Seepage Water Management

Voluntary Guidelines for Good Stewardship in Rice Production

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Seepage Water Management

Voluntary Guidelines for Good Stewardship in Rice Production

S. R. Roberts, Postgraduate Researcher, Department of Agronomy and Range Science, University of California, Davis

N. K. Gorder, Associate Environmental Research Scientist, California Environmental Protection Agency, Department of Pesticide Regulation

J. E. Hill, Extension Agronomist, Department of Agronomy and Range Science, University of California, Davis

J. M. Lee, Associate Environmental Research Scientist, California Environmental Protection Agency, Department of Pesticide Regulation

S. C. Scardaci, University of California Cooperative Extension Farm Advisor, Colusa County

What is seepage?

Seepage is the lateral movement of irrigation water through a rice field levee or border to an area outside the normally flooded production area (fig. 1). Seepage can occur through levees into adjacent dry fields or into existing drains and canals. Although leakage caused by crayfish and rodent burrowing is not considered seepage, it can also result in the movement of irrigation water away from rice fields.

Figure 1. Seepage is the movement of water from a flooded rice field into an adjacent nonmanaged area. In this photo, the dark areas near the levee indicate seepage.

How can I recognize seepage?

Seepage appears early in the growing season as a wet area on the outside of border levees or in adjacent dry fields (see fig. 1). Seepage is readily apparent later during the growing season as an accumulation of water or by the growth of green weeds along the edge of a field (fig. 2; see also cover photo). Occasionally, seepage appears as a wet area that can damage a perimeter road.

Figure 2. Unwanted seepage in a ditch near and around a drain during the holding period. Note the abundance of weeds near the drain.

