# Growing Season Water Use in California Rice Systems

## Overview

In California, there is little to no rainfall during the growing season, so it is not usually considered in water budgets. On average, about 5 acre feet/acre (AF/ac) of irrigation water is applied to a rice field during the growing season. Evapotranspiration (ET) is not highly variable and ranges from 2.6 to 3.2 ft (32-38 in). Other losses are highly variable depending on soil type and management. The growing season average for soil percolation (downward flow of water below the root zone) is about 0.1 ft; for seepage (lateral movement of water out of field) about 0.07 ft. Tailwater drainage is also highly variable and can range from 0 to 3 ft. Leaks in levees and outlet boxes can be a big source of water loss and hard to quantify.

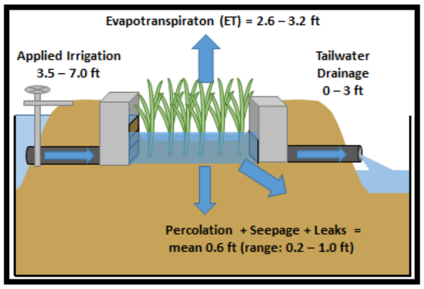


*Figure 1. Ranges in water inputs and losses from California rice fields. Seepage and percolation ranges are based on indirect measurements.*

Water lost as ET cannot be reused; however, water lost in tailwater drainage and seepage can be reused downstream to irrigate other fields. Water lost via percolation recharges aquafers or streams.

At a minimum, enough water needs to be applied to meet the seasonal ET demand and make up for losses due to percolation and seepage. This is roughly 3.5 ft. However, fields and how they are managed are highly variable, and affect water use. Some of these factors are discussed next.

## Factors Resulting in Water Use Variability

**Percolation and seepage losses:** On average, these losses are very low in most California rice fields due to the heavy clay soils or the presence of a hard pan. However, on coarse textured soils or where the field may be located over an old stream bed (have a gravel or sand bed underneath) percolation and seepage rates may be higher.

**Soil water storage:** Depending on how dry the soil below the tilled layer is at the start of the season affects how much water is required to initially flood a field. If the winter and spring have been dry, it may take more water to initially flood a field than in wet years when the soil below the plow layer is still relatively wet.

**Early season drains:** Water may need to be drained from the field during the first few weeks of a season for a number of reasons. First, some growers practice the Leather's method which is draining the field for a few days shortly after planting. This prevents damage to the stand from winds churning up the water, which dislodges seedlings. Draining early may also reduce tadpole shrimp damage. The field is flooded after the young seedlings have anchored their roots in the soil (usually 2-5 days after draining). Second, fields are drained for certain herbicide applications (pinpoint drain), usually around 3-4 weeks after planting. Some herbicides require that the weeds be exposed; thus, the field needs to be drained.

**Increasing water height during booting:** Pollen formation occurs during booting (between panicle initiation and heading) which usually occurs during the last half of July. Developing pollen is very susceptible to cold temperatures, which cause blanking and lower yields. Farmers are encouraged to raise the water level in their fields up to 8 to 10 inches deep to protect the developing panicle from cold nighttime temperatures. Cool nighttime temperatures are most commonly a problem in the southern part of the Sacramento Valley but can be a problem in some years throughout the valley.

**Managing salinity:** High salinity can reduce rice yields. Salinity is a problem when rice is grown on saline soils or receives high salinity irrigation water. Irrigation water with a high amount of recycled water or well water can be high in salinity. As the applied water flows from the field inlet down the field to the drain, the salinity in the water increases due to evaporation of water. One way farmers can reduce salinity build up in the flood water is to keep the water flowing through the field. This practice is referred to as maintenance flow. This practice also helps farmers maintain a uniform water height in the field throughout the season.

**End of season drain:** At the end of the season farmers drain their fields about six weeks before harvest in preparation for the harvest. The timing of the drain is important and varies depending on soils and weather. The goal is to dry the soil enough to allow a combine to go over it without causing large ruts, while not drying out too early which can lower yields and grain quality. This drying can be either accomplished by allowing the water to subside naturally or releasing the water through the tailwater drain. The later practice results in higher tailwater drain losses.

**Varieties and crop development:** The time from planting to harvest (and thus the period of irrigation) varies depending on the rice variety being grown, the region of the valley and the time of planting. Rice varieties grown side-by-side can vary in duration by as much as a couple weeks. Moving from south to north in the valley, average temperatures increase and thus the time from planting to harvest is shorter in the north than in the south. Finally, planting later, usually means planting during a warmer time of the season; thus later plantings tend to have shorter crop duration.

## For more on this topic:


- ✓ Agronomy Research and Information Center-Rice: rice.ucanr.edu
- ✓ Linquist, B.A. et al. (2015) Water balances and evapotranspiration in water- and dry-seeded rice systems. Irrigation Science 33:375-385.
- ✓ Montazar, A. et al. (2017) A crop coefficient curve for paddy rice from residual of the energy balance calculations. Journal of Irrigation and Drainage Engineering. 143(2) doi: 10.1061/(ASCE)IR.1943-4774.0001117.
- ✓ Marcos, M. et al. (2018) Spatio-temporal salinity dynamics and yield response of rice in water-seeded rice fields. Agricultural Water Management 195:37-46.
- ✓ LaHue, G.T. and B.A. Linquist (2019) The magnitude and variability of lateral seepage in California rice fields. Journal of Hydrology 574:202-210



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