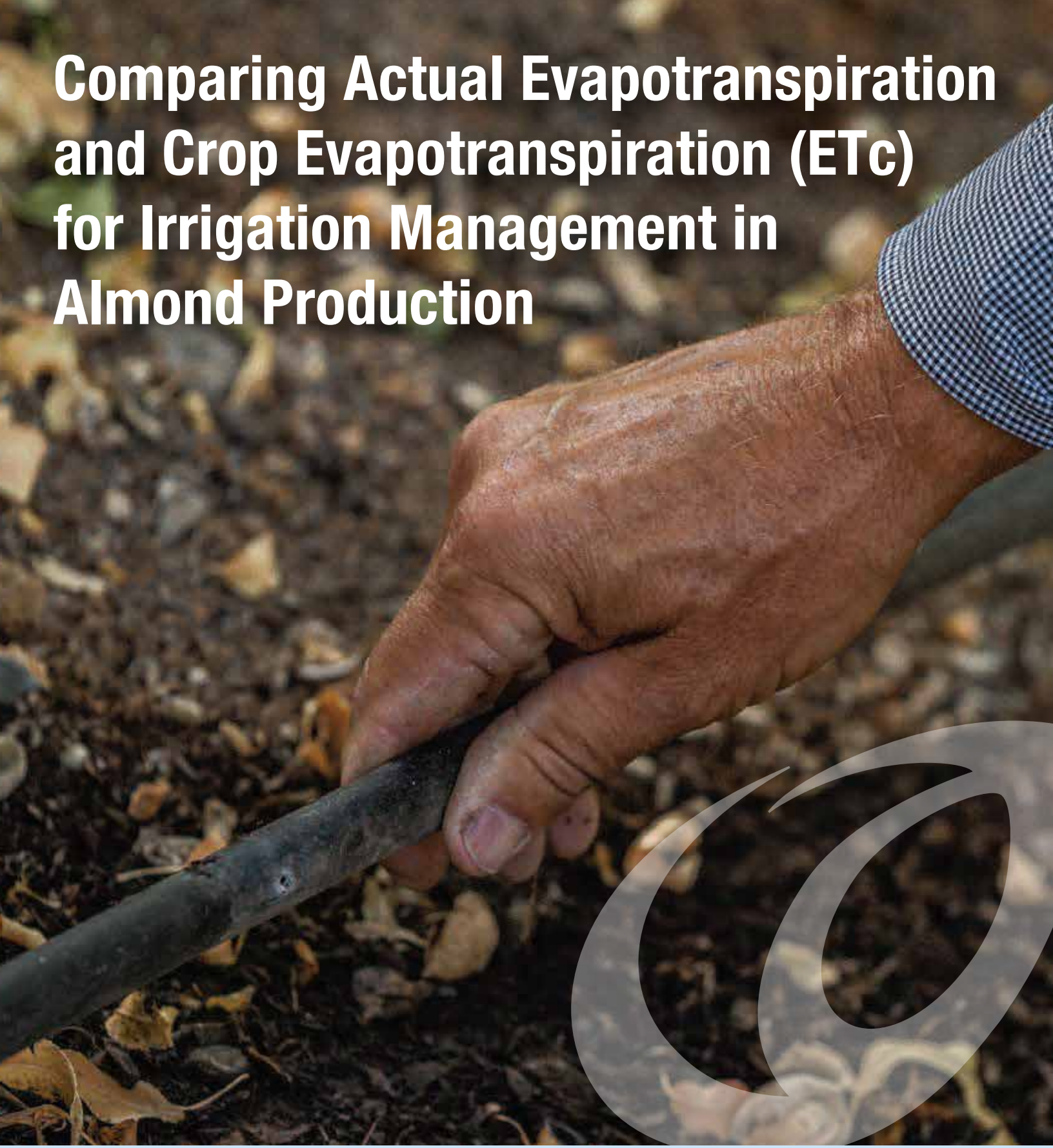
Comparing Actual Evapotranspiration and Crop Evapotranspiration (ETc) for Irrigation Management in Almond Production



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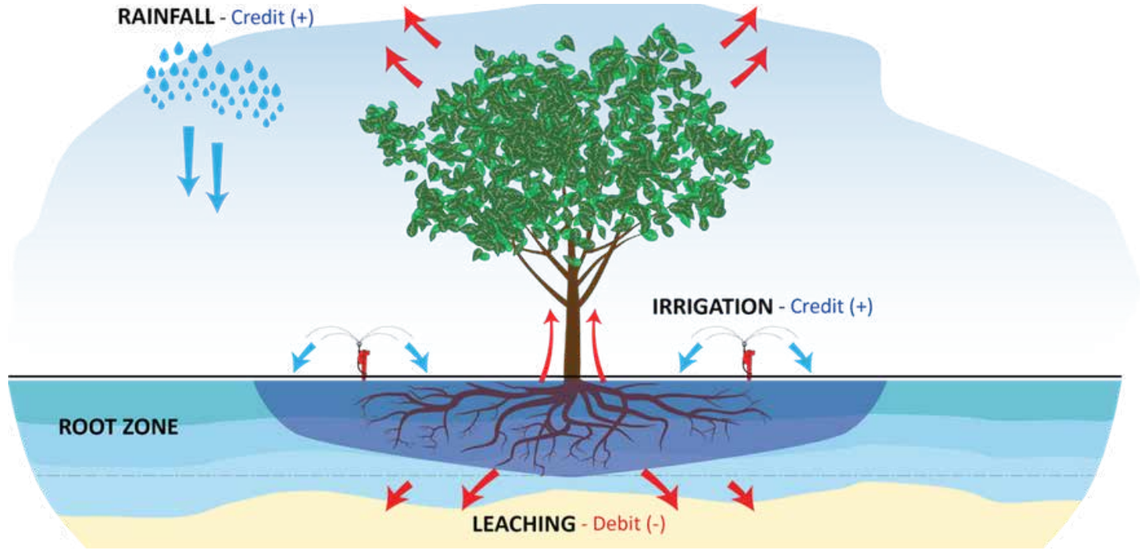
WHAT IS EVAPOTRANSPIRATION (ET)?

