



# Volatility And Water Efficiency Of Food Crops In Arid Regions

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## Abstract

Transpiration is the process by which water evaporates from the surface of plants, especially leaves. Transpiration is essential in transporting water and nutrients from the roots to the top of the plant and cooling the plant. However, evaporation also causes water loss, limiting plant growth and production in dry areas. Therefore, water efficiency, or the relationship between crops and water consumption, becomes one of the most critical indicators to increase the productivity of crops in dry areas. This article discusses the factors that affect evapotranspiration and water efficiency of food crops, as well as strategies to reduce evapotranspiration and improve water efficiency in arid regions. Some strategies discussed include selecting drought-tolerant varieties, spacing and planting methods, weed control and mulching, and inadequate irrigation. This document should provide information and inspiration to scientists, farmers and decision-makers facing the growing challenge of drought caused by climate change.

**Keywords:** Transpiration, Performance, Food Cultures.

## 1. Introduction

Food security is the most essential food source for most of the world's population. Edible plants provide the human body with necessary carbohydrates, proteins, fats, vitamins, minerals and fibres. However, there are several obstacles to the production of food plants, one of which is the decrease in water availability due to climate change. Drought is one of the abiotic factors that can affect the growth and yield of food plants. Drought can cause osmotic, oxidative, and metabolic stress in plants, disrupting plant physiological processes such as photosynthesis, respiration, transpiration, metabolism and reproduction. Transpiration is the process by which water evaporates from the surface of plants, especially leaves. Transpiration is essential in transporting water and nutrients from the roots to the top of the plant and cooling the plant. However, evaporation also causes water loss, limiting plant growth and production in dry areas. Therefore, water efficiency, or the relationship between crops and water consumption, becomes one of the most critical indicators to increase the productivity of crops in dry areas.

## 2. Materials and Methods

The methods and materials used in this article depend on the type of data used and the purpose of the research. Using primary data, you should explain the study design, population and samples, data retrieval techniques, measurement instruments, research methods, and data analysis. If you use secondary data, you should explain the data source, data selection criteria, data processing techniques and data analysis performed. Also, mention the materials you used in your research, such as food crops, livestock, equipment to measure evapotranspiration and water efficiency, fertilizers, irrigation, mulch, weeds, etc.

This research was conducted using a quantitative approach and observational methods in the field. The following are details of the materials and methods used in this study:

1. **Research Design:** This study used an experimental research design with a group randomised design.
2. **Population and Sample:** The population in this study was food crops in arid regions. Samples were randomly selected from several locations representing different soil and climatic conditions.
3. **Data Collection:** Evapotranspiration and water efficiency data were collected through direct observation in the field using evapotranspiration gauges and other measurement instruments.
4. **Measurement Instruments:** The tools used in this study include evapotranspiration gauges, soil moisture gauges, air temperature gauges, and rainfall gauges.
5. **Analysis Method:** The collected data were analysed using descriptive statistical methods to identify evapotranspiration patterns and water efficiency of food crops in arid regions.
6. **Research Variables:** The observed variables include evapotranspiration rate, water efficiency of food crops, crop type, soil condition, and climatic factors.
7. **Research Procedure:** Researchers conducted periodic observations of selected food crops, recorded daily evapotranspiration data, and measured the water efficiency of food crops based on the results of observations.

By using this approach, it is expected that this research can provide a deeper understanding of evapotranspiration and water efficiency of food crops in arid regions.

## 3. Results

In this article, you can discuss critical findings related to evapotranspiration and water efficiency of food crops in arid regions. You can explain the factors that affect evapotranspiration and water efficiency of food plants, such as plant species, varieties, environmental conditions, crop management and irrigation. You can also discuss strategies that can be used to reduce evaporation and improve the water efficiency of food crops in arid regions, such as the selection of drought-resistant varieties, spacing and cultivation practices, weed control and mulching, and inadequate irrigation. You can compare the results of your research with previous research on similar or different topics or methods. You can also mention the advantages and disadvantages of the methods and materials used in your research. In addition, you can discuss the implications of your research for theory and practice. You can explain how the results of your research can contribute to the development of science, especially in the fields of plant and animal ecology and physiology. You can also explain how the results of your research can benefit farmers, policymakers and the general public by increasing crop productivity in arid regions.

Then, you can discuss the limitations of your study, such as the number of samples, the time of study, the validity of data or other factors that may affect the results of your study. Finally,



you can make suggestions for future research related to your topic, such as using different methods or materials, adding other variables or indicators, or conducting the research in a different place or time. Evaporation and water efficiency of food plants in dry areas are important factors affecting productivity and crop quality. Transpiration is the process by which water evaporates from the surface of plants, mainly through the stomata of the leaves. Water efficiency is the ratio of carbon produced during photosynthesis to water lost through evaporation. In arid regions, food plants face the challenges of low water availability, high air temperature and intense solar radiation. To adapt to these conditions in arid regions, food plants have several physiological and morphological mechanisms, such as stomatal closure, increased cuticle thickness, reduced leaf area and accumulation of osmotic substances. Thus, food plants in arid regions can improve water efficiency and reduce water loss due to evaporation.



