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USE OF WATER RESOURCE FOR AGRICULTURAL PRODUCTION IN NORTH-EAST INDIA

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Water is one of the most vital natural resources used not only for direct consumption purposes but also as an input in the process of production in different sectors of the economy of which agriculture is the most important. One of the salient characteristics of water is that in addition to the fact of its being an indispensable input it works as an augmenting input in agriculture when it is combined with other inputs of production such as improved seeds (HYV) and fertilizer. Thus it has a tremendous role to play in agriculture in increasing both production and productivity. It helps in bringing wasteland under crops, in adopting multiple cropping practices and in raising greater quantities of the same crop on the same plot. Most importantly, irrigation generates an element of stability in agriculture by partly freeing it from the vagaries of monsoon. The present work in this regard is an attempt to study the role and use of water in the agricultural sector in the North Eastern States.

The study is based on the information relating to all the seven States in North East India which are predominantly agrarian in nature. The whole of the N.E. Region covers a total geographical area of 25,509 thousand hectares and it is about 7.75 percent of the total geographical area of India. Geographically Arunachal Pradesh is the biggest State in region covering 8374 thousand hectares followed by Assam, Meghalaya, Manipur and the other three States of which Tripura is the smallest State covering only 1049 thousand hectares. More than 63 percent of the total geographical area in the region is covered by the two big States, viz. Arunachal Pradesh and Assam. It is found that there is a wide gap between the geographical area and the reported area for land utilisation in the region mainly because of the two States such as Arunachal Pradesh and Nagaland. Among the seven States, Assam being the second biggest State accounts for more than 72 percent of

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the net sown area in the region. The smallest State, Tripura also accounts for 7.12 percent which is much higher than that of the other five States, taken individually. The percentage of net sown area to the reported area is estimated to be too low in many States except Assam and Tripura where it is 34.5 and 25.7 percent respectively.

The N.E. Region is highly dependent on natural moisture and rainfall for growing varieties of crops leading to high degree of instability in agricultural production. Though rainfall is high in the region its distribution over time and space is far from uniform. The variations in the pattern of rainfall and its uncertainty in the region may be judged from the observations of recorded rainfall of Assam (as the representative of the region) over a period of 10 years. Table 1 reveals that the annual variations in rainfall in Assam are very wide from one place to another and from year to year. Moreover, the onset of monsoon and its cessation is most uncertain. Delay in pre-monsoon showers and delay in onset of monsoon not only lead to series of dislocations but also cause great damage to the crops. Thus, if the cereal production is to be increased and cropping intensity is to be raised, irrigation would be one of the most important infrastructures. The traditional *Ahu* crop grown in the period from March to August has been advanced to February with the introduction of HYV seeds and February being a dry month, agriculture during this period is badly in need of irrigation. In this connection, it may be mentioned here that Assam Agricultural Commission set up in 1975 emphasized the importance of irrigation for agricultural development through improved technology and inputs. The Central Task Force (1980) also emphasized the need for irrigation (Phukan, 1990).

Information on irrigation in Assam and in all other States in the region is very much confusing. According to Goswami, the data on irrigation in Assam is most unreliable and the chaotic nature of irrigation statistics might be due to some misunderstanding (Goswami, 1963). Basic Statistics of North Eastern Region, 1992 published by the North Eastern Council, Shillong indicated that about 22 percent of the net area sown in the region was irrigated (Table 2). Out of a total of 824 thousand hectares of land irrigated in the region 572 thousand hectares are in the State of Assam alone. Though Assam possesses relatively more irrigated area yet it is lagging much

behind Manipur, Nagaland and Meghalaya in respect of percentage of net irrigated area to net sown area. Besides, there has not been any progress in the creation of irrigation facilities over the years. Instead, the percentage of net irrigated area to the net sown area has significantly declined from 26.6 percent in 1958 to 22.1 percent in 1989.

Analysis of irrigation facilities by sources reveals that the seven States in the N.E. Region are not equally endowed with different irrigation facilities. Irrigation in the form of tank, tube well, dug well etc are just non-existent in the region except in the State of Tripura. Canal irrigation exists only in the States of Assam and Tripura. Hence, whatever irrigation facilities exist in different States in the region are mostly in the form of very minor irrigation and "other sources of irrigation" and shown in the Table 2. Thus, it can be said that the creation of irrigational facilities is not up to the mark and probably it is yet to create an impact on the total production and productivity in agriculture in the region.

Although attempts are made at the farmers' level to increase production and productivity in agriculture by adopting modern technology to a certain extent in the form of improved seeds and fertilizer, nothing substantial has been achieved in the region. Table 3 reveals that production of food grains has increased only from 3826.0 thousand hectares in 1980-81 to 3940.1 thousand hectares in 1988-89 thereby showing a meager increase of less than 3 percent over a period of 8 years (N.E.C. Report, 1992). During the same period there has been no increase in the average yield of food grains. Rather it has been fluctuating from year to year mainly due to vagaries of monsoon in the absence of sufficient irrigation facilities. Average yield of food grains has remained at the low level of 1353 kg/ha in the region as against 1487 kg/ha at the all India level in 1988-89. Low increase in production and low yield in the region may be attributed to the low level of cropping intensity, low level of fertilizer consumption and lack of initiative in bringing more area under improved seeds. The present study reveals that only 34 percent of the net areas sown are put to double cropping and 41 percent brought under HYV. Consumption of fertilizer has also remained at the low level of 12.9 kg/ha in sharp contrast to 86.5 kg/ha at the all India level (N.E.C Report, 1992). Thus, not only there exists enough scope to increase cropping intensity and fertilizer consumption but also to bring more area under HYV to increase overall production of food grains.

