Global Journal of Researches in Engineering
Civil And Structural Engineering
Volume 13 Issue 7 Version 1.0 Year 2013
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4596 & Print ISSN: 0975-5861

Water Requirement for Crops in Barind Area- before and after Implementation of BIADP, Bangladesh

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GJRE-E Classification : *FOR Code: 290899*

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I. Introduction

Among the various phenomenon climate change is manifested by temperature rise along with the changes in precipitation, evaporation and relative humidity etc. threatening impacts in natural, social and economic systems. With the climate change, these factors will affect agriculture most [1,2]. Bangladesh is an agriculture dependent country. Most of the people (more than 80%) are involved in agriculture profession. Hence agriculture and its related things such as water resource management, irrigation, drainage etc. are most important in Bangladesh [2]. Improper knowledge and lack of modern technologies, farmers improperly lift water without considerate ground sources. As a result water table declines in many areas of Bangladesh. Hence groundwater (GW) level declined substantially during the last decade causing threat to the susta-inability of water use for irrigation in NW region of Bang-ladesh [2,3]. The northwest region is almost entirely dependent on groundwater for irrigation purpose. The region is highly developed agriculturally with the largest irrigated area of all regions supplied mainly by shallow tube wells. The number of Deep Tube wells (DTW) has been significantly increased during the recent past years. About 2100 Deep Tube Wells, 45,000 Shallow Tube Wells (STW) and other mode of irrigation wells are being used in the study area for irrigation [4,5]. It covers about 88% of the total cultivable area in the study area. The remaining irrigable area has been intended to cover by installation of additional DTWs under a specific project [5]. The Barind Integrated Area Development Project (BIADP) under the Barind Multi-purpose Development Authority (BMDA) was sta- rted on late eighties century in the districts of Chapai Nawabgang, Naogan and Rajshahi with 25 upazilla for the improvement of agriculture in Bairnd area- northwest region of Bangladesh which covers an area of 7500 km^2 [7]. But in time considering for the better prospect of the project an expanded project area of 38 upazilla of an area of 9288 km^2 has been undertaken recently [8]. For the future development of Barind area BIADP fixed objectives like poverty mitigation, human resource improvement, food safety etc. [6,8]. Availability of water is the key factor for growing any kind of agriculture crop [9]. The water requirements will vary with the crops as well as with the place [10]. In other words, different crops will have different water requirements, and same crop may have different crop requirements at different places of the same country; depending upon the climate, type of soil, method of cultivation, and useful rainfall, etc [11]. Ground water condition of an area is mainly depending on geology, hydrologic parameter, soil properties, recharge and discharge and hydraulic characteristics of aquifer [12]. An important component of water balance equation is ground water recharge. Estimation of recharge volume is very important in forecasting groundwater condition in present stage and its effect on future stage [4,12].

II. Data Collection

The monthly rainfall data in Rajshahi district within the Barind area was collected from Bangladesh Meteorological department, Dhaka. The maximum and minimum temperature (°C) data for Rajshahi station was collected from Bangladesh Meteorological department,

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collected from Bangladesh Meteorological department, Dhaka. The crop coefficient of various crops was collected from Rice, and Wheat Research Institute in Rajshahi.

Blaney-Criddle Method was used for the determination of consumptive use and crop water requirement. As the consumptive use is depending on the temperature and monthly sunshine hours the trend of maximum, minimum temperature and monthly sunshine hours was analysed during pre- (1964-1985) and post- (1986-2008) implementation stages of BIADP (Fig. 1 to 11). To get real view of crop water requirement rainfall data was also analysed. To determine the difference of Cu, C.I.R the graphical representation was done for the periods of 1964-1985 and 1986-2008 for IRRI rice and wheat. Thus the each gradient represents the value of Cu, C.I.R for pre and post project respectively. The negative gradient of maximum and minimum temperature and positive gradient of rainfall indicates the positive input in Cu and C.I.R for crops. To determine the individual years Cu and C.I.R for the period of 1975-1984 and 1999-2008 at minimum and maximum temperature the values of Cu and C.I.R for individual years was plotted against years for each crop (Fig. 12 to 27). Statistical data of Cu and C.I.R was given for crops during 1964-1985 and 1986-2008 by taking the average value of temperature, sunshine hours, rainfall of February, March, April, May and June for IRRI rice; November, December, January and February for Wheat and Potato.