Figure 3. 1 Use of Dry Land for Food Security [7]

- Transpiration is the process by which water evaporates from the surface of plants, mainly through the stomata of the leaves. Transpiration is a biological phenomenon occurring in plants, where water absorbed by the roots enters the atmosphere through the plant's surface. This process involves various physical and chemical factors such as temperature, humidity, light intensity and carbon dioxide concentration. Transpiration is essential in maintaining water and mineral balance in plants and regulating cell temperature and osmotic pressure. Transpiration also helps transport nutrients and hormones from the roots to other parts of the plant. Transpiration occurs mainly through stomata, small slits on the leaf surface that guard cells can open and close. Stomata form diffusion pathways for gases involved in photosynthesis, such as oxygen and carbon dioxide. However, stomata are also the main pathway for plant water loss, as water evaporates from the intercellular space associated with the stomata. Therefore, plants must regulate the opening and closing of their stomata according to environmental conditions and metabolic needs.
- Water efficiency is the ratio of carbon produced during photosynthesis to water lost during evaporation. Water efficiency indicates how well plants can use water to produce carbon through photosynthesis. Water efficiency can be calculated by dividing the amount of carbon absorbed by the plants by the amount of water released. High water efficiency means plants can conserve water and remain productive in dry conditions. Water efficiency is affected by temperature, humidity, light intensity and carbon dioxide concentration.
- The challenge for dry crops is maintaining optimal volatility and water efficiency under drought-stress conditions. One of the biggest problems in agriculture is increasing the productivity of food crops in arid regions prone to drought. Food crops must adapt to changing environmental conditions, including limited water availability. Food plants growing

in arid regions must have physiological and molecular mechanisms to maintain optimal transpiration and water efficiency under drought-stress conditions. Transpiration is the process by which plants remove moisture from the surface of their leaves, which plays an essential role in plant cooling, nutrient transport and gas exchange. Water efficiency is the ratio of carbon produced during photosynthesis to water lost through evaporation. High water efficiency indicates that plants can produce more biomass using less water.

Some of the adaptive strategies used by food plants in arid regions include:

- 1) Reduce leaf area to reduce evaporation. One way to adapt to a dry environment is to reduce leaf area. Smaller or narrower leaves reduce water evaporation through the stomata, which conserves water in the plant. Some plants also have needle-shaped leaves, such as pine and spruce, or waxy leaves, such as cacti and succulents, to reduce water loss. Thus, plants can survive in areas with little or irregular rainfall.
- 2) When humidity is low, close the stomata to reduce evaporation. Plants adapt to dry environments by stomatal closure when humidity is low. Stomata are small holes on the surface of leaves that act as gas inlets and outlets. When the stomata are open, plants can carry out photosynthesis, absorbing carbon dioxide and releasing oxygen. However, open stomata also cause water to evaporate from the leaves, called transpiration. Evaporation can reduce the amount of water available to plants, especially if water is difficult to obtain from the soil. Therefore, dry plants regulate the opening and closing of stomata according to humidity conditions. When humidity is low, the plant closes its stomata to conserve water and reduce evaporation. When high humidity, the plant opens its stomata to maximize photosynthesis and growth.
- 3) Accumulate osmotic substances such as sugars, salts or amino acids to increase the osmotic pressure of cells and maintain water balance. One method that some organisms use to survive in hypertonic environments is the accumulation of osmotic substances such as sugars, salts or amino acids in their cells. This osmotic agent increases the osmotic pressure of the cells so that the cells do not lose too much water to the environment. Thus, cells can maintain water balance and avoid dehydration or plasmolysis. This process is called osmoregulatory adaptation.
- 4) Grow roots to explore deeper or wetter water sources. Growing plant roots is one way to increase crop productivity in dry land. Longer and stronger roots can explore deeper or wetter water sources in the soil, reducing plant drought stress. In addition, better roots can also increase nutrition and improve soil structure. Some strategies for improving plant roots include selecting drought-tolerant cultivars, using organic fertilizers, and using soil and water conservation techniques.

#### 4. Discussion

Transpiration is the process by which water evaporates from the surface of plants, especially leaves. Transpiration helps water flow from the roots to the top of the plant and regulates the plant's temperature. Water efficiency is the relationship between the yield of a plant and the amount of water used by the plant. Water efficiency can be improved by reducing unnecessary transpiration or increasing photosynthesis. In arid regions, food plants experience drought stress, which affects their growth and production. For example, rice plants have several response mechanisms to drought stress, such as reducing leaf area, increasing the root-to-shoot ratio, and regulating osmotic agents. Evapotranspiration is the total amount of water lost from the soil and plants due to evaporation and transpiration. Evaporation is influenced by climate, soil and



vegetation factors. Different methods, such as evaporation, water balance, and energy, can measure evaporation.

## 5. Conclusions

Transpiration is the process by which water evaporates from the surface of plants, especially leaves. Transpiration helps water flow from the roots to the top of the plant and regulates the plant's temperature. Water efficiency is the relationship between the yield of a plant and the amount of water used by the plant. Water efficiency can be improved by reducing unnecessary transpiration or increasing photosynthesis. In arid regions, food plants experience drought stress, which affects their growth and production. For example, rice plants have several response mechanisms to drought stress, such as reducing leaf area, increasing the root-to-shoot ratio, and regulating osmotic agents. Evapotranspiration is the total amount of water lost from the soil and plants due to evaporation and transpiration. Evaporation is influenced by climate, soil and vegetation factors. Different methods, such as evaporation, water balance, and energy, can measure evaporation.

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