	23200	21.21	14780	20.49	1560	17.63	9860	15.15
5.	Malbazar	14350	13.12	7424	10.29	800	9.04	11136	17.11
6.	Matiali	1666	1.52	1572	2.18	850	9.61	5421	8.33
7.	Nagrakata	1900	1.74	782	1.08	75	.85	4521	6.95
	Total	109378	100	72129	100	8846	100	65087	100

Source: DAP, PPR, Land use Plan, Jalpaiguri, 2014

From the above mentioned table, it is found that the Rajganj block, Jalpaiguri Sadar, Dhupguri block have more than 20% of Irrigated land. Maynaguri has also more than 17% of irrigated land. In respect to these blocks rest of the blocks have not well irrigated, especially in Nagrakata, Matiali where less than 2% of land under Irrigation. From the overall study it

can be said that some of the blocks like Nagrakata and Matiali, where the agricultural activities have not developed yet. On the other hand blocks like Rajganj, Jalpaiguri, Maynaguri and Dhupguri, it is found that the irrigation system well developed as well as and the agricultural practices.

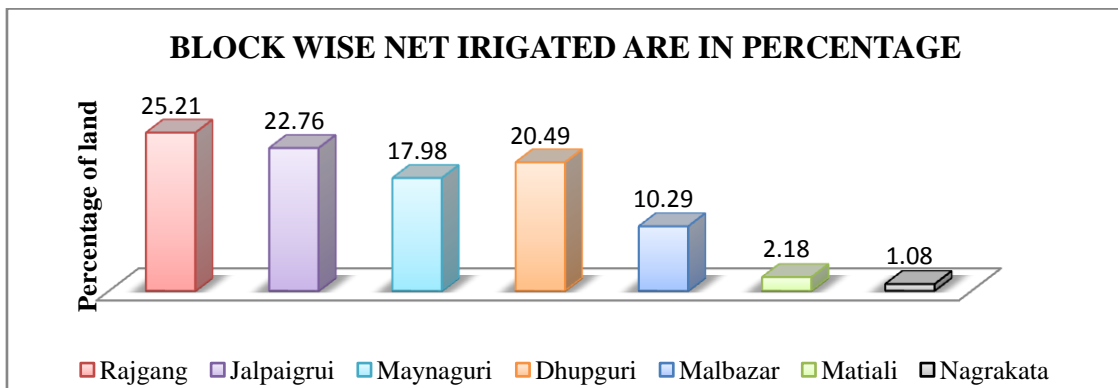


Figure 2 Block-wise Net-irrigated area.

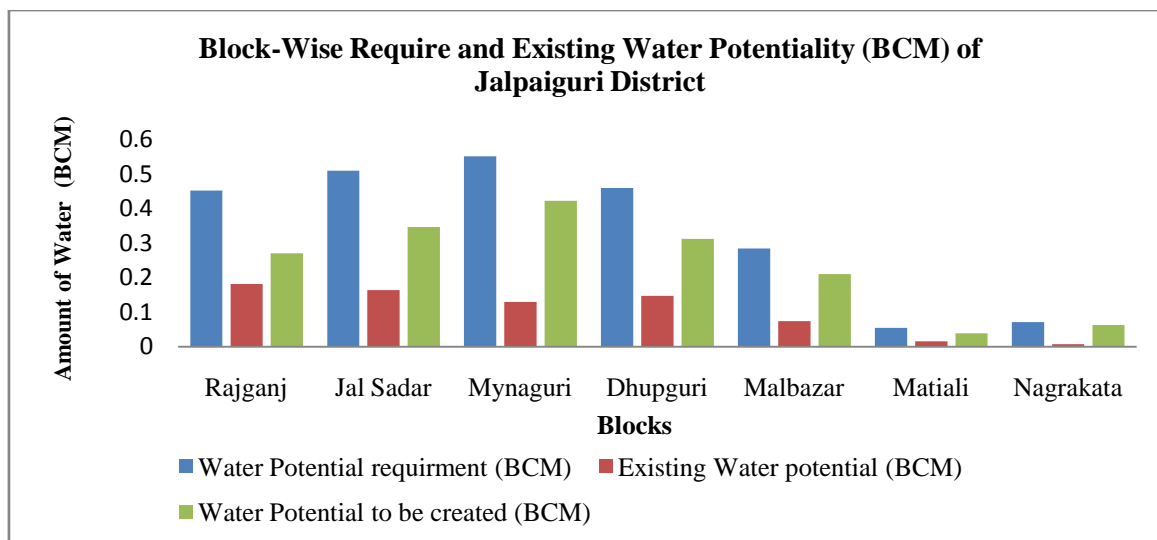
**3.2 Water Potentiality of the District**

