



Tropentag 2023  
September 20-22, 2023

Conference on International Research on Food Security, Natural Resource  
Management and Rural Development  
organised by the Leibniz Centre for Agricultural Landscape Research (ZALF),  
Germany in cooperation with Humboldt-Universität zu Berlin, Germany

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## **Sustainable production of pistachios in dealing with climate change in central plateau of Iran”**

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### **Abstract**

The topic of sustainable production of pistachios in the face of climate change is relevant in the context of food and agroforestry systems because pistachios are an important horticultural and agricultural product in Iran, with a high export value. Climate change poses a threat to the production of pistachios in central Iran, which has a unique habitat and climate for cultivating pistachios. In Iran, 90 varieties of pistachios are cultivated in an area of 530000 hectares, of which about 100000 hectares are related to pistachio seedlings. Compared to its competitors (American pistachios), Iranian pistachio nuts have the highest amount of fat, about 56 %, which, in addition to its beautiful appearance and unique taste, has distinguished it from other pistachios in the world. The increase in temperature, changes in rainfall volume, intensification of drought in desert and subtropical areas, and change in the level of surface and underground water sources have made it challenging to maintain the production volume and quality of pistachios. Sustainable production of pistachios in Iran requires identifying approaches and solutions to combat climate change including the use of low-chill cultivars, controlling pests caused by climatic stress, and selecting the correct location for establishing new gardens. To achieve a high-quality product and sustainable production, it is also important to consider growth factors and stress indicators, including cold demand, watering rate, soil salinity, etc. in all stages from pollination and flowering to crop growth. By applying these measures, it is possible to achieve high-quality pistachios and sustainable production that can contribute to food security and support the agricultural systems in Iran.

**Keywords:** Climate change, dehydration, export value, Iran, low-chill cultivars, pistachio, *Pistacia vera*, sand and dust

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## **Introduction**

Among the different economic sectors, the agricultural sector has been affected by climatic conditions more than other sectors due to the prevailing conditions. Therefore, in addition to the governments, farmers also play a central role in responding to these climate changes and adapting to them, so that adapting agricultural systems at the farm level to the current conditions is considered the best way to adapt and respond to climate changes.

Pistachio is one of the most important horticultural and agricultural products of Iran with a high export value, which accounts for a significant share of farmers' income, especially in hot and dry areas, with little water and climates that are not suitable for agriculture, such as Kerman and South Khorasan in the central plateau of Iran, have given. The cultivated area of 90 varieties of pistachios in Iran is about 530 thousand hectares, of which about 120 thousand hectares are made up of pistachio seedlings, and from the environmental point of view, it is considered an artificial forest in the country. Compared to its competitors such as American pistachios, Iranian pistachios have the highest fat content of about 56%, which, in addition to its beautiful appearance and unique taste, has distinguished it from other pistachios in the world. The role of pistachio orchards is very effective in softening and reducing air pollution, stabilizing quicksand and reducing storms. In last years, Iran has been the world's largest producer and exporter of pistachios, and in 2006, Iran's pistachio export value was 61% of the world's pistachio export value. But in recent years, this rate has been decreasing. Pistachio is considered as the last agricultural product that can be cultivated in most pistachio growing areas of Iran. In terms of resistance to salinity, this product is the last product that can be cultivated in saline areas, or in other words, it is tolerant to salinity, meaning that if pistachio orchards do not tolerate salinity, lack of water and the harsh climate of the region where they are cultivated, no other product can. It cannot be cultivated in that area, and in this situation, the next stage will be the development of the desert and desertification, which will result in the migration of people and unemployment. Despite its high tolerance, the pistachio tree is a sensitive tree, and the construction of pistachio orchards in the country without the necessary scientific studies, without providing the required infrastructure and considering the climatic conditions and the lack of knowledge of the farmers, is worrisome. Pistachio is sensitive to late spring cold, and freezing temperature and even close to it cause a lot of damage to pistachio orchards. Early heat in spring will cause the loss of flowers and fruits at the beginning of the season, and excessive heat during the time of fruit pitting and fruit pit development will cause abortion and increase the percentage of fruit porosity.

