

BULLETIN: MAY 3, 2023

CALIFORNIA FLOODING EVENTS SOIL SAMPLING AND TESTING

Disclaimer

This document is intended to cover key considerations related to flood assessments and any associated soil sampling and testing only for California. The authors, contributors, and reviewers make no claims or warranties about any specific actions. The providers of this document do not certify compliance with local, state, and federal laws, rules, and regulations. This document is designed to facilitate inquiries and information regarding flood assessment and response.

Background

Due to the significant flooding events in California during early 2023, growers have questioned when fields can be safely replanted (see FDA's definition of flood, hazards, and guidance on harvestability). The current LGMA guidance provides sampling recommendations for operations if they choose to plant or replant flooded ground within 30 days of water receding and before the 60-day wait period. This document provides current information and thinking on this subject as provided by Subject Matter Experts Dr. Channah Rock and Dr. Trevor Suslow and is based on available on-farm testing and post-flood survey data.

This information applies to fields directly impacted by flood waters and within a minimum of 100 feet from the visible water mark. This 100 ft setback distance recommendation considers the potential for subsurface horizontal transport that may not be visible and subsurface seepage that may not result in noticeable vertical transport and surface pooling.

This document provides guidance regarding soil sampling, analysis target(s), and microbiological acceptance criteria.

Flood Assessment Considerations

While the critical period for conducting initial flood assessments for the 2023 flooding events is well past, this guidance can be helpful. Learnings drawn from past soil testing studies on flooded soil and during the past four months on the California Central Coast. Soil sampling data can help to inform decision making and ultimately reduce potential risk of leafy green crop contamination.

For flood events, it is recommended to conduct an environmental assessment considering the following actions:

- Document the date of the flood event
- Create a map of the impacted areas of the ranch
- Document the date and time that water started receding from the farm or ranch
- Determine the flood water source, and describe what hazards may have impacted the flood water (i.e., water through an animal operation of any scale, from grazing areas, wildlife refuges, overflowing rivers, natural water way, drainage ditches, untreated wastewater exposure, compost facility, industrial complex, etc.)
- Assess the impact or severity of the flood event (i.e., impact on crop or equipment, such as a crop or wellhead immersed in flood water)

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Soil Sampling and Testing Parameters

The decision to plant or replant ground that has been flooded within 30 days is a risk-based decision. The parameters below are considered reasonable acceptance criteria when testing previously flooded soil.

Soil Sampling Parameters

- **Sample Area:** Samples should be collected from the previously flooded area moving from most flooded to least flooded (include at least two samples from a non-flood area within a contiguous ranch if available). See the sampling diagram *Figure 1* below.
- **Minimum Number of Samples per Defined Lot Location:** A minimum of 10 individual soil samples should be collected from an individual lot.
- **Lot Size:** Lot size is determined by the grower based on field flooding, ability to work the ground, and future planting.
- **Sample Depth:** Soil samples should be collected at a composite depth between 1 - 6 inches from the soil surface. It is important to maintain a consistent sampling depth across the defined lot.
- **Sample Weight:** Sufficient soil weight should be collected (approximately 100 grams per sample). Request the lab to analyze a minimum of 25 grams per target organism. Based on recent tests on flood-impacted soil, the surface-only nature of boot swab samples was shown to be less sensitive and, therefore, they are not acceptable for this purpose.
- **Sampling Plan:** Random sampling should be conducted with more samples taken closer to the location where flood waters entered and exited the field and fewer samples from the buffer and non-flooded area.
- **Sampling Diagram:** The following diagram outlines soil samples collected across a defined lot in a randomized pattern across vertical transects, with more samples collected closest to the flooded area (green) and fewer samples collected away from the flooded area (white).

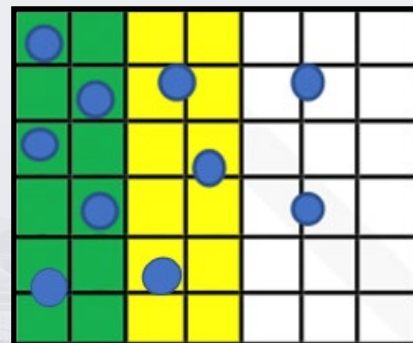
Figure 1.

Green: Flooded area

Yellow: Buffer (100 ft from water mark)

White: Non-flood area (>100 ft from water mark)

● = Approximate 100-gram Sample



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Testing Recommendation

- **Frequency:** Minimum one sampling event.
- **Timing:** The initial sample event may be conducted after flood waters have receded or when groundwork and soil equipment activities have commenced. Based on experience from testing, it is recommended to wait at least seven days to allow for die-off. It is important to note that because of the saturation of flooded ground, the use of tractors and other implements may take shorter or longer than seven days post-water receding.
- Subsequent sampling event(s) should be conducted weekly until results indicate the acceptance criteria below have been achieved. Until these metrics are met, all equipment passing through the flood-impacted areas must be cleaned and sanitized before entering non-flooded areas.

Test Organisms

- Generic *E. coli*
- Salmonella
- STEC

Acceptance Criteria for Sample Set (sampling event)

- Generic *E. coli*: All 10 samples \leq 10 MPN or CFU/gram soil
- Salmonella: Negative/non-detect
- STEC: Negative/non-detect

Results

- **If you meet the Acceptance Criteria**
 - Planting can commence.
- **If you don't meet the Acceptance Criteria**
 - The recommendation is to conduct additional groundwork with the use of tractors and implements to turn the soil to encourage drying out and aeration.
 - Repeat recommended sampling and testing weekly until the criteria have been met or you have reached 60 days from when the water has receded from the farm or ranch.

Additional Actions Specific to Flooded Ground During Pre-Harvest Assessments:

Regardless of meeting the acceptance criteria before or after a 60-day plant interval, perform pre-harvest product testing per Western Growers Appendix C's Sampling and Testing Protocol and follow-up soil testing.

References

Petersen, F., & Hubbart, J. A. (2020). Physical factors impacting the survival and occurrence of *Escherichia coli* in secondary habitats. *Water*, 12(6), 1796.

Dr. Michelle Danyluk and Dr. Laura Strawn reviewed this document.