An assessment of linear change Trend in Agro Climatological parameters that influence growth of citrus

A Case study: Northern parts of Iran

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Introduction

Citrus fruits are ranking in the first place in the world with respect to production among fruits. They are grown commercially in more than 50 countries around the world.

Citrus fruit production recorded a handsome increase during the 1990s, and recently reached 100 million tons annually. Considering the therapeutic value of these fruits and the general health awareness among the public, citrus fruit are gaining importance worldwide, and fresh fruit consumption is likely to increase.

Climatic changes results essentially from man's action on the ecosystems that degrade very quickly but recovers very slowly and lose biodiversity.

Climate change strongly influences desertification process by its impact on the vegetation, soil and hydrological cycle. Agriculture is interface of ecosystem and community. Agriculture is not only responsible for 20 percent of green house gas emissions into the atmosphere but also it becomes affected from environmental conditions change. As a result, combining of agro-climatic studies and environmental condition is needed for a sound assessment of future climate change.

Keywords: Agriculture, climate change, green house gas.

Material and methods

The area of study in this research was the North of Iran. We have used information from six stations in the

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area including Gorgan, Noshahr, Rasht, Ramsar, Anzali and Babolsar. In the research, the time-series (annual, seasonal and monthly period) of eight climate-variables including accumulated rainfall, mean temperature, min temperature, max temperature, min and max temperature difference (TD), Growing Degree Day (GDD), Helio thermal Units (HTU) and Photo thermal Units (PTU) were Analyzed to ascertain the existence of climate variability in the period 1976-2005 in the Northern part of Iran. Man Kendal test and linear regression models (t-test) have been used for the trend detection in the time series of research variables. The Mann–Kendall method has been suggested by the World Meteorological Organization to assess the trend in environmental data time-series. This test consists of comparing each value of the time-series with the others remaining, always in sequential order. The presence of a statistically significant trend is evaluated using the Z value. This Statistic is used to test the null hypothesis such that no trend exists. A positive Z Indicates an increasing trend in the time-series, while a negative Z indicates a decreasing trend. To test for either increasing or decreasing monotonic trend at p significance level, the null hypothesis is rejected if the absolute value of Z is greater Than $Z_{1-p/2}$; where $Z_{1-p/2}$ is obtained from the standard normal cumulative Distribution tables. In this work, the significance levels of p= 0.01 and 0.05 were applied, and the significant level (p-value) was obtained for each analyzed timeseries. It is also possible to obtain a non-parametric estimate for the magnitude of the slope of trend. The t-test for trend detection is based on linear regression, and therefore checks only for a linear trend. There is no such restriction for the Mann- Kendall test.

Results and discussion

The results of this research indicated generally increasing trends in most of these variables (statistically significant at $p<0.01$ or $p<0.05$) by Mann–Kendall test and linear regression models. However, the minimum and maximum temperature difference presented decreasing behavior. The study showed that most of the stations studied are going through a process of environmental warming. The results also suggest that the historical trends may be related to climate variability in northern part of Iran, which affects both semi tropical and coastal part of the region.

The decrease in the minimum and maximum difference is generally based on Wants' Hoff factor accompanied by reduced quality of the citrus, while the increase in mean Temperature, GDD, HTU and PTU is satisfied with the plantation area of the citrus.

Conclusion

This study investigated climatic variability in northern part of Iran based on Maximum, minimum and mean air temperatures, the difference between minimum and maximum temperature, rainfall, Growing Degree Day (GDD), Helio thermal Units (HTU) and Photo thermal Units (PTU). It emphasizes that the time-series of these climatic variables in northern part of Iran presented an increasing trend (statistically significant at $p<0.01$ or $p<0.05$) for almost all stations.

Moreover, the difference between minimum and maximum temperature trend is inverse, that is, decreasing over time, also statistically significant in most stations. The time behavior pattern of the temperature is physically consistent with the behavior of the other climatic variables analyzed. The decrease in difference between minimum and maximum temperature is reduced generally, while the mean temperature, min temperature, maximum temperature, HTU, GDD and PTU were increased.

This study showed climate variability in most of the stations studied. This

Variability affects not only the semi-tropical region of northern part of Iran but also the coastal part of the region.