Coping with Drought

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By now everyone in California agriculture is well aware of the severe drought conditions throughout much of our state. It is a drought of superlatives – historic, unprecedented, extreme, exceptional – and there is no doubt that California's agricultural commodities, including avocados, are going to suffer this year. The U.S. Drought Monitor, a national program begun in 2000, now reports that more than 60 percent of California is under extreme or exceptional drought. This is the first time since the monitoring program started that exceptional drought has been recorded in California. It is important that California avocado growers begin to take steps, if they haven't already, to cope with the severe drought.

Impacts of Drought

Avocados are not adapted to hot, dry climates. They are native to the mountain cloud forests of Mexico and Central America where temperatures are cool (55 to 70°F) and rainfall is high (25 to 60 inches). As a result, they have shallow root systems (80 percent of roots are in the top 18 inches of soil) where they scavenge the nutrients from rapidly decomposing organic matter. Under drought conditions, avocado leaf stomates close to reduce water loss from transpiration, resulting in reduced photosynthesis. Over time, continued drought will result in the trees exhausting their carbohydrate reserves, reducing yield and growth.

Perhaps more important in California is the interaction of drought and salinity. Without rainfall to help leach salts from our soils, salinity builds up and becomes toxic to avocado trees, which are very salt sensitive. Figure 1 shows how normal microsprinkler irrigation pushes salts out of the root zone, but salts accumulate between trees and below the root zone. We rely on rainfall to periodically flush the salts from the areas not normally wetted by the microsprinklers. Without rainfall, the red zones (high salts) become larger, and in time it is not possible to keep the salts from entering the root zone. High salts inhibit plant water uptake and exacerbate drought conditions.

A map of California from the U.S. Drought Monitor showing the severe drought conditions covering much of the state as of February 13, 2014. More than 60 percent of the state is under extreme or exceptional drought conditions.

Coping with Drought

Since avocados are drought sensitive, the only real solution to drought is more water. Thus, strategies for coping with drought focus on maximizing the use of what little water is available by improving efficiencies and prioritizing where water is applied.

1. Irrigation System Maintenance

Probably the single best thing most growers can do to save water is to inspect, maintain and repair their irrigation system. Poly hoses should be inspected for leaks and repaired if necessary; and clogged, broken or missing sprinklers should be repaired or replaced.

If you have not previously had the distribution uniformity (DU) of your system checked, or if it has been a number of years, now would be a great time to do it. Many of the water management districts perform this service for growers or they can refer you to a company that can perform the test. Avocado growers should aim to achieve at least 85 percent DU. Even for a small grove, improving the irrigation system DU by a few points can result in big water savings.

DU directly affects how much water you need to apply. For every percentage point your DU is below 100, you need to apply that much more water to ensure that each tree receives the water it needs. For example, if you are trying

to apply 100 gallons per tree and your DU is 75 percent, you will need to apply 125 gallons per tree to make sure that all trees receive 100 gallons. However, some trees will then receive 125 gallons, which could lead to over watering and exacerbate root rot or other root health issues. An easy way to improve your system's DU is to install pressure regulators on all lateral lines and consider installing pressure-regulating sprinklers. If your grove is on a slope, these are must-have items to prevent the trees at the bottom of the hill from drowning while those at the top don't receive enough water.

2. Soil Moisture Monitoring

A recent survey conducted by University of California (UC) Riverside researchers, and funded by the Giannini Foundation of Agricultural Economics, found that 60 percent of California avocado growers never monitor soil moisture. And of those who do monitor soil moisture, most do it by feel. Utilizing a set of soil moisture sensors, such as tensiometers, to monitor soil moisture and determine when to water can greatly improve water use efficiency and prevent your trees from becoming too stressed. Dr. Gary Bender, UC farm advisor, has a great YouTube video explaining how a tensiometer works and how to install one in an avocado grove (www.youtube.com/watch?v=UHVlvAO5NDQ).

Although tensiometers or other soil moisture sensors can help you determine when to water, they do not tell you how much water to apply. To determine how much water your avocado trees need, you should use an irrigation calculator such as the one available on AvocadoSource.com (www.avocadosource.com/tools/IrrigationCalculator.asp).