The water potentiality refers to the total amount of water need to full fill the existing water demand of an area. From table 2, it is found that the blocks like Rajganj, Jalpaiguri Sadar, Dhupguri and Maynaguri have more than 0.45 BCM of water

required. But only 0.18 BCM in Rajganj, 0.16 BCM in Jalpaiguri Sadar, 0.13 BCM in Maynaguri and 0.15 ion Dhupguri block have existing water. As the blocks are well developed in agriculture, hence these blocks needs more than 2 times of waters that exist now.

**Table 2 Block wise Water Potential requirement and Existing Water Potential of the District**

Name of the C. D. Blocks	Percentage of Area Under Irrigation	Crop Water Demand (mm)	Water Potential requirement (BCM)	Existing Water potential (BCM)	Water Potential to be created (BCM)
Rajganj	29.58	1000	0.4531	0.18186	0.27124
Jal Sadar	32.79	1000	0.51122	0.16415	0.34707
Maynaguri	24.44	1000	0.553	0.1297	0.4233
Dhupguri	26.85	1000	0.46102	0.1478	0.31322
Malbazar	13.6	1000	0.2855	0.07424	0.21126
Matiali	7.67	1000	0.055	0.01572	0.03928
Nagrakata	1.97	1000	0.07137	0.00782	0.06355
District Total	21.56		2.39021	0.72129	1.66892



Source: CWC, Dept. of Water resources in district & status report.

Figure 2 Block wise water potentiality.

Table 3 Status of Surface and Ground Water Irrigation of the District. (Area in ha)

Name of the C. D. Blocks	Surface Irrigation						Ground Water										Other Sources including traditional WHS			
	Tanks / Ponds / Reservoirs						Tube well				Open well / Ring well				Bore Wells / MTW					
	Community Ponds Including small		Individual / Pvt. Ponds		Govt. Reservoir / Dams		Govt. Tube wells		Pvt. Tube wells		Community / Govt. Open well		Pvt. Open or Ring well		Govt.				Pvt.	
	No	CA	No	CA	No	CA	No	CA	No	CA	No	CA	No	CA	No	CA			No	CA
Rajganj	0	0	75	7.5	3	0	26	133	300	150	0	0	6	3	0	0	0	0	30	54
Jal Sadar	34	172	95	95	0	0	5	2.5	480	240	50	2512	0	0	0	0	58	23	8	0
Maynaguri	26	131	30	300	0	0	64	321	500	250	12	6	12	60	80	32	80	32	80	23
Dhupguri	16	81	42	420	0	0	31	157	704	352	11	59.5	37	18	55	22	73	29	22	
Malbazar	16	8	20	20	0	0	40	200	400	200	22	110	80	40	20	80	10	40	70	56
Matiali	20	100	40	4	0	0	0	0	74	37	31	156	0	0	20	80	0	0	50	31
Nagrakata	10	52	27	2.7	4	0	20	10	40	20	0	0	66	33	5	20	3	12	0	0
Total	10	545	84	849	7	0	44	223	203	101	56	2843	50	25	18	72	22	89	45	58
	90		92	.2			74	7	54	77	87	.5	74	37	0	00	4	60	8	70

Source: NWDA, CGG. 2014

Note: No-Numbers and CA-Command Area.