The overwhelming importance of irrigation for the development of agriculture in the N.E. Region may be highlighted by a study of correlation between variables like total cropped area, area under HYV, fertilizer consumption, food grain production on the one hand and the net irrigated area on the other. From the available data we have estimated simple correlation coefficient of each of the variables mentioned above separately with the net irrigated area. In the process we have arrived at significant results to substantiate our emphasis on the cardinal role of irrigation. The study reveals that there exists a high correlation between net irrigated area with the total cropped area (r=0.99), area under HYV (r=0.99), fertilizer consumption (r=0.93) and food grain production (r=0.99) as shown in Table 4. All these results reiterate that to achieve better performance in agriculture a proper balance is to be maintained among the various inputs and hence a simultaneous proportionate increase in irrigation facilities is a must when modern farming practices are adopted.

In conclusion, it can be said that the North Eastern Region is lagging behind in respect of overall development of the agricultural sector. The region though predominantly agrarian has not been able to free it from the clutches of vagaries of monsoon through adequate irrigation facilities. As a result, there has not been any significant increase in the production; and virtually no improvement in the average yield of food grains has been possible even after the introduction of modern technology of production. However, there exists enough scope to increase the production and productivity of food grains and other crops by putting greater emphasis on the creation of irrigation facilities and through achievement of optimal combination of various agricultural inputs such as irrigation, cropping intensity, and improved seeds and fertilizers.

The study pin points the fact that irrigation as a strategic input in any development programme of the primary sector of the North Eastern Region. Fortunately the region is endowed with enough although erratic rainfall and a snow-fed gigantic river system like the Brahmaputra and its tributaries. There is, thus, enough scope for both water harvesting and river-based irrigation system; in short, one should not allow vast water resources of the region to be drained into the sea along with valuable top soil. Instead every effort must be made to utilize these for productive purposes.

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Table 1

STAIONWISE ANNUAL RAINFALL IN ASSAM

(In millimeters)

Year	Chapermukh	Rupsi	Dibrugarh	Guwahati	North Lakhimpur	Silchar	Tezpur
1977	3426	3349	3189	2519	3251	3455	2141
1978	2616	1850	2007	1546	2883	2837	1752
1979	2132	2132	1941	1335	2797	1792	1442
1980	NA	NA	2146	1557	3071	1780	1645
1981	1563	1156	2057	1434	2493	2361	1457
1985	338	277	2353	1469	3481	2035	2137
1986	1347	2916	2211	1437	2639	3057	2000
1987	2778	3830	2445	1838	3299	3216	1958
1988	3408	3321	3141	2091	3449	1859	2124
1989	3282	3236	2497	1935	3190	4053	1822

Source: Statistical Hand Book, Assam (Different Years of Publications).

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Table 2

NET IRRIGATED AREA BY SOURCES

(Area in '000 hectares)

State	Canal	Tank	Tube Well	Other Well	Other Sources	Total
Arunachal Pradesh	-	-	-	-	32	32 (18.60)
Assam	71	-	-	-	501	572 (21.14)
Manipur	-	-	-	-	65	65 (46.43)
Meghalaya	-	-	-	-	50	50 (25.51)
Mizoram	-	-	-	-	8	8 (12.31)
Nagaland	-	-	-	-	56	56 (31.11)
Tripura	26	2	7	-	6	41 (15.18)
N.E. Region	97	2	7	-	718	824 (22.10)

Source: Basic Statistics of North Eastern Region, 1992.

Note: Figures in parentheses denote percentage of net irrigated area to net sown area.

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Table 3

PRODUCTION AND YIELD OF FOOD GRAINS

(Production in '000 tonnes & yield in kg/ha)

Year	North-East India		All India	
	Production	Yield	Production	Yield
1980-81	3826.0	1116	129588.5	1023
1981-82	3485.5	1020	13394.8	1032
1982-83	3906.6	1114	129564.1	1035
1983-84	3908.2	1108	151542.9	1163
1984-85	3898.2	1085	145538.7	1149
1985-86	4309.6	1168	150469.0	1184
1986-87	3701.3	1048	126361.0	1311
1987-88	4141.7	1162	119368.0	1328
1988-89	3940.1	1112	169921.8	1331

Source: Basic Statistics of North Eastern Region, 1992.

Table 4

State	Net Irrigated Area	Total Cropped Area	Area under HYV	Fertilizer Consumption	Food Grain Production
Arunachal Pradesh	32	232	15	360	197.4
Assam	572	3654	1176	25480	2628.4
Manipur	65	190	94	7310	287.8
Meghalaya	50	239	51	3070	138.3
Mizoram	8	68	10	320	65.3
Nagaland	56	198	32	310	154.8
Tripura	41	445	186	8920	468.1
N.E. Region	824	5026	1564	45770	3940.1
Coefficient with Net Irrigated Area	1.00	0.99	0.99	0.93	0.99

Source: Basic Statistics of North Eastern Region, 1992.

Note: Area in ’000 hectares, fertilizer in tonnes and production in ’000 tonnes.

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