In order to prevent the vulnerability of the pistachio crop, strategies to deal with the impact of climate change on pistachio trees, both traditional and modern, should be predicted. In this research, according to the climatic conditions of the central plateau of Iran, solutions have been investigated, especially in the use of water.

## **Material and Methods**

The statistical population of the collected data of the research is Iran Pistachio Research Centre, Iran Pistachio Association, Pistachio Committee, interviews with gardeners of pistachio gardens in Kerman and South Khorasan provinces, and reports of Horticultural Sciences Research Institute (HSRI). The variables that were studied are the area of the gardens, the geography, and climate of cultivated gardens, the type of irrigation operations used in the stages of planting and harvesting, common and traditional and also modern methods of pistachio planting, inputs such as fertilizers, Pesticides, comparison of different pistachio cultivars and pistachio morphology.

## **Results and Discussion**

If the tree faces water shortage during the critical growth stages, such as pistachio kernel formation, it will hurt fruit growth. The speed of these climate changes has significantly increased during the last decade so a large amount of pistachio gardens in the country have been damaged by these climatic adversities. The effect of climate change on the pistachio crop includes: 1) an increase in temperature and lack of cooling needs, 2) fluctuations in the amount of precipitation in different seasons, especially autumn and winter, 3) severe temperature fluctuations during the swelling, budding, flowering, pollination and insemination of flowers 4) increase in hot summer days and continued drought 5) change in the level of surface and underground water resources 6) increase in salinity and imbalance of nutrients in the soil and finally 7) the decrease in water quality, has caused a significant decrease in the quantity and quality of the product of this green gold of Iran.

Correct irrigation solutions and soil improvement to preserve water resources, increase productivity, and reduce production costs:

- Change in the traditional planting method and shift to modern, drip, bubbler, jug, and subsurface irrigation with sponge pipes,
- Using the drip and subsurface irrigation system,
- Expressing the real value of water and economic valuation of water to evaluate the economic supply and demand of water,
- Providing the right amount of water for the trees at the required time,
- Awareness of farmers in the field of prevention methods of Aflatoxin contamination and correct irrigation,
- Preparing a topographical map of the garden to determine the slope of the land for the construction of irrigation canals in the right place,
- Land levelling and preparation operations such as loading and mixing soil layers,
- Avoid heavy watering of soil with low permeability during flowering,
- Lack of irrigation for mature trees (limited irrigation or deficit irrigation).

## Conclusions and Outlook

Sustainable pistachio production in Iran requires identifying approaches and solutions to deal with climate change, including the use of low-cold cultivars, controlling pests caused by climatic stress, and choosing the right place to build new orchards. In general, pistachio trees prefer deep soil with light to medium texture. Failure to provide the water needs of trees in April, during flowering and the time when the brain is filling, generally leads to atrophy and miscarriage in July.

- What is certain is that farmers are not able to change or control climatic conditions on a large scale, but proper management in line with these natural changes will be useful in reducing the complications ahead.
- In the face of autumn and winter, hot and low rainfall with successive fluctuations wet and cloudy springs with unusual rainfall, and hot summers with severe day and night temperature differences, changes in the intensity of storms and dust. , unusually late or early years for flowering and harvest, which all indicate serious climate changes. Iranian farmers and gardeners, especially those living in the centre of Iran, have touched and understood climate change and its effects on their skin and flesh.
- Knowing the climatic suitability and modifying the cultivation pattern will be the basic solution to maintain production security and change the pattern of water consumption in the agricultural sector. The zoning showed that the ambient temperature in the pollination stage and the percentage of relative air humidity in the pollination and fruit growth stages are the main limiting factors of pistachio cultivation.

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