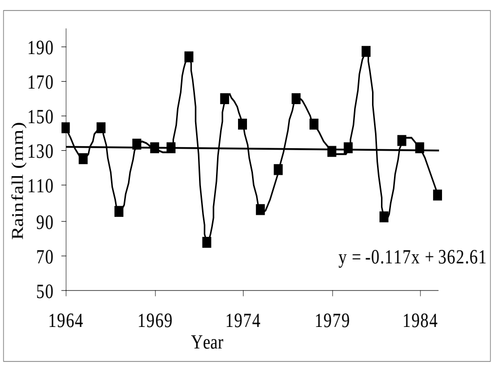

Figure 1 : Pre-project rainfall

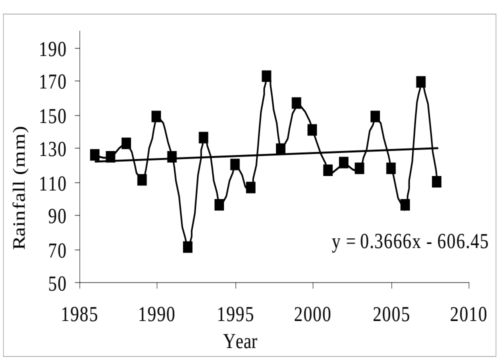

Figure 2 : Post-project rainfall

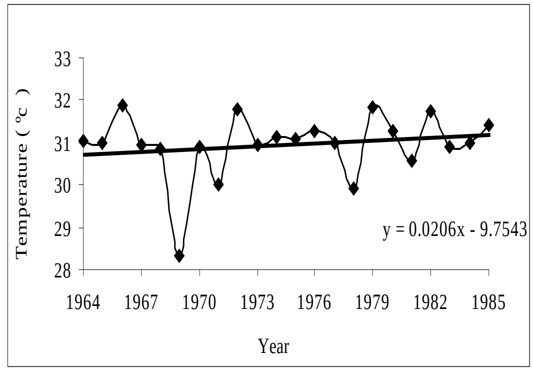

Figure 3 : Pre-project maximum temperature

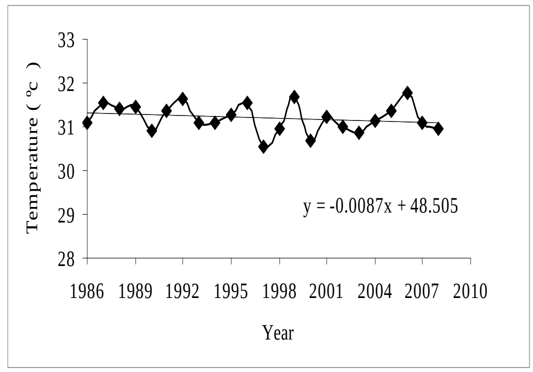

Figure 4 : Post-project maximum temperature

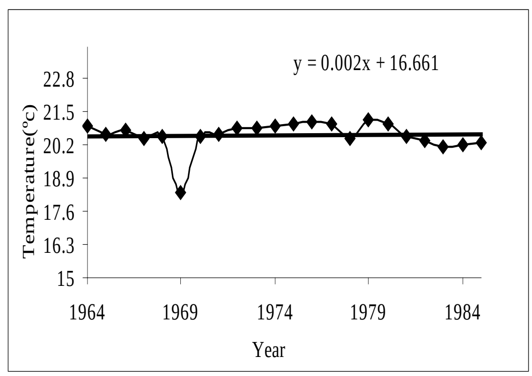

Figure 5 : Pre-project minimum temperature

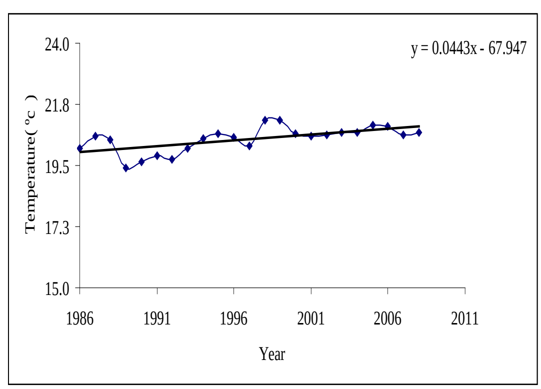

Figure 6 : Post-project minimum temperature

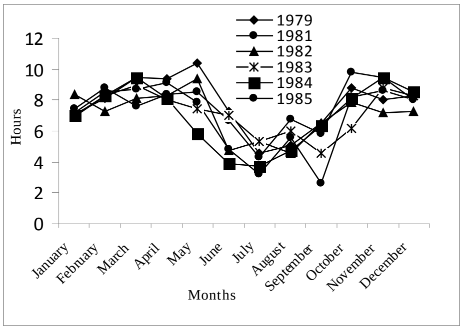

Figure 7 : Variation of monthly sunshine hours from 1979 to 1985