The table 3 depicted the irrigation system (Except Canal Irrigation) of the district, which includes both Surface and Groundwater Irrigation. The blocks like Maynaguri, Dhupguri and Jalpaiguri Sadar have fare proportion of irrigation water come from Individual and private ponds, in Maynaguri 300 hectare, Dhupguri 420 hectare, Jalpaiguri Sadar 95 hectare of land irrigated through pond water. On the other hand the Groundwater irrigation incorporates, Tubewell, Open/Ring well, Bore wells have been found in all the blocks. But the intensity is higher in Rajganj, Jalpaiguri Sadar, Maynaguri and Dhupguri

blocks where it is found that 1,636 hectare in Rajganj, 7234.5 hectare in Jalpaiguri Sadar, 9,821 hectare in Maynaguri and 9,210 hectare in Dhupguri block irrigated through ground water sources.

### 3.3 Canal Irrigation System

Canal Irrigation is important system for surface water irrigation. In the district like Jalpaiguri, where it is found that several canals have been constructed and utilize as a source of irrigation water for crops cultivation.

Table 4 Canal irrigation system in Jalpaiguri District.

NAME OF THE BLOCKS	CANAL NAME	CANAL LENGTH IN KM	WATER REACHES IN KM	AREA COVERED IN HECTARE
TEESTA MAHANANDA LINK CANAL				
RAJGANJ	L.B.M.C	16.123	9	1500
	D-1 L.B.M.C	2.572	1.572	121
	D-2 L.B.M.C	17.95	9	1400
	D-3 L.B.M.C	5.746	5.746	432
	R.B.M.C	8.987	8.987	540
	D-3 A.L.B.M.C	1.888	1.888	86
	D-1 R.B.M.C	5.026	5.026	360
	D-2 R.B.M.C	3.455	3.455	440
	D-1	23.235	18	150
	D-3	5.22	5	750
	D-4	6.45	6	700
	MINOR-1 D-4	1.75	1	50
	MINOR-2 D-4	3.3	2	100
	MINOR-3 D-4	1.65	1.5	100
	D-5	1.59	1.2	150
	D-6	1.46	1.46	100
	D-7	4.011	4.011	800
	D-8	0.61	0.61	45
	D-9	2.78	2.78	530
	MINOR-1 D-9	1.35	1.35	156
	D-10	13.99	10	3200
	MINOR-1 D-10	10.2	0.4	30
	MINOR-4 D-10	2.5	0.9	30
MINOR-5 D-10	1.5	0.85	90	
JALPAIGURI SADAR	MINOR-1 D-1	4.75	4.75	4350
	MINOR-2 D-1	1.94	1.9	
	MINOR-3 D-1	1.97	1.9	
RAJGANJ- JALPAIGURI SADAR	D-2	59.01	40	10400
	MINOR-2 D-2	1.86	1.86	150
	MINOR-3 D-2	27.03	24	9300
TEESTA JALDHAKA MAIN CANAL				
MAL	D-1 T.G.M.C	8.341	8.341	1640
	D-1 A.T.G.M.C	2.87	2.87	298
	D-2 T.G.M.C	10.622	10.622	1760
	D-3 T.G.M.C	7.07	7.07	1080
	D-4 T.G.M.C	4.03	2	800
MYNAGURI	D-5 T.G.M.C	11.58	3	400

Especially in Rajganj, Jalpaiguri Sadar, Maynaguri and Mal blocks have covered with canal irrigation. In the study area there are two main canals have been constructed viz, Teesta-Mahananda Link Canal and Teesta-Jaldhaka Main Canal, from where various minor and distributary canals have spread out and supply the water for irrigation.

From the above mentioned table (table 4), it is found the Rajganj block have larger proportion of canal irrigation than

other blocks. In Rajganj Block 11886 hectares of land has got the irrigation water from canals, and the block has approx. 143 km of Canals including minors and distributaries. The other blocks like Jalpaiguri Sadar, Maynaguri and Mal also covered with canals for irrigation. In Jalpaiguri Sadar block 4,350 hectares of land irrigated through Canal irrigation, and in Maynaguri 400 hectares, Mal 5,578 Hectares, and Rajganj-Jalpaiguri Sadar 19,850 Hectares of land irrigated through Canals irrigation system.