3. Root Rot and Sunblotch Infected Trees

Most California avocado growers probably have some trees that are affected by root rot, *Phytophthora cinnamomi*. These trees can be chemically treated and, under good conditions, they can be maintained and be productive. However, chemical treatments are not curative, and these trees will be more sensitive to other stresses like drought. Root rot-affected trees should be carefully evaluated to determine if they are producing an economically sustainable yield. If not, they should be removed and the sprinklers capped.

Avocado sunblotch viroid (ASBVd) infected trees are less common than root rot infected trees, but they are out there. Typical symptoms are discolored and depressed stem streaks, grooves on older branches, and yellow grooving on the fruit. There may also be symptomless trees whose only symptom is a lack of production. ASBVd-infected trees should be removed and the sprinklers capped.

4. Tree Maintenance

Some groves have trees that have canopied over and are too tall to be managed efficiently, and these trees can cost more to harvest. This year would be a good time to stump these trees since it's probably a task you've been putting off anyway. Tall trees can be stumped back to 4-5 feet, painted to prevent sunburn, and the sprinklers capped for about two months. Once regrowth starts, the water can be turned back on and gradually increased as the canopy redevelops.

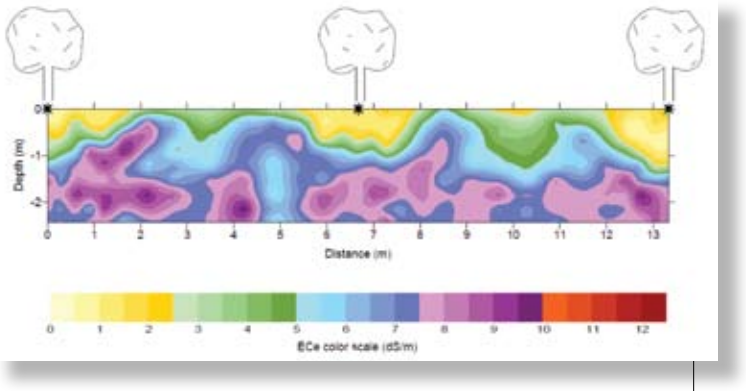

Figure 1: A diagram showing how salinity accumulates outside the wetted zone in an orchard irrigated with microsprinklers. The yellow regions represent low salinity immediately below and around the microsprinkler; the blue to red areas indicate high salinity accumulation between trees and below the root zone. (Diagram from: Soil Salinity Accumulation in Orchards with Drip and Micro-spray Irrigation in Arid Regions of California, Irrigation and Training Research Center Report No. R 03-005, http://www.itrc.org/reports/pdf/treecropsalinity.pdf.)

If you have trees in a wind-exposed area that suffer wind damage every year, this may be the time to stop investing resources in those trees and take them out of production.

Pruning trees, although often necessary, is not a good strategy to reduce water use. Pruning opens windows into the tree canopy, exposing previously shaded leaves to sun and increasing air flow. Both of these effects can result in greater water loss from the remaining leaves, counteracting the water savings from the removed leaves. Thus, pruning may result in a slight water savings at best.

Mulching trees is a good way to help reduce water use by reducing evaporation from the soil, decreasing runoff, and improving soil permeability and water holding capacity. Since mulching can be a costly investment, you should focus on your most productive areas and young trees that may not yet have a large root system. Apply three to six inches of mulch beneath each tree extending out to or just beyond the edge of the canopy. Be sure to keep the mulch a few inches away from the tree trunk so as not to encourage trunk canker or collar rot, caused by *Phytophthora mengei*. When possible, use material from within the grove (prunings or chipped limbs from stumped trees) as mulch. If you have to bring mulch in from outside the grove, try to source it locally to prevent the spread of pests and disease, such as the polyphagous shot hole borer and fusarium dieback disease.

No one can predict how long this historic drought will last. However, by taking some steps to improve water application and use efficiency, and focusing available water on the most productive areas of a grove, we can ensure that California's avocado growers remain productive.