ET describes the process through which water is transferred from the land to the atmosphere by **E**vaporation (from soil) and **T**ranspiration (from plants). Evaporation is driven by solar radiation and influenced by factors like temperature, humidity, and wind. Transpiration rates are affected by the physiological characteristics of the plant, environmental conditions, and the availability of soil moisture.



Why is ET important?

Understanding ET is vital for effective water management in agriculture. It not only helps in determining irrigation schedules and water usage efficiencies, but also provides growers with a clearer picture of how much water is actually being used by the crop versus how much is needed under optimal conditions. This understanding ensures that crops receive the right amount of water to meet production goals, while also helping conserve water resources, reduce waste, and improve overall sustainability in farming systems.

What are the differences between actual ET (ETa) and crop ET (ETc)?

ETa refers to the total amount of water that is actually used by the crop under real-world field conditions, measured under existing soil moisture and climatic conditions. It can be measured through remote sensing, field sensors, or micrometeorological techniques. It is influenced by soil moisture availability, meteorological conditions, and vegetative cover.

ETc is the amount of water used by a crop under optimal conditions of water supply (no stress conditions). It is commonly used for determining irrigation needs and is often calculated using reference ET (ETo) and a crop specific coefficient (Kc) that adjusts for crop type and growth stage.

How Field Conditions Can Affect ETa and ETc

While ETc provides a theoretical estimate of crop water use under ideal conditions, ETa reflects what actually happens in the orchard. The gap between the two often emerges under real-world field conditions:

Heat Stress:
During extreme heat waves, almond trees may partially close their stomata to conserve water, reducing transpiration. ETc, which assumes full water supply and no stress, will predict higher water use than what is actually occurring. ETa measurements capture this reduced transpiration, showing a drop compared to ETc.

Deficit Irrigation Strategies:
Growers sometimes apply less water than full ETc to control tree growth, improve hull split, or conserve water during critical drought years. Under these conditions, ETa will track lower than ETc, reflecting intentional water stress. Comparing the two helps growers verify whether their deficit targets are being met without causing yield loss.

Soil Salinity:
Soils with high salinity make it harder for almond trees to take up water, even if moisture is present. ETc does not account for this barrier, while ETa reflects reduced transpiration due to osmotic stress. A widening gap between ETa and ETc in saline areas can signal declining orchard health or the need for leaching practices.

Irrigation Non-Uniformity:
If irrigation systems deliver uneven water distribution across an orchard, some zones may experience mild stress. ETc assumes uniform supply, but ETa will reveal patchy reductions in water use, highlighting problem areas for system maintenance or re-design.

Feature	ETa	ETc
Definition	Water loss measured under actual environmental and soil moisture conditions.	Estimated water use assuming optimal conditions with no water stress.
Data Source	Derived from field sensors or remote sensing technologies.	Calculated from climatic data using ETo and Kc.
Considers Water Stress?	Derived from field sensors or remote sensing technologies.	No. Assumes sufficient water for full irrigation without stress to the crop.
Best Use	Making real-time irrigation adjustments to match current conditions.	Planning seasonal irrigation needs and water budgeting.
Application in Irrigation Management	Enables precise, real-time adjustments to irrigation, helping to manage actual water use efficiency, address drought stress, and optimize deficit irrigation strategies.	Assists in estimating seasonal water demands, guiding baseline irrigation schedules to ensure optimal crop health and performance.

Practical Consideration for Almond Growers

- Verify **ETa** with soil moisture estimates to confirm irrigation needs.
- Technology integration (satellite data, field sensors) enhances **ETa** accuracy.

Concluding Thoughts

- **ETc** provides a guideline for planning irrigation schedules, while **ETa** offers real-time precision to adjust irrigation based on actual conditions.
- Using both **ETc** and **ETa** facilitates a comprehensive irrigation strategy that enhances water use efficiency, reduces operational costs, and improves the health and sustainability of almond orchards.

Vision

California almonds make life better by what we grow and how we grow.

Mission

Expand global consumption of California almonds through leadership in strategic market development, innovative research and accelerated adoption of industry best practices.

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