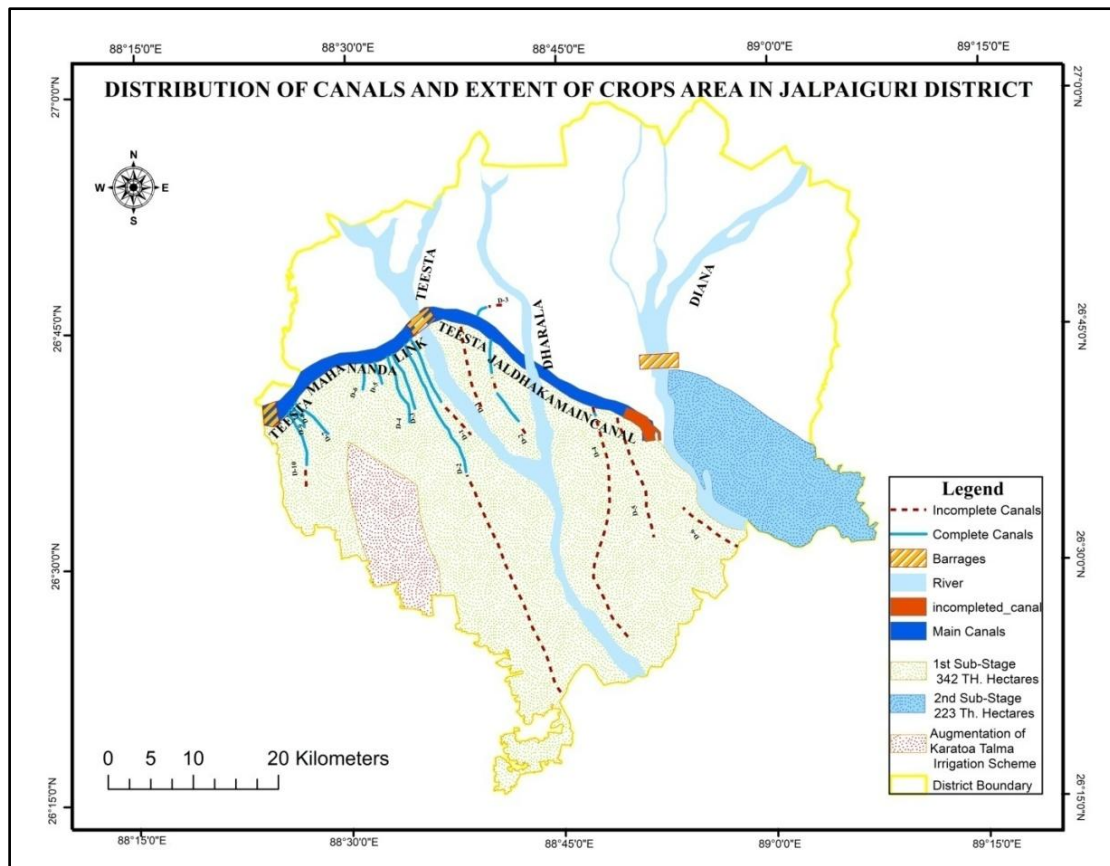


Figure 3 Distribution of canals and cultivated area.

**3.4 Agricultural Status**

The cropping status of the district varies from block to block. We can find from the table 2 that the blocks like Rajganj, Jalpaiguri Sadar, Maynaguri and Dhupguri has more than 30% of geographical area under Net Sown area. So in these blocks the agricultural practiced well developed and for this

development Irrigation plays a key role. From the table no. 1.1 it is found those block which have more prominent in irrigation system they have more net sown area. Rest of the blocks i.e. Nagrakata, Matiali, Malbazar have less area under irrigation as well as net sown.

Table 5 Agricultural Status of the District.

Name of the C. D. Blocks	Total Geographical Area (Ha)	Area Under Agriculture (Ha)					Area Under Forest (Ha)
		Gross Cropped Area	Net Sown Area	% of Area Under Net sown	Area Sown more than once	Cropping Intensity (%)	
Rajganj	61483	45310	24165	39.30	21145	188	18791
Jal Sadar	50065	51122	29501	58.93	21621	173	720
Maynaguri	53060	55300	33260	62.68	220240	166	3888
Dhupguri	55055	46102	26200	47.59	19902	176	5995
Malbazar	54590	28550	18560	34.00	9990	154	147
Matiali	20491	5500	3752	18.31	1748	147	3758
Nagrakata	39749	7137	5303	13.34	1834	135	10109
<b>District Total</b>	<b>334493</b>	<b>239021</b>	<b>140741</b>	<b>42.08</b>	<b>98280</b>	<b>170</b>	<b>43408</b>