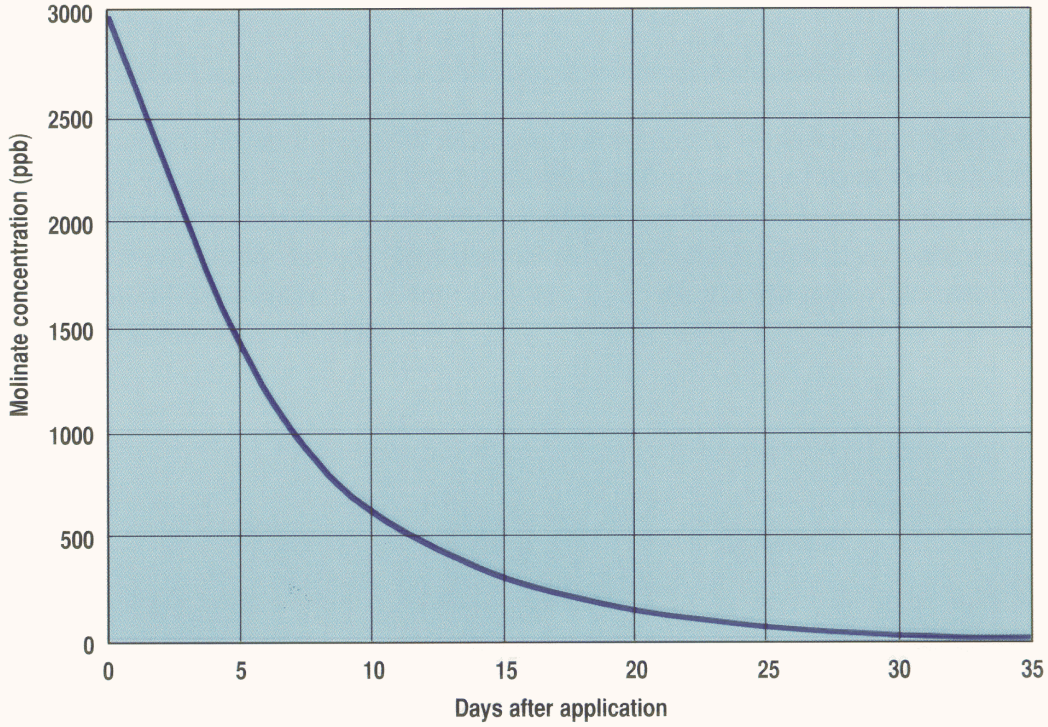

Figure 3. Typical dissipation curve of molinate (Ordram) in a commercial rice field. Concentrations of molinate and other pesticides in seepage water are likely to reflect the concentrations of the water in the field. Adapted from S. C. Scardaci et al., "Evaluation of rice water management practices on molinate dissipation and discharge, rice pests, and rice production" (University of California Agronomy Progress Report 200, 1987); and L. J. Ross and R. J. Sava, "Fate of thiobencarb and molinate in rice fields" (Journal of Environmental Quality 15:220–225, 1986).

Water can also seep directly from a field into an adjacent drain or canal. This seepage may be difficult to recognize, but the inability to maintain water depth may indicate that it is occurring. Checks or fields that use significantly more water than others, even though soil types are comparable, may actually be seeping. If you are satisfied that your practices are adequate for good water management (level fields, good rodent and crayfish control, rice boxes in good repair, etc.), seepage may be the cause of the water loss. Seepage can cause excessive water use and can create difficulty in maintaining uniform water levels even when the best water management practices are used.

Why is seepage a problem?

Seepage water that contains high concentrations of pesticides can hinder efforts to comply with California's stringent water quality goals. Efforts to meet these

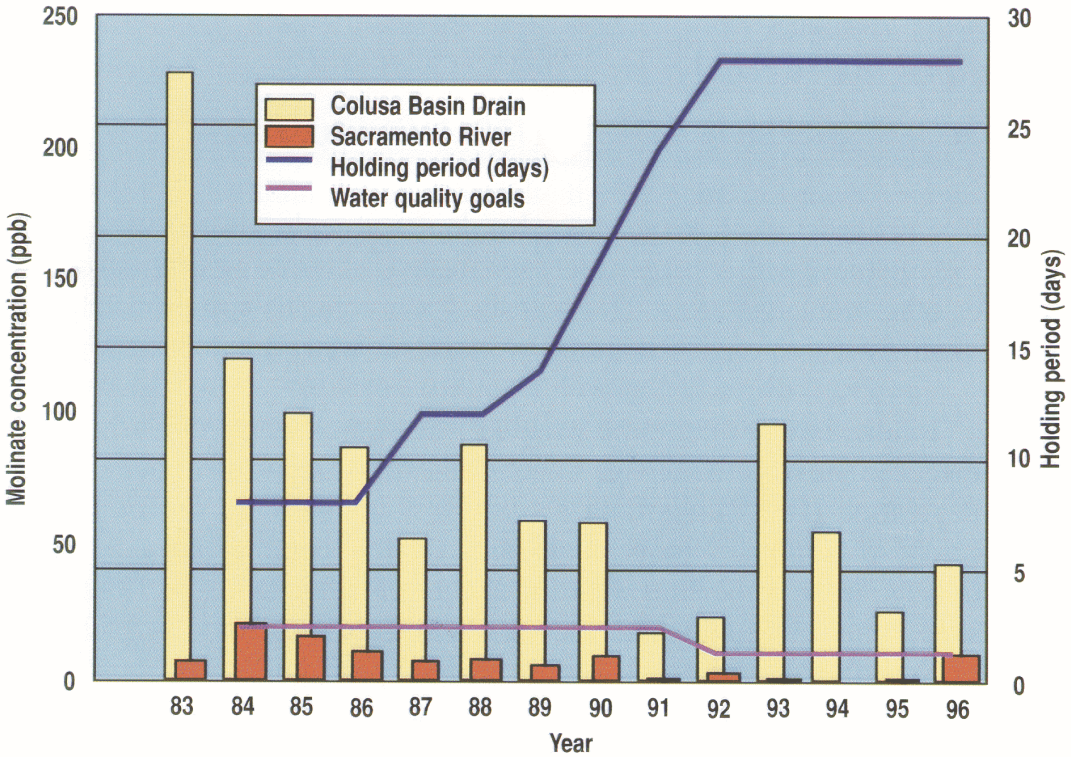

Figure 4. Maximum concentrations of molinate (Ordram) in the Colusa Basin Drain and the Sacramento River. In recent years, water quality goals in the drain and elsewhere were exceeded before the end of water-holding periods, suggesting that seepage and off-target applications (e.g., drift) remain important sources of pesticides.