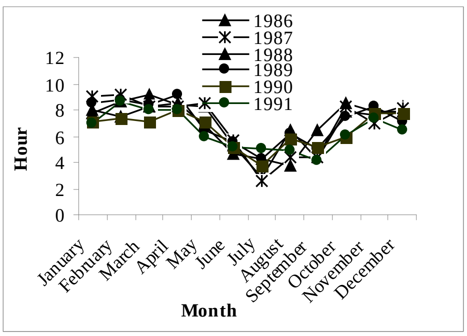

Figure 8 : Variation of monthly sunshine hours from 1986 to 1991

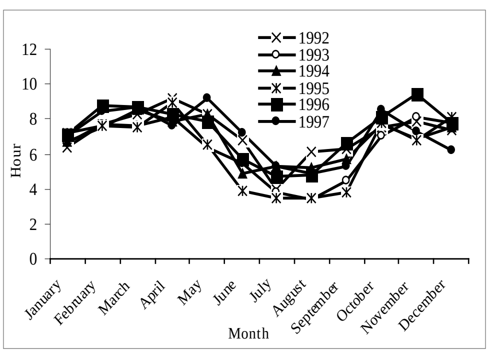

Figure 9 : Variation of monthly sunshine hours from 1992 to 1997

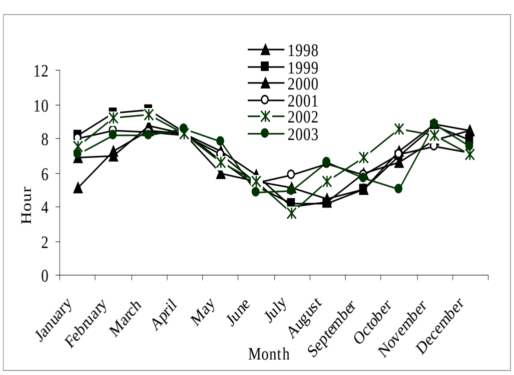

Figure 10 : Variation of monthly sunshine hours from 1998 to 2003

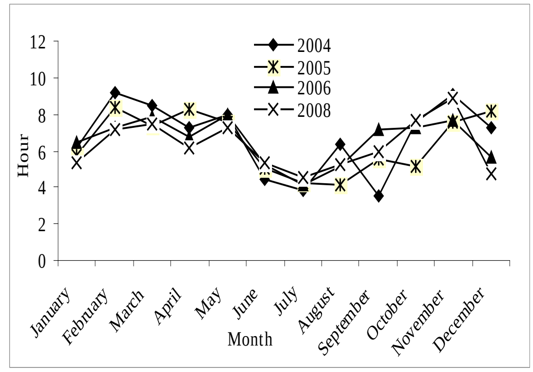

Figure 11 : Variation of monthly sunshine hours from 2004 to 2008

III. Graphical Representation and Discussion of Cu & C.I.R per Year (1975-1984,1999-2008)

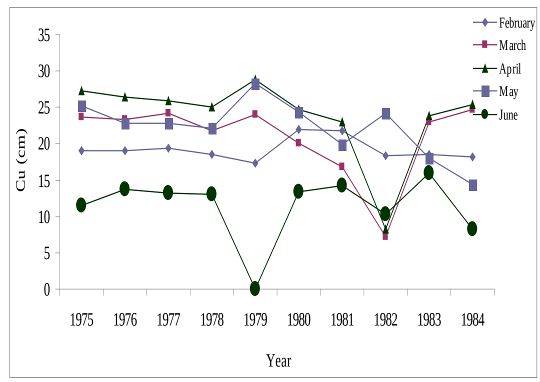