Source: DAP, PPR, Land use plan Jalpaiguri district, 2014

On the other hand the cropping intensity also varies, but it is more prominent on those blocks which have more area under net sown and also large proportion of the agricultural land under irrigation. Hence the productivity of the crops also effects from the irrigation point of view. The cropping Intensity also varies block to block, where it is found that in Rajganj

block the Cropping intensity is 188%, which is the higher than the other blocks. On the other hand in Nagrakata block experience lower Cropping intensity i.e. 135%. The average Cropping intensity of the district is 170% where the Rajganj, Jalpaiguri Sadar, Dhupguri, blocks has the higher intensity than the district average.

#### 4. Spatio-Temporal Changes in Cropping Pattern

The changes in production and area in agriculture with respect to time is called Spatio-temporal change in cropping pattern. Table 6 depicted the changes in landholdings of various crops from 2009-10 to 2013-14 and it is found that with the time passing, the area of various crops have been changing gradually. For the food grains, the area under Rice crops has been increasing from 227.5 thousands hectares in 2009-10 to 229.6 thousands hectares in 2013-14. Like rice the Cereals also increases within the period from 255.6 thousands

hectares to 259.9 thousands hectares. Similarly the pulses also increase in these periods of time. The changes in the production area of Oil seeds have been fluctuating during the time-span, where it is found that in 2009-10 the 15.7 thousands hectares of lands under the Oilseeds and in 2010-11 the area increases to 19.7 thousands hectares.

Again the area under Oilseeds subsequently declining since then and in 2013-14 it was 16.7 thousand hectares.

**Table 6 Area under Principle Crops in the District of Jalpaiguri ('000 hectare)**

Crops	2009-10	2010-11	2011-12	2012-13	2013-14
(1)	(2)	(3)	(4)	(5)	(6)
<b>Food grains</b>					
1. Rice	227.5	224.1	224.6	228.1	229.6
Aus	34.6	30.8	29.9	29.1	29.4
Aman	174.7	176.0	177.8	180.0	180.1
Boro	18.2	17.3	16.9	19.0	20.1
2. Wheat	16.0	18.0	17.1	17.4	17.2
3. Barley	(a)	(a)	(a)	(a)	(a)
4. Maize	11.8	12.8	13.5	12.7	12.7
5. Other Cereals	0.3	0.3	0.3	0.3	0.4
<b>Total Cereals</b>	<b>255.6</b>	<b>255.2</b>	<b>255.5</b>	<b>258.5</b>	<b>259.9</b>
6. Gram	0.1	(a)	0.1	0.1	(a)
7. Tur	(a)	(a)	(a)	0.1	-
8. Other Pulses	4.4	4.3	4.2	4.6	4.7
<b>Total Pulses</b>	<b>4.5</b>	<b>4.3</b>	<b>4.3</b>	<b>4.8</b>	<b>4.7</b>
<b>Total Food grains</b>	<b>260.1</b>	<b>259.5</b>	<b>259.8</b>	<b>263.3</b>	<b>264.6</b>
<b>Oil Seeds</b>					
1. Rapeseed & Mustard	10.7	10.3	10.0	9.8	9.2
2. Linseed	0.8	1.0	0.8	0.7	0.7
3. Other Oil seeds	4.2	8.4	7.4	7.1	6.8
<b>Total Oil seeds</b>	<b>15.7</b>	<b>19.7</b>	<b>18.2</b>	<b>17.6</b>	<b>16.7</b>
<b>Fibres</b>					
1. Jute	39.3	40.0	35.7	35.1	35.2
2. Mesta	0.2	0.2	0.3	0.3	0.2
3. Other Fibres	-	-	-	-	-
<b>Total Fibres</b>	<b>39.5</b>	<b>40.2</b>	<b>36.0</b>	<b>35.4</b>	<b>35.4</b>
<b>Miscellaneous crops</b>					
1. Sugarcane	0.1	0.2	0.2	0.1	0.2
2. Potato	32.3	31.7	31.9	33.6	40.1
3. Tobacco	0.7	0.6	0.5	0.7	0.6
4. Tea	77.3	77.3	77.3 (P)	94.4(E)	94.4(E)
5. Chillies (dry)	5.5	5.5	5.5	5.5	5.5
6. Ginger	1.5	1.5	1.5	1.5	1.6
<b>Total Miscellaneous crops</b>	<b>117.4</b>	<b>116.8</b>	<b>116.9</b>	<b>135.8</b>	<b>142.4</b>

