

M.Sc THESIS

STUDYING CLIMATE CHANGE AND ITS IMPACT ON
CROP WATER REQUIREMENT

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ABSTRACT

Climate change is likely to adversely affect food security in many regions of the world, especially in developing countries like Pakistan, where a large fraction of the population is already facing malnutrition. In such countries, the survival of the population will depend on the effective adaptation of agriculture to climate change. According to the Assessment Report 5 of the Intergovernmental Panel on Climate Change (IPCC), the global surface temperature has increased by 0.65 – 1.06 °C during the years 1880–2012, and the rate of the temperature increase after 1951 has been approximately 0.12 °C per 10 years, which is almost twice the rate since 1880. Furthermore, it is predicted that by the end of the 21st century (2081–2100), the average global surface temperature will increase 1.5 – 2 °C which is higher than that in the years 1850–1900. As Climate change could not only affect global food production and supply, but can also impact on crop growth and water consumption pattern, as well as the quantity of irrigation water that crops require to grow well. Hence, the aim to explore the variability in crop water requirement under climate change scenario to provide a theoretical basis for the design of irrigation water conservation facilities and agricultural water resources management. The study involves, trend analysis using Mann-Kendall's trend test to examine the variability in climatic variables, future projection of the data using climate change scenarios and estimation of crop water requirement using Cropwat 8.0 software to understand the impact of changing climate on crop water requirement of sorghum crop in different cities of Pakistan.

The trend analysis of crop water requirement (CWR) and climatic variable (Precipitation and maximum and minimum temperature) were performed for the historical period (1960-2011) and the future projected period up to 2099. The results revealed that during historical period (1960-2011): a significant increasing trend in minimum temperature and rainfall, while a slight change in maximum temperature was observed. Whereas, during future projected period; an increasing trend was observed in all variables at all stations.

The impact of variation of climatic variability on CWR resulted that with increase in precipitation CWR significantly showed decreasing trend for the period 2000-2011, whereas CWR showed increasing trend with the increase in temperature. Crop water requirement of sorghum for both Lahore and Faisalabad station was maximum for the year 2002 but for Multan station it was maximum for the year 2005. It was also noted that the CWR is more dependent on mean minimum temperature rather than mean maximum temperature.

Hence, the current study concluded that the prevailing trends and variability, caused by climate change, have an effect on the crop water requirement that should be considered by the water managers for better water management in a water scarce country like Pakistan. Crop productivity should also be measured with changing climate i.e. how much crop yield is decreasing with increase in temperature. Non-Linear regression should be applied and equation should be established for crop water requirements and climate change variables. So that future water demands may be better managed by proper planning and agriculture can give proper and reasonable contribution towards the raising of GDP of Pakistan.