Managing Water Salinity in Rice Fields

Background

Rice yields are sensitive to salinity, so it is important to monitor and manage fields to prevent high salt concentrations from developing. High water salinity can reduce rice yield by decreasing stand density, reducing plant growth, and increasing pollen sterility. In most CA rice fields, salinity is not a problem. However, if using recycled water or well water for irrigation, or if soils have high salinity, then salinity may be a problem.

Figure 1. Most of the water delivered to rice fields in California is good quality and has low salinity. However, recycled water and water from wells can have high salinity which may affect rice growth and yields.

When Can High Water Salinity Lead to Yield Loss?

In rice fields, when average flood water salinity is greater than 0.88 dS/m, yields begin to decline (Figure 2). This yield threshold is lower than the previous report of 1.9 dS/m.

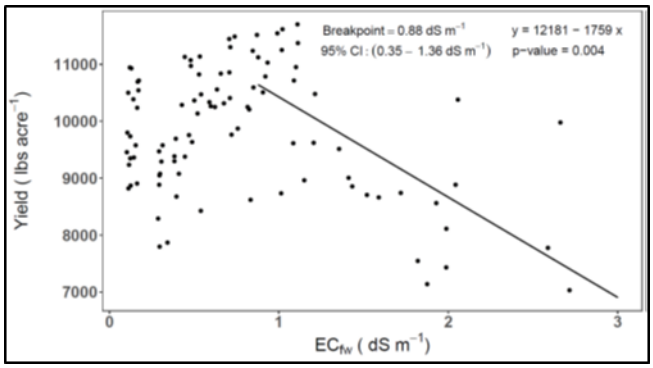

Figure 2. The relationship between yield and season average field water salinity (EC_{fw}).

Where is Salinity a Problem in Fields?

Salinity in a field increases as the distance from the irrigation inlet increases (Figures 3 &4) due to evapo-concentration (evaporation causing salts to concentrate in the remaining water). As water moves down a field, it experiences more evapo-concentration and thus higher water salinity in bottom checks. For a 100 ac field, water salinity at the bottom of the field is roughly 50% higher than the irrigation water entering the field. Water salinity is also higher in stagnant areas of the check with no water flow (Figure 4, left).

When in the Growing Season is Flood Water Salinity the Highest?

Flood water salinity is highest early in the season (Figure 3) due to:

- Low canopy cover early in the season resulting in high rates of evapo-concentration (from temperature and wind).
- Holding water or allowing water to subside early in the season, primarily for herbicide applications, concentrates salts in the field water.

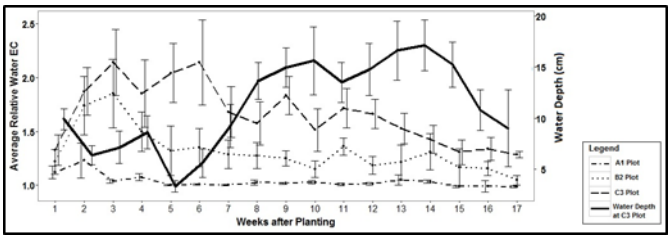

Figure 3. Water salinity varies over time and location within a rice field. Average relative water EC (field water salinity relative to irrigation water salinity) during the growing season in the top (plot A1), middle (plot B2), and bottom checks (plot C3). Average water depth in the bottom check (dark solid line) is shown on the right axis. Error bars represent standard error.

Managing Salinity

- **Irrigation water should have an EC below 0.6 dS/m** – For an averaged sized field this will help ensure that the field water salinity does not increase beyond the 0.88 dS/m yield threshold at the bottom of a field.
- **Change water flow path** – Salinity builds-up in stagnant parts of the field. Changing the water flow path will reduce salinity hot spots from developing (Figure 4).
- **Early in the season when salinity is highest, allow for spillage and maintain higher water levels** – This may not be possible in drought years or with certain herbicide programs.
- **Smaller fields and multiple side inlets** – The distance water travels in a field determines the build-up of water salinity. Larger fields will have greater water salinity build-up in the bottom of the field. Smaller fields and multiple inlets should be considered in areas that have saline soils or that receive irrigation water high in salinity.

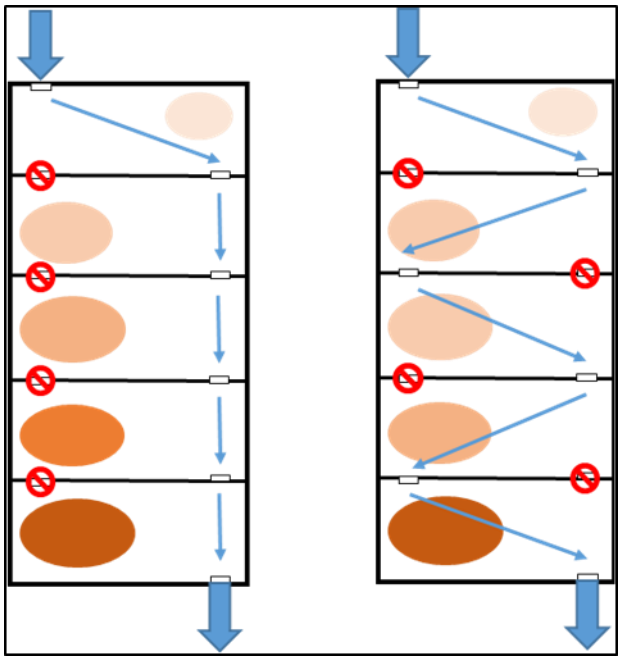

Figure 4. The diagram on left shows a field with water running down one side of the field and how flood water salinity (increasing darkness of the circle) is concentrated on one side of the field. Changing the water flow path (shown on right) the water flow path is forced through the high salinity areas and helps flush out the high salinity water.

For more on this topic:

- Marcos et al. (2018) Spatio-temporal salinity dynamics and yield response of rice in water-seeded rice fields. Agric. Water Mgmt. 195:37-46.
- Scardaci et al. (2002) Water management practices can affect salinity in rice fields. California Agriculture 56:184-188.
- Grattan et al. (2002) Rice is more sensitive to salinity than previously thought. California Agriculture 56:189-195.

Agronomy Research and Information Center

http://agric.ucdavis.edu/

University of California Cooperative Extension

Authors: Bruce Linquist
(2023)