Sources: 1) Directorate of Agriculture, Govt. of W.B., 2) B.A.E. & S., Govt. of W.B., 3) Tea Board of India

#### 4.1 Agricultural Productivity of the District

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. It is also the per unit area of crops production of a given region. In the district like

Jalpaiguri which is an agrarian society, primarily farmers' practice subsistence cultivation for their livelihood and the success of the cultivation depends on the production of crops.

Table 7 Productivity Trends of Various Crops in Jalpaiguri District (kg/hectare)

Crops		2009-10	2010-11	2011-12	2012-13	2013-14
(1)		(2)	(3)	(4)	(5)	(6)
<b>Food grains</b>						
1.	Rice	1913	2203	2091	2161	2378
	Aus	1481	1865	1851	1888	1960
	Aman	1941	2268	2136	2132	2336
	Boro	2470	2148	2038	2849	2817
2.	Wheat	2269	2301	2492	2233	2314
3.	Barley	1129	1358	1350	1273	1375
4.	Maize	2008	3202	2553	2621	3386
5.	Other Cereals	860	784	845	822	500
<b>Total Cereals</b>		<b>1938</b>	<b>2259</b>	<b>2141</b>	<b>2187</b>	<b>2333</b>
6.	Gram	1457	875	1089	1395	1118
7.	Tur	1100	1094	488	1359	-
8.	Other Pulses	500	613	658	590	660
<b>Total Pulses</b>		<b>512</b>	<b>616</b>	<b>660</b>	<b>612</b>	<b>657</b>
<b>Total Food grains</b>		<b>1914</b>	<b>2232</b>	<b>2116</b>	<b>2158</b>	<b>2303</b>
<b>Oil Seeds</b>						
1.	Rapeseed & Mustard	597	626	650	682	664
2.	Linseed	277	304	307	286	281
3.	Other Oil seeds	923	1460	1184	1496	1559
<b>Total Oil seeds</b>		<b>666</b>	<b>966</b>	<b>846</b>	<b>994</b>	<b>1011</b>
<b>Fibres*</b>						
1.	Jute	13.1	12.1	12.5	12.5	12.0
2.	Mesta	10.9	12.0	10.3	10.3	10.0
3.	Other Fibres	-	-	-	-	-
<b>Total Fibres</b>		<b>13.1</b>	<b>12.1</b>	<b>13.1</b>	<b>12.5</b>	<b>12.0</b>
<b>Miscellaneous crops</b>						
1.	Sugarcane	98701	98925	116395	104567	102366
2.	Potato	27996	23141	26531	31214	24710
3.	Tobacco	1512	1067	1729	1420	1384
4.	Tea	1940	1985	1962 (P)	2046(E)**	2221(E)
5.	Chillies (dry)	1007	1009	1000	1009	1009
6.	Ginger	2325	2345	2340	2340	2348
<b>Total Miscellaneous crops</b>		<b>9165</b>	<b>7812</b>	<b>8802</b>	<b>9323<sup>#</sup></b>	<b>8617</b>

Sources: 1) Directorate of Agriculture, Govt. of W.B., 2) B.A.E. & S., Govt. of W.B., 3) Tea Board of India

From the above mentioned table (Table 7), the temporal changes in production of various crops (viz, Food grains, Cereals, Oilseeds, etc.) have been shown. And it is found that most of the crops productivity have been increasing at the given time period. In the case of Food grains, the rice production has been gone up from 1913 kg/hectare in 2009-10 to 2378 kg/hectare in 2013-14. Other food grains like wheat,

Barley and Maize, the production have also gone up. The production of Cereals like Gram, Tur etc. has also Increases. In 2009-10 the Cereals production was 1938 kg/hectare while it is 2333 kg/hectare in 2013-14. Oilseeds have also gone up from 666 kg/hectare to 1011 kg/hectare in the same time periods. Crops like Fiber, and Miscellaneous has fluctuates their production in various time sections.

