

Climatic Variables of 50 Years and their Trends over Rajshahi and Rangpur Division

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Abstract

An agro-climatic study was conducted at three regions of Rajshahi division with 50 (1961-2010) years of climatic data (temperature, rainfall, relative humidity and sunshine) to observe the climatic variability. The annual average temperature was showed decreasing trends over Rajshahi, Rangpur and Dinajpur regions by 0.0134, 0.0262 and 0.0118^oC/year. Annual average rainfall showed increasing trends over Rangpur and Dinajpur region by 14.971, 18.673mm/year and decreasing trends over Rajshahi region by 3.0698mm/year. Average relative humidity was showed increasing trends over Rajshahi, and Dinajpur region by 0.0261, and 0.0269%/year. Over Rangpur region, the decreasing trend was observed by 0.0599%/year. Decreasing trends of sunshine were observed for all regions. Distributions of regional average of climate factors in the study area were observed ^TRangpur> ^TRajshahi> ^TDinajpur, ^RRangpur> ^RDinajpur> ^RRajshahi, ^{RH}Rangpur> ^{RH}Dinajpur> ^{RH}Rajshahi and ^SDinajpur> ^SRajshahi> ^SRangpur for temperature, rainfall, relative humidity and sunshine, respectively.

Key Words: Climatic data, Rajshahi and Rangpur division

Introduction

Bangladesh is a country of divergent climatic condition throughout the year which has a complex influence in economic and social aspects, mainly for its geographic location and physiographic condition. The arrogant Himalayas in the north and funnel-shaped Bay of Bengal in the south have made Bangladesh a meeting place of the life- giving monsoon rains and the catastrophic devastation of floods, cyclones, storm surges, droughts etc. (Paramanik, 1991). Rajshahi division (including Rangpur Division) has a tropical wet and dry climate. The climate of Rajshahi is generally marked with monsoons, high temperature, considerable humidity and moderate rainfall (Banglapedia, 2004). Analysis of climatology at regional scale is most useful for the solution of practical agricultural problems. The climatic information serves not only as guide to the selection of the proper sites for a given crop but also the most desirable period for sowing and harvesting (Amin *et al.*, 2004). In Bangladesh, such study has been done to analysis the pattern and trend of rainfall, temperature, solar radiation, relative humidity, heat budget and energy balance on different ecosystem, and meteorological application on rice production, response of weather on wheat yield. But past records prevailed that very few study has done to analysis the relationship between climatic parameters and crop production. Under these circumstances a piece of research was conducted with the following objective: to observe the climatic variability for last 50 years in Rajshahi and Rangpur division.

Materials and methods

Three different -stations located at different representative regions of Rajshahi and Rangpur division were selected for study. The stations were namely: Rajshahi, Rangpur and Dinajpur. The stations have been selected in such a way as to represent all geographical and climatological variations.

Monthly mean data of different climatic elements such as maximum temperature (^oC), minimum temperature (^oC), rainfall (mm), relative humidity (%) and sunshine (hr) at this area for the period of January 1961 to December 2010 (i.e. 50 years) were used in this study and data were collected from Bangladesh Meteorological Department (BMD) and Bangladesh Beuro of Statistics (BBS). It is also essential to mention that there were some missing data in some months. Data were considered to be missing when the data were not recorded. To maintain the continuity, the gaps were filled up by the time mean values of the existing years.

After completion of collecting data were compiled, tabulated and analyzed according to the objectives of the study. Data were put in MS excel and Mstatc for statistical analysis. Annual average and 5-years moving average of climatic parameters (temperature, rainfall, relative humidity and sunshine) of different regions of Bangladesh were calculated to analyze the variation and trend line of

climatic parameters during 1961-2010. Regional average of 50 years climatic data was calculated to find out the distribution of climatic parameters. The regression equations and the coefficient of determination (R^2) have been obtained through scatter diagrams by taking two indices at a time. The significance test of the coefficient of determination (R^2) has been carried out by using t-test (Alder and Roessler, 1964).

Results and Discussion

Variability of climatic parameters in Bangladesh during 1972-2001

In the study four climatic parameters such as i) temperature ii) rainfall iii) relative humidity and iv) sunshine were considered.

Temperature

The annual average temperature showed decreasing trend over the period of study for Rangpur region by $0.0262^{\circ}\text{C}/\text{year}$ (Fig. 1), in Rajshahi region the annual average temperature showed decreasing trend by $0.0134^{\circ}\text{C}/\text{year}$. Slightly decreasing trends were recorded over Dinajpur region and the value was $0.0118^{\circ}\text{C}/\text{year}$ (Fig. 1). Similar results were also observed by other researcher. Ara *et al.* (2005) reported that the annual average dry bulb temperature was increased by $0.016^{\circ}\text{C}/\text{year}$ over Khulna, $0.017^{\circ}\text{C}/\text{year}$ over Dhaka, $0.023^{\circ}\text{C}/\text{year}$ over Sylhet, $0.012^{\circ}\text{C}/\text{year}$ over Chittagong and decreased by $0.005^{\circ}\text{C}/\text{year}$ over Rajshahi division during the period 1951 to 2001.