Figure 12 : Yearly variations of Cu for rice for maximum temperature (1975-1984)

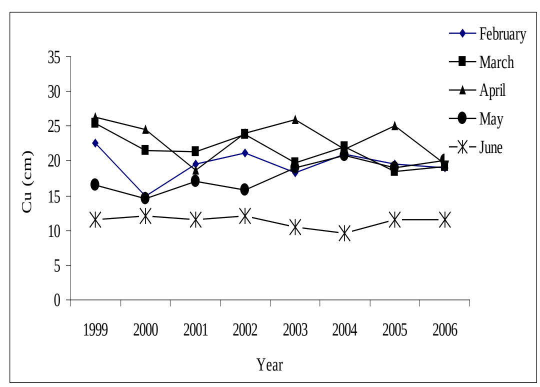

Figure 13 : Yearly variation of Cu for rice for maximum temperature (1999-2008)

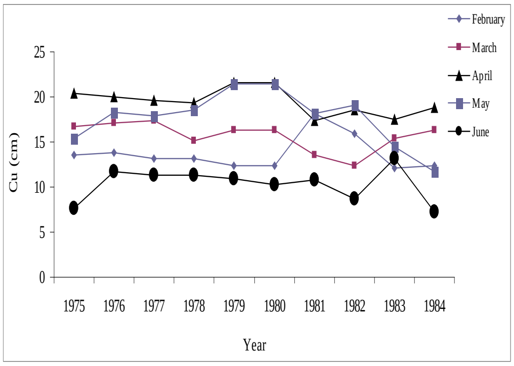

Figure 14 : Yearly Variation of Cu for Rice for minimum temperature (1975-1984)

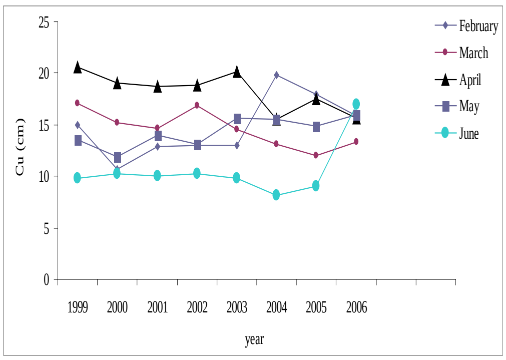

Figure 15 : Yearly variation of Cu for rice for minimum temperature (1999-2008)

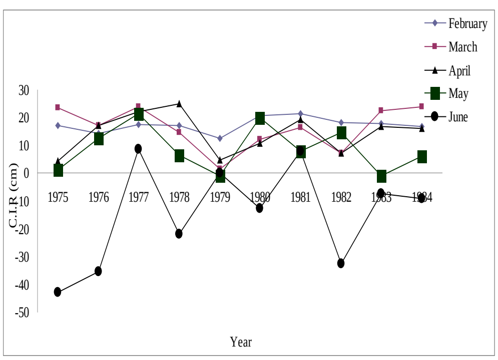

Figure 16 : Yearly variation of C.I.R for rice for maximum temperature (1975-1984)

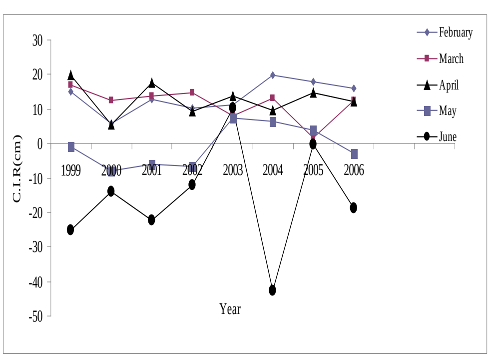

Figure 17 : Yearly Variation of C.I.R for rice for maximum temperature (1999-2008)

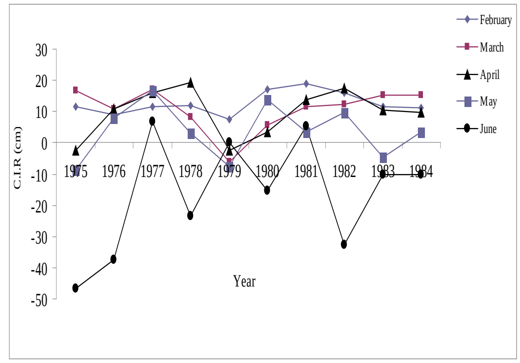

Figure 18 : Yearly Variation of C.I.R for rice for minimum temperature (1975-1984)

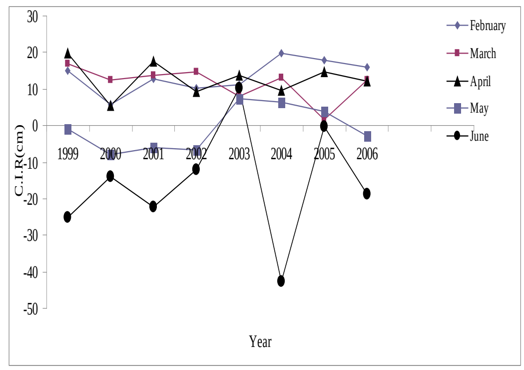

Figure 19 : Yearly variation of C.I.R for rice for minimum temperature (1999-2008)

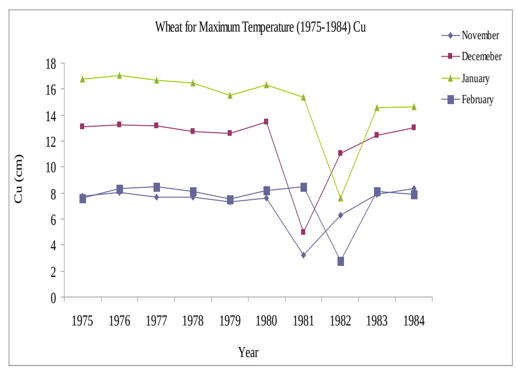

Figure 20 : Yearly variation of Cu for wheat for maximum temperature (1975-1984)

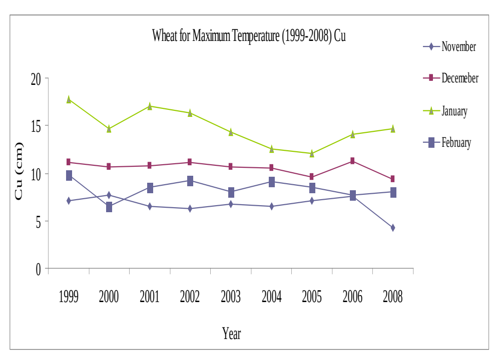

Figure 21 : Yearly variation of Cu for wheat for maximum temperature (1999-2008)

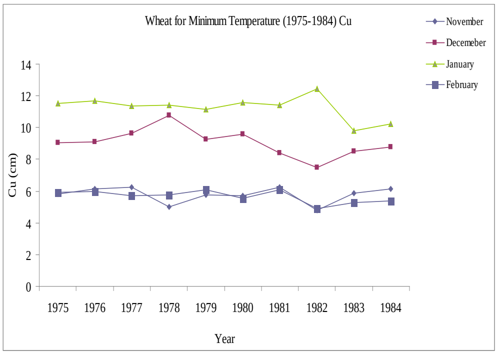

Figure 22 : Yearly variation of Cu for wheat for minimum temperature (1975-1984)