Table 8 Seasonal Productivity of Crops (Rain-fed and Irrigated), 2014

SAESON	NAME OF THE CROPS	RAIN FED				IRRIGATED			
		AREA (HA)	PRODUCTION (QTN/YR)	PRODUCTIVITY (QTN/HA)	COST OF PRODUCTION (RS/HA)	AREA (HA)	PRODUCTION (QTN/HA)	PRODUCTIVITY (QTN/HA)	COST OF PRODUCTION (RS/HA)
KHARIF	Paddy	21000	819000	39	42837.5	500	21750	43.5	46587.5
	Veg	130	34775	267.5	28750	113	34465	305	30000

RABI	Boro Paddy	0	0	0	0	13850	706350	51	59700
	Wheat	55	1650	30	36250	150	5400	36	37500
	Pulses	178	1068	6	26250	37	333	9	27500
	Oil Seeds	100	925	9.25	26575	80	900	11.25	27650
	Potato	0	0	0	0	2755	826500	300	138750
	Veg & Others	235	75200	320	28750	2304	921600	400	30000
SUMMER	Paddy	0	0	0	0	650	27300	42	59700
	Maize	210	7560	36	22500	90	4950	55	25320
	Pulses	55	269.5	4.9	26250	26	201.5	4.75	27500
	Oil Seeds	37	310.8	8.4	26800	240	2400	10	27900
	Fibre	2050	49200	24	57500	0	0	0	0
	Veg&Other Horticulture	235	66622.5	283.5	28750	180	62280	346	30000
TOTAL		24285	1056580.8	43.51		20975	2614429.5	124.65	

Sources: 1) Directorate of Agriculture, Govt. of W.B., 2) B.A.E. & S., Govt. of W.B., 3) Tea Board of India.

The table 8 depicted the Seasonal productivity of crops in Jalpaiguri district, where it is found that in Kharif season nearly 21130 hectares of land have been cultivated. The total production of paddy in Kharif season is 819000 quintals and in rain fed areas while in irrigated regions only 500 hectares and 21750 quintals of paddy cultivated. The productivity (Kg/Hectare) of paddy during Kharif season varies between rain-fed and irrigated regions. Vegetables have also cultivated during Kharif season in both Rain fed and irrigated regions, where it is found that the productivity is more in irrigated areas (305 qtn/ha) than rain fed areas (267.5 qtn/ha).

In the Rabi season various crops like Boro paddy, wheat, pulses, oil seeds, potato and vegetables etc. have been cultivated. The Boro paddy is totally depends on irrigation in this season, due to the lack of rainfall. The productivity of Boro paddy is about 51 quintals per hectare. The productivity of other crops like wheat, pulses, oilseeds, potato and vegetables have more in irrigated areas than rain fed regions. Similarly in the summer season the productivity of crops like maize, pulses, oilseeds, fiber and vegetables have more in irrigated areas than rain fed regions. The cost of production of various crops during the above mention seasons is slightly higher in irrigated areas than rain fed due to cost in irrigation practiced.

Table 9 Changes in Crops Production before and after Canal Irrigation Introduced.

Sl. No.	Crops	Before Canal Irrigation water(in quintal/Hectare)	After Receiving Irrigation water from Canals (in quintal/Hectare)	Mean Difference (In quintal/Hectare)
1.	Boro paddy	-	25.85	25.85
2.	Potato	196.82	242.15	52.32
3.	Wheat	14.95	22.42	7.47
4.	Tomato	176.40	182.87	7.47
5.	Chili	145.50	174.40	29.90
6.	Cabbage	180.87	220.25	37.37
7.	Amon Paddy	19.42	24.90	7.47
8.	Jute	22.42	21.68	-

Source: Field Survey

Table 9 depicts the changes in crops production before and after canal irrigation introduced. From this table we can find that all the crops production has increase after the introduction of canal irrigation. More specifically the production of potato was 196.82 quintal per hectare before the introduction of canal irrigation. While it is increase to 242.15 quintals per hectare of land after introducing of canal irrigation. Similarly the other crops like wheat, tomato, chili, cabbage, Amon paddy and jute etc. has increases their production after the introduction of canal irrigation. The production of Potato, chili, Cabbage has increased significantly.