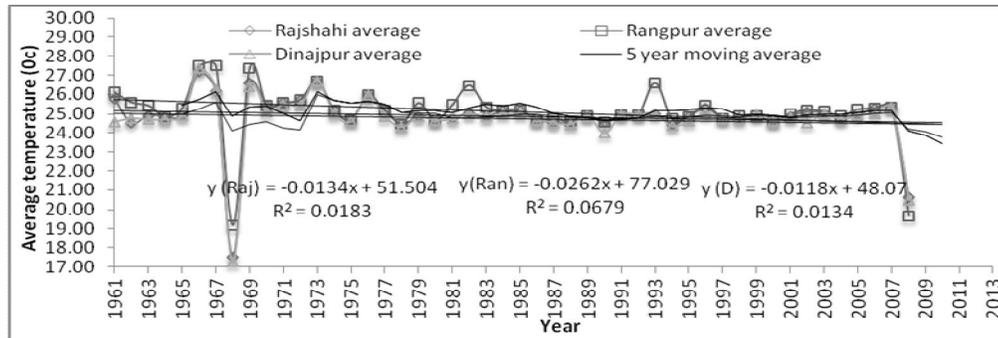


Figure 1. Annual average temperature, 5-year moving average and trend line over Rajshahi, Rangpur and Dinajpur region during 1961-2010

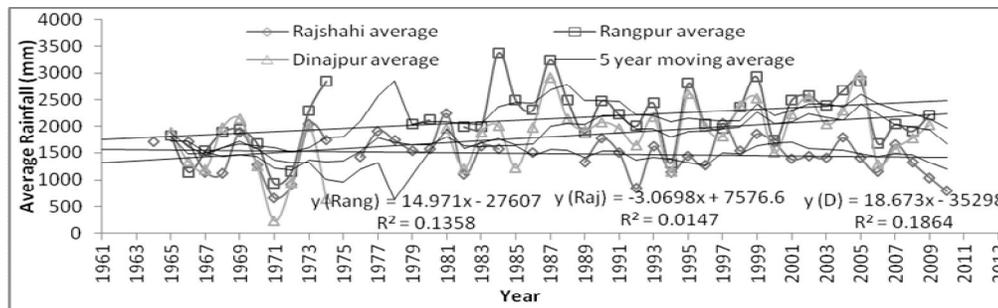


Figure 2. Annual average rainfall, 5-year moving average and trend line over Rajshahi, Rangpur and Dinajpur region during 1961-2010

Rainfall

The annual average rainfall showed a decreasing trend (Fig. 2) over Rajshahi region by $3.0698 \text{ mm}/\text{year}$ and increased over Rangpur region by $14.971 \text{ mm}/\text{year}$. The value of coefficient of determination was 0.1358 for Rajshahi region, which was significant at 0.01 level. Increasing trend was recorded over Dinajpur region by

$18.673 \text{ mm}/\text{year}$ (Fig. 2). The value of coefficient of determination was 0.1864 for Dinajpur region, which was significant at 0.01 levels. Choudhury, (2004) reported that annual average rainfall was found in an increasing trend over Rajshahi, Dhaka and Chittagong by 0.1003, 0.022 and 1.08 mm/year, respectively and decreasing trends were recorded

over Sylhet, Khulna and Barisal by 0.463, 0.742 and 0.131 mm/year.

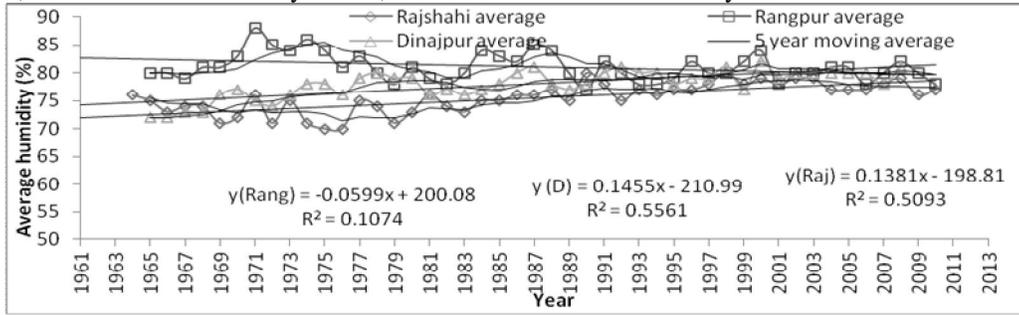


Figure 3. Annual average humidity, 5-year moving average and trend line over Rajshahi, Rangpur and Dinajpur region during 1961-2010