goals depend on long holding periods, which allow pesticides to dissipate almost completely in rice fields before release. Figure 3 illustrates dissipation for molinate (Ordram), a rice pesticide used on nearly all California rice acreage. Note that long holding periods reduce the amount of molinate leaving the field.

Nevertheless, the concentrations of rice pesticides found in many agricultural drains exceed the levels found in tailwater released from rice fields after an adequate holding period. Therefore, seepage and off-target applications (e.g., drift) are believed to be the sources of the high concentrations currently found in agricultural drains. As holding periods for rice pesticides increased during the last decade and the contribution of fieldwater releases to pesticide loading of surface waters declined (fig. 4), the relative contribution of seepage to this loading was recognized. Currently, seepage is regarded as an important contributor to pesticide loading in Sacramento Valley waterways.

What is the scientific evidence to indicate that seepage water contains pesticides?

Rice pesticides, such as molinate, that do not strongly adsorb to soil particles can move with seepage water from treated fields into agricultural drains or other nontarget areas. This seepage water contains approximately the same concentration of certain rice pesticides as water in the field.

In an effort to determine whether rice pesticides, particularly molinate, can move with seepage water, California's Department of Pesticide Regulation (DPR) undertook a study (unpublished) to determine the extent of molinate movement from treated commercial rice fields through levee banks into adjacent ditches or fallow fields. In 1992, two sites located in commercial rice fields in Colusa County were chosen because they were known to have seepage problems in previous years. The cooperation of the growers and the aerial applicators was obtained prior to the study to ensure that aerial drift was not a problem.

Prior to the application of molinate, the suspected seepage areas were covered with heavy plastic tarps to prevent contamination from aerial drift; these areas were kept covered throughout the study. At the first site, on a Willows clay, the molinate concentration in the seepage water peaked 2 days after application at 205 parts per billion (ppb). At the second site, on a Wikoda silty clay, concentrations at 6 days after sampling were as high as 720 ppb. When seepage water containing such high concentrations flows into surface waterways, water quality goals are threatened. At the time of the study, the water quality goal for molinate was 10 ppb for all public waterways.

While this study was not able to determine the extent of seepage throughout the Sacramento Valley, it did show that molinate can move with seepage water through levees to nontarget areas.

Other unpublished studies conducted by the Central Valley Regional Water Quality Control (CVRWQC) Board found that both molinate and carbofuran (Furadan) are present in seepage water in ditches adjacent to treated fields. Water-soluble rice pesticides are likely to be present in the seepage water soon after the field has been treated.

Where is seepage most likely to be a problem?

Seepage is most likely to cause water quality problems in areas adjacent to or near agricultural drains or canals. If efforts are not made to keep seepage water on the farm and out of drains, water quality goals may be exceeded, as they have been exceeded in the past in agricultural drains.

Keeping treated rice field waters within the irrigation system and out of drains that leave the farm during the holding period is the most important goal of seepage control.

Seepage problems can also be compounded by aerial drift. If pesticides have drifted to border levees, perimeter levee roads, or fallow areas, any seepage water, even untreated water, may pick up and carry pesticides to drains and canals. Good communication with aerial applicators is important to establish the common goal of keeping drift from nontarget areas.

When is seepage most likely to create a problem?

