Managing Rice with Limited Water

Background

During drought years water deliveries are often restricted. In these situations, how can you use the least amount of water to grow rice without reducing yields? Based on past studies, the amount of water delivered to rice fields varies widely (i.e. 4 to 7.7 ft). This water is lost as evapotranspiration, percolation and seepage, and tailwater drainage (Figure 1).

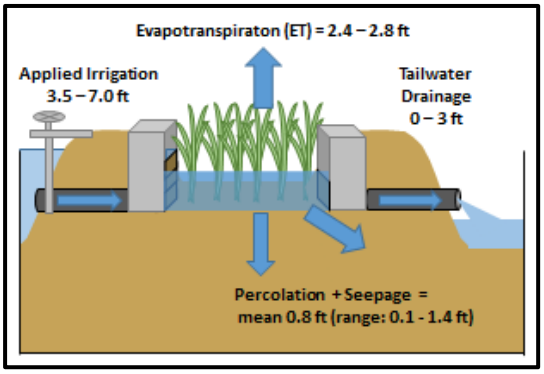

Figure 1. Ranges in water inputs and potential losses from California rice fields.

Best Practices to Conserve Water while not Reducing Yields

Avoid fields that have high percolation. In most California rice soils, water percolation rates are low due to the high clay soils that rice is typically grown on. However, some soils may have high percolation rates due to a highly permeable layer or old creek bed that runs through the field. When water is in short supply, consider fallowing these fields.

Avoid early planting. Planting early increases water use because planting occurs during a cooler time of the year. Since crop duration is dependent on temperature (growing degree days), early planting extends the duration of the crop, thus needing to be irrigated for longer and increasing ET and percolation/seepage losses.

Short duration varieties. Choose shorter duration varieties which reduce the time the field has to be flooded. Rice typically needs to be flooded from planting to reproductive stage R7 (R7, when one kernel on the main panicle is yellow; about 3 weeks after heading). Table 2 gives an indication of the differences flooding period by variety.

Table 1. Days to from planting to R7 for different varieties grown in California

Variety	Days to reach R7*
M-105, S-102, CM-101	99-102
M-206, M-210	105
M205, M-209, M-211	108-112
M-410, M-402	124-128

** Days from planting to R7 (typically when it is time to safely drain) for different California rice varieties at the Rice Experiment Station. These days are to be used for comparison among varieties. Actual days to R7 will vary depending on year and location in the Sacramento Valley.*

Don't spill. Rice can be grown using 3.5 to 4 ft of water (depends on the percolation and seepage characteristics of the field) if there is no tailwater drainage (Figure 1). Tailwater drainage results from lowering the water for herbicide applications, maintenance flow, and draining the field at the end of the season for harvest. No-spill (no tailwater) practices require closer management of irrigation water and planning for upcoming events where water may need to be lowered. With no-spill management, yields can be maintained as long as the irrigation water has relatively low salinity (<0.6 dS/m) and soils are not saline. Most California rice fields receive irrigation water that has low salinity.

Fix leaks. Leaks around outlet boxes or in levees can result in significant water loss. These leaks can be caused by water erosion, crayfish, or rodents. Fields should be routinely monitored for such leaks and leaks repaired.

Figure 2. Leak near outlet caused by crayfish.

Don't drain at the end of the season. It is common to pull outlet boards at the end of the season to drain the field in preparation for harvest, resulting in significant tailwater drainage losses. Instead, growers should turn off irrigation before needing to drain and allow the water to naturally subside rather than drain the field. Determining when the irrigation water can be turned off depends on how much water is in the field, climate, and soil properties. Fields with heavy clay soils can safely have no standing water 21 to 24 days after 50% heading without risking yield loss and grain quality.

Dry- versus water-seeding. While it may seem counter intuitive, dry/drill seeding does not necessarily require less water than water-seeding. In California, dry seeding usually requires two or three flushes of irrigation water to establish the crop before a permanent flood is established. These flushes require a lot of water. Once the field is flooded the water has to be drained resulting in high tailwater losses. Dry seeding can use less water if rice seed is planted to moisture which reduces the need to flush the field (or number of times field is flushed) in order to germinate the seed and establish the crop.

Figure 4. Drill seeded rice field before permanent flood.

For more on this topic:

- ✓ Agronomy Research and Information Center-Rice: rice.ucanr.edu
- ✓ View video at http://ucanr.edu/insights.
- ✓ 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.

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http://agric.ucdavis.edu/

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