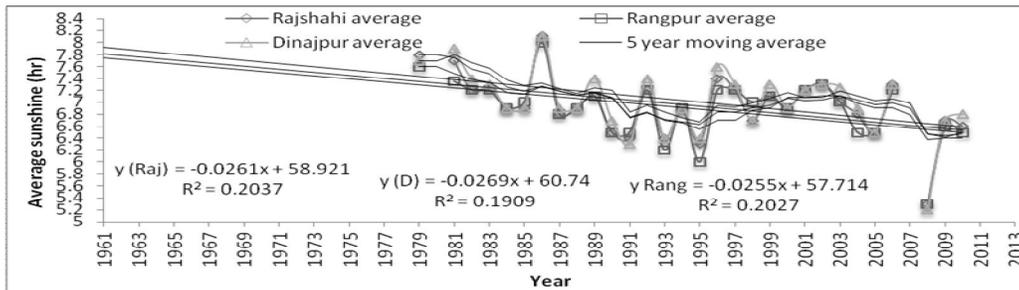


Figure 4. Annual average sunshine, 5-year moving average and trend line over Rajshahi, Rangpur and Dinajpur region during 1961-2010

Relative humidity

The annual average relative humidity for the period 1961-2010 was found to increase over Rajshahi and Dinajpur region by 0.1381 and 0.1455%/year (Fig. 3), respectively. The value of coefficient of determination was 0.1074 for Rajshahi region, which was significant at 0.05 level. And the value of coefficient of determination was 0.5093 for Dinajpur region, which was significant at 0.01 level. Over Rangpur region, the decreasing trend was observed by 0.0599%/year (Fig. 3). The value of coefficient of determination was 0.5561 for Rangpur region which was significant at 0.01 level.

Sunshine

The decreasing rate of annual average sunshine was recorded over Rajshahi and Rangpur region by 0.0261 and 0.0255 hr/year (Fig. 4) with standard deviations 0.41, 0.57 hr and standard errors of mean 0.074 and 0.103 hr, respectively. Over Dinajpur region, the decreasing trend was recorded by 0.1909hr/year (Fig. 5b) with standard deviation 0.70, 0.59 hr. and standard errors of mean 0.13 and 0.11 hr, respectively. The value of coefficient of determinations was 0.2037, 0.1019, and 0.2027 which were significant at 0.01 level.

Table 1. Basic information about climatic factors from 1961-2010 in three regions

| Region | Temperature (⁰ C) | | Rainfall (mm) | | Relative humidity (%) | | Sunshine (hr) | |
|----------|-------------------------------|-------|---------------|--------|-----------------------|------|---------------|-------|
| | SE | Std. | SE | Std. | SE | Std. | SE | Std. |
| Rajshahi | 0.200 | 1.388 | 54.59 | 353.78 | 0.387 | 2.65 | 0.095 | 0.521 |
| Rangpur | 0.203 | 1.406 | 86.38 | 546.29 | 0.362 | 2.45 | 0.093 | 0.510 |
| Dinajpur | 0.205 | 1.421 | 93.64 | 584.79 | 0.378 | 2.51 | 0.102 | 0.556 |

Regional average of climatic factors

The different regional average of climatic factors in Rajshahi Division during 1961 to 2010 is shown in Table 1. The distribution of temperature (T) of different regions was Rangpur > Rajshahi> Dinajpur. The magnitude of highest average temperature was 25.12°C over Rangpur whereas the lowest average was found 24.75°C over Dinajpur region. The distribution of rainfall (R) of different regions was Rangpur> Dinajpur> Rajshahi. The highest average

rainfall was found over Rangpur with a magnitude of 2158.83 and the lowest value was 1474.29 mm over Rajshahi region. The distribution of relative humidity (RH) of different regions was Rangpur > Dinajpur> Rajshahi. The relative humidity was highest recorded 81.07% in Rangpur and lowest value was 75.53% in Rajshahi region. The rate of exposure to sunshine (S) of different regions was Dinajpur> Rangpur> Rajshahi. The highest sunshine was shown 7.02 (hr) in Dinajpur and the lowest value was 6.90 (hr) in Rajshahi region.

Table 2. Average climatic factors of different regions in Bangladesh during 1961-2010

| Regions | Temperature (°C) | Rainfall (mm) | Relative humidity (%) | Sunshine (hr) |
|----------|------------------|---------------|-----------------------|---------------|
| Rajshahi | 24.87 | 1474.29 | 75.53 | 6.94 |
| Rangpur | 25.12 | 2158.83 | 81.07 | 6.90 |
| Dinajpur | 24.75 | 1831.95 | 77.95 | 7.02 |

Summary and Conclusion

The agro-climatic information is most useful for the solution of practical agricultural problems. Without such analysis, the adoption of farming system or an agronomic technology to an area might be unsuccessful. It could be used in the evaluation of potential areas of crop production and selection for cultivation of most desirable crop for sowing and harvesting to avoid climatic stress. For boost up crop production in future crop climatic relationship should be well established and major climatic factors, drought, cyclone or flood forecasting/warning systems should be improved for application of modified cropping patterns and simultaneously socio-economic status of the agrarian people should be strengthened. Climatic information should be used for all aspects of crop production. From the study it can be concluded that: The annual average temperature was showed decreasing trends over Rajshahi, Rangpur and Dinajpur regions. The annual average rainfall showed increasing trends over Rangpur and Dinajpur region and decreasing trends over Rajshahi region. Average relative humidity was recorded increasing trends except Rangpur region. Decreasing trends, of sunshine were recorded for all regions.

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