Seepage is most likely to be a problem during early stand establishment and water-holding periods (see fig. 3). Concentrations of pesticides are highest in fields immediately after an application. Also, rice field soils are more permeable early in the season, before levees have had an opportunity to settle.

Why are rice growers being asked to control seepage water?

The CVRWQC and the DPR believe that water quality can be impacted if seepage water is allowed to reach agricultural drains. Statewide, water-holding periods have reduced rice pesticide concentrations to near non-detectable levels in the Sacramento River. However, concentrations of rice pesticides continue to exceed water quality goals in agricultural

drains. For example, the Colusa Basin Drain (see fig. 4), the primary agricultural drain for Glenn, Colusa, and Yolo Counties, continues to experience peak concentrations above established water quality goals. Rice growers in all counties should make every effort to prevent seepage problems and to avoid additional restrictions.

If voluntary efforts to control seepage by rice growers are sufficient to minimize the impacts of seepage on the agricultural drains, no future regulatory actions will be necessary.

What conditions or practices might result in a seepage problem and what can be done to minimize the impact of seepage or leaks?

Recognizing the causes of seepage as well as when and where it occurs can be the first step to good seepage management. Consider some of the following questions in deciding whether you may have a seepage problem and what steps to take to control it.

SIMPLE SEEPAGE SOLUTIONS
Common Sense Tips for Managing Seepage and Leaks

- First and foremost, block any exits of the seepage ditch that may drain into agricultural drains or canals.
- If the seepage problem is extreme and cannot be prevented, a small sump and pump may be needed to move water back into the system or onto fallow land.
- Carefully check levees and banks for crayfish and rodent damage. Repair leaks and control pests when present according to IPM guidelines.

Seepage Prevention Begins with Sound Levee Construction and Maintenance

- Whenever possible, build border levees in the fall to allow for settling and compaction during the rainy winter months.

- Always build levees at a moisture content suitable for maximum compaction of your soil type. See your local U.S. Natural Resources Conservation Service engineer for details.

- Ensure that levee construction begins with a solid foundation and core. Do not build levees on top of a straw layer or other organic matter, as this may lead to horizontal flow below the levee. Avoid excessive straw and organic matter in levee construction.

- Sandier soils may require wider border levees.

- Compact and firm up the levee core during construction using a tractor track.

- If feasible, surround the levee system with a perimeter road to help ensure that all water is contained within the system.

- Use the recommendations for levee construction in the U.S. Natural Resources Conservation Service publication *Closed Rice Water Management Systems* (USDA, 1994), available from your local Natural Resources Conservation Service office or county agricultural commissioner.

- Inspect and repair permanent levees for wind, wave, crayfish, and rodent damage both prior to flooding and during the growing season.

- Control crayfish and rodents according to University of California Statewide Integrated Pest Management (IPM) guidelines (see *Integrated Pest Management for Rice*, 2d ed., UC DANR Publication 3280, 1993; see also the UC IPM website at http://www.ipm.ucdavis.edu). Some county agricultural commissioners' offices supply rat bait for a small fee.

Recognizing Seepage
A Checklist

- ✓ Have you noticed wet, soft, weedy areas outside your rice fields?
- ✓ Can water from these damp areas easily flow into agricultural drains and canals?
- ✓ Do you construct drain ditches to protect perimeter roads?
- ✓ Do you typically rotate rice with other crops that require that you construct new levees when rice is grown?
- ✓ Do you construct levees in the late spring so that levees do not have a chance to settle during the rainy winter months?
- ✓ Have you experienced problems with crayfish burrowing around rice boxes or through levees?
- ✓ Have you noticed rodent damage to rice, which may indicate rats living in and burrowing in levees or canal banks?
- ✓ Do you have difficulty maintaining uniform water depth in certain fields or checks despite adherence to otherwise good water management practices?
- ✓ Do some fields or checks use significantly more water than others?

A 'Yes' to any of the above questions can mean your farm is at risk for seepage problems. Voluntary efforts to control seepage can begin by observing good levee construction practices.