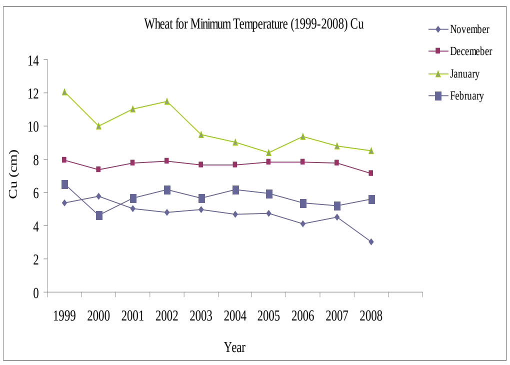

Figure 23 : Yearly variation of Cu for wheat for minimum temperature (1999-2008)

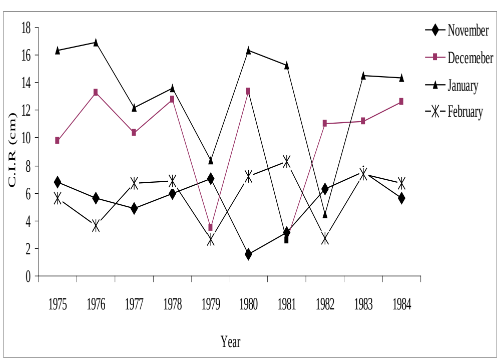

Figure 24 : Yearly variation of C.I.R for wheat for maximum temperature (1975-1984)

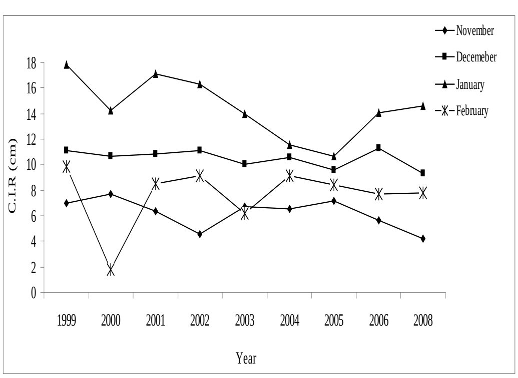

Figure 25 : Yearly Variation of C.I.R for wheat for maximum temperature (1999-2008)

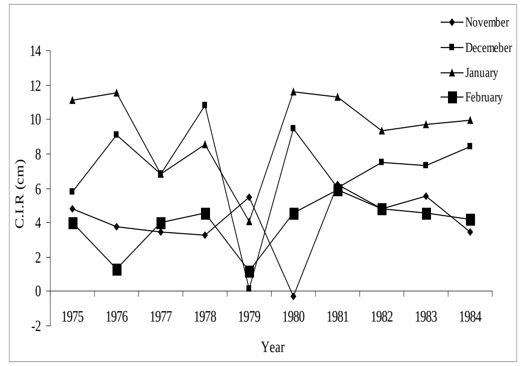

Figure 26 : Yearly variation of C.I.R for wheat for minimum temperature (1975-1984)

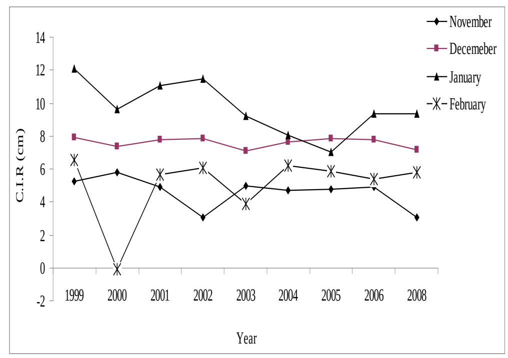

Figure 27 : Yearly Variation of C.I.R for wheat for minimum temperature (1999-2008)

