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THE SCOOP

on fruits and nuts in Stanislaus County

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Drought Irrigation Strategies for Peaches & Almonds

Growers who rely on district water to irrigate their tree crops will have far less than their trees require for maximum yield this year. Currently, growