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Impact Climate Change on Crop Water Requirement of Different Orchard Crops for Agro-Climatic Condition of Udaipur, Rajasthan

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Abstract: The study was carried out to evaluate the impacts of climate change (in term of daily weather parameters like temperature, humidity, wind speed and sunshine hours) on crop water requirement of different perennial orchard crop (citrus, papaya and guava) over period of five year (2014 to 2018) in climatic condition of Udaipur, Rajasthan. The results showed the significant impact of climate change on reference evapo-transpiration and rainfall patterns during year 2014 to 2018. The maximum annual ETo was found for year 2015 with a value of 1410 year^{-1} whereas, annual rainfall was found to be maximum for year 2016 with a value of 747 mm year^{-1}. The minimum values of annual ETo and annual rainfall were for years 2017 (1259, mm year^{-1}) and 2018 (556 mm year^{-1}) respectively. The uneven trend of ETo and Rainfall for different year due to climate change. The average daily ETo was maximum for May during all year followed by June. The minimum average daily ETo was for December. The average daily ETc for citrus papaya and guava fruit crop varied from 2.8 to 3.2, 2.8 to 3.2 and 2.8 to 3.1 mm day^{-1} respectively, during year 2014 to 2018. . The maximum crop water requirement for citrus, papaya and guava crop ranges from 27 to 30, 9 to 11 and 34 to 40 litre plant^{-1} day^{-1} during all five year. In this area spatial and temporal variability in normal rainfall pattern, atmospheric temperature and reference evapo-transpiration mainly occurs due to overall urbanization, pollution, deforestation, improper use of natural resources and intervention through mining activities, which results improper future planning for establishment of orchard crops.

Keywords: Climate change, Crop evapotranspiration, Crop water requirement, Citrus and papaya

In India establishment of an orchard is basically a long term investment and it require a very critical planning so, it is very essential to know the impact of climate change on different aspect of orchard crop like crop water requirement, growth parameters and fruit yield. Consider impact of climate change in future planning for cultivation of orchard crops in different parts of country. Water is a precious and commonly used natural resource with limited availability. Agriculture sector continues to draw a large share (90%) of available fresh water resources and the demand is likely to increase further (Amarasinghe et al 2008). In present era, fresh water resources are limited and depleted day by day which creates problem of water scarcity. The rainfall trend shows a continuous decrement in average annual rainfall in India. The arid and semi-arid regions of India face the double burden of declining and high erratic rainfall, increment in temperature that surpass threshold limits for major stable orchard crops. In order to minimize all these problems it is very essential to analyze the impact of climate change on agriculture. The selection of orchard crop in an area mainly depends on suitability of existing climatic conditions for batter fruit production. The crop water requirement basically depends on the climatic conditions, crop characteristics and evapotranspiration of crops. The crop coefficient of orchard crops varies with season it was found maximum during summer month and minimum during winter season (Doorenbos and Pruitt 1977).

MATERIAL AND METHODS

Study area: Study on impact of climate change on crop water requirement of different orchard crops was carried out for Udaipur district of Rajasthan. The study area is located between 24°35'31.5" latitude 73°44'18.2" longitude with an altitude of 582.17 m above mean sea level (MSL).

Agro-climatic conditions: Udaipur comes under dry, sub-humid agro-climatic region (Fig. 1). The average annual rainfall of Udaipur is 637mm, most of the rain received during the period of July to September. The May is hottest month and December is the coolest of the year. The daily meteorological data such as daily weather parameters like maximum temperature (Tmax, ^{0}C) and minimum temperature (Tmin, ^{0}C), maximum relative humidity (RHmax, %) and minimum relative humidity (RHmin, %), wind speed (WS, km hr^{-1}) at height of 2.0 m, sun shine hours (SSHr, hr), rainfall (R, mm) for five year (2014 to 2018) were collected from meteorological observatory of College of Technology and Engineering, Udaipur.

Reference evapotranspiration (ETo): The modified Penman-Monteith method suggested by (Allen et al 1998) was used to compute reference evapo-transpiration (ETO). The FAO Penman-Monteith method to estimate ETo is given below:

$$ET_0 = \frac{0.408\ \Delta.4\ (R_n - G) + \gamma \dfrac{900}{T + 273} U_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34U_2)}$$