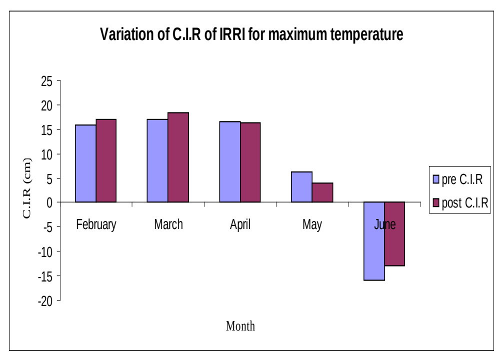

Figure 28 : Variation of C.I.R of rice for maximum temperature

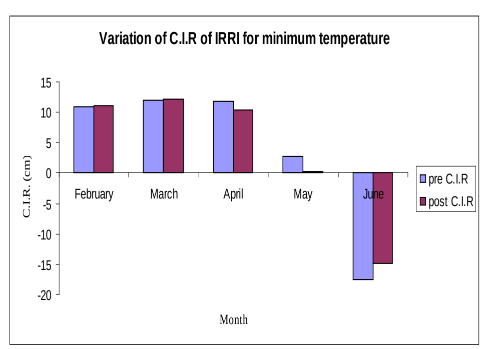

Figure 29 : Variation of C.I.R of rice for minimum temperature

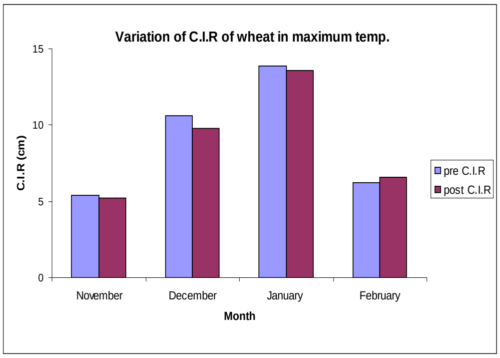

Figure 30 : Variation of C.I.R of wheat for maximum temperature

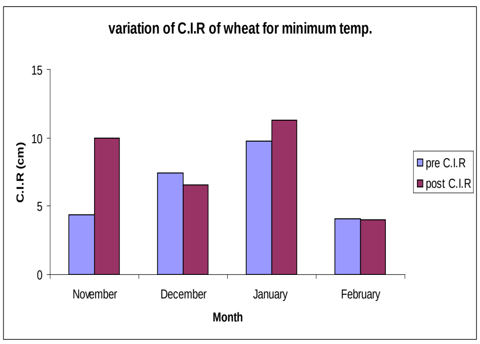

Figure 31 : Variation of C.I.R of wheat for minimum temperature

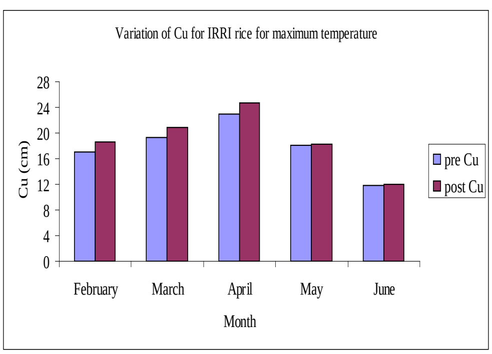

Figure 32 : Variation of Cu of rice for maximum temperature

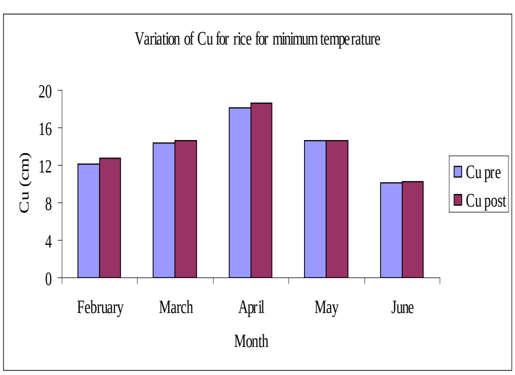

Figure 33 : Variation of Cu of rice for minimum temperature

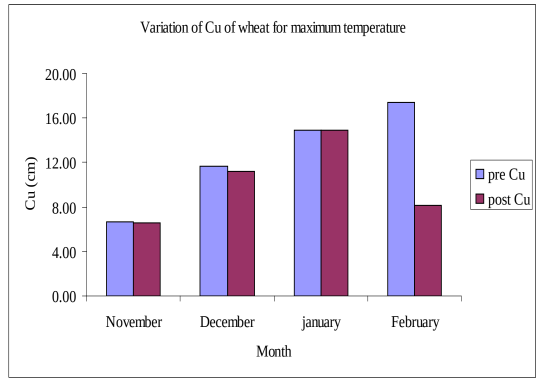

Figure 34 : Variation of Cu of wheat for maximum temperature

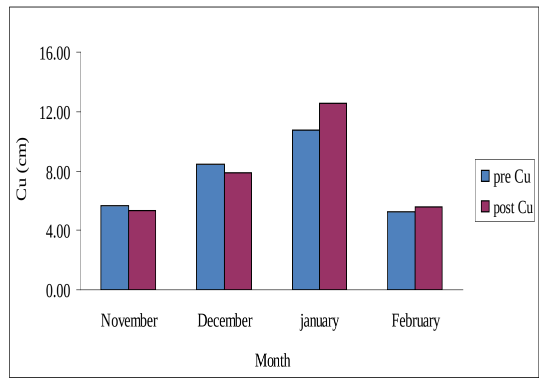

Figure 35 : Variation of C.I.R of wheat for minimum temperature

IV. Result and Discussion

Meteorological data analysis represents that before implementation of the project the rainfall was in decreasing trend and after implementation of the project it is increasing. Before implementation of the project maximum and minimum temperature was increasing this became in decreasing trend, after implementation of BIADP (Fig. 1 to 6).

Figure 7 represents that before 1985 the monthly sunshine hours was more than 10 hours in few months. On the contrary after 1985 the sunshine hour is less than 10 hours (Fig. 8 to 11).

The average value of Consumptive Irrigation Requirement (CIR) for IRRI rice during pre-project for maximum temperature for the month of February, March, April, May and June were 15.83 cm, 17cm, 16.52 cm, 6.22 cm and -15.81 cm respectively. The negative value indicates the excess of rainfall than Cu. On the contrary after implementation of the project for the same crops these values were 17.07 cm, 18.3 cm, 16.337 cm, 3.97 cm, and -13.02 cm respectively (Fig. 28).