## 5. Conclusion

Now irrigation is the matter of concern, because high yielding varieties Seeds cannot grow without water, so it is necessary for the crops cultivation and more productivity of Boro paddy, Amon paddy, Potato Tomato etc. Mostly Indian agriculture depends on monsoon climate so naturally irrigation is needed for cultivation. As per the area belongs to monsoonal tropical climate, the uncertain behavior of the climate affects the productivity of crops. The growing population is one of the aspects for incorporating High Yielding Variety of seeds to cover up the demand. For the cultivation of high yielding variety seeds, Water is one of the most important components. Thus in the non-monsoonal seasons, the cultivation process largely depends on Irrigation, whether it is groundwater irrigation or canal irrigation. Some of the blocks, especially in the lower

catchment areas of the rivers in the district, has the potentiality to use the water of river as canal irrigation. By the construction of Teesta-Mahananda Link and Teesta-Jaldhaka Main canals and its Minor distributaries it is possible to use the water for irrigation in the large proportion of land in the district. Especially in Rajganj, Jalpaiguri Sadar, Maynaguri and Mal blocks, the agricultural activities have benefited through these canal irrigation. And hence the uses of HYV Seeds have frequently increasing. The other blocks have relied mostly on groundwater irrigation. Thus from the overall study it can be said that the productivity of various crops especially in the non-monsoonal seasons largely depends on the irrigation. But due to lack of management in the canal irrigation system, sometimes the

agricultural activities hamper and the farmers facing various problems like low-productivity, water logging, water induced diseases etc. Thus it can be said that in one hand the irrigation system especially the canal irrigation improve the productivity of crops, but in the other hand improper management of canals leads to various agricultural and anthropogenic problems.

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#### **References**

1. Bhalla, G.S., and Singh Gurmail, (2009): Economic Liberalization and Indian Agriculture: A state wise analysis, Economic and Political Weekly, Delhi, xlv (52), pp.35-44.
2. Das, S., (2012): surface water potential of Jalpaiguri District, West Bengal, India, The journal of Bengal Geographer, Dason Research foundation, ISSN 2319-619X, vol.3, issue 32, pp.28-29.
3. Kundu, D. K., and Sigh, Ravendra and Mahapatra, B.S., (2013): Soil Health and water quality issues for sustainable agricultural production in the eastern region of India, Journal of Agricultural Physics, and vol. 13, pp. 1-12
4. Shafi,M., (1967):Crops-wise rates of growth under area, production and yield in each productivity region in Uttar Pradesh, pp. 261
5. Sarkar, S.K., (2015): Teesta's Turn Next, The Statesman, 6th June, Kolkata, p. 6
6. Measuring Agricultural Productivity Using the Average Productivity Index (API) by Lal Mervin Dharmasiri, Archived 2013-10-20 at the Way back Machine.
7. Kusari, A.M. et al. (1981): West Bengal District Gazetteer, Jalpaiguri district, Govt. of West Bengal.
8. Siddiqui, S.H., (2007). "Water Resources and Irrigation Development in North Bihar Plain," in M. Ali, et al. (ed.), Fifty Years of Indian Agriculture, Concept Publishing Company, New Delhi, vol. 2, pp. 258-265.
9. Basak, N.N., (1999): Irrigation Engineering, Tata McGraw Hill Private Limited, New Delhi, p. 1.
10. Egli, D.B., (2008): "Comparison of Corn and Soybean Yields in the United States: Historical Trends and Future Prospects". *Agronomy*. **100**: S7988. doi: 10.2134 /agronj 2006.0286c.
11. Molden, D. (Ed). *Water for food, Water for life: A Comprehensive Assessment of Water Management in Agriculture*. Earthscan/IWMI, 2007.
12. District Statistical Handbook, Jalpaiguri District, 2014, p. 5.1–5.8