The average value of CIR for IRRI rice for Barind area during pre-project at minimum temperature for the month of February, March, April, May, and June were 10.93 cm, 12.01 cm, 11.77 cm, 2.73 cm, -17.46c m, respectively and after implementation of the project for the same crops these values were 11.14 cm, 12.09 cm, 10.33 cm, 0.23 cm, -14.88 cm respectively (Fig. 29).

For Wheat, the average value of CIR before implementation of project at maximum temperature in the month of November, December, January, and February for Barind area were 5.40cm, 10.60cm, 13.85cm, 6.25cm respectively where after implementation of the project these values were 5.21cm, 9.89cm, 13.60cm, 6.56cm respectively (Fig. 30).

For Wheat, before implementation of project the average value of CIR value at minimum temperature for the month of November, December, January and February were 4.40cm, 7.44cm, 9.73cm, 4.10cm respectively where after implementation of the project at minimum temperature these values were 3.97cm, 6.53cm, 11.28cm, 3.97cm respectively (Fig. 31).

V. Conclusion

From the analysis of the meteorological data after implementation of BIADP the rainfall trend is increasing, maximum temperature and minimum temperature is decreasing and also a positive effect has been found for monthly sunshine hours.

The Consumptive use for rice and wheat was more before implementation of the project due to increased maximum, minimum temperature and sunshine hours which decreased after implementation of the project. The Consumptive Irrigation Requirement was decreasing at present due to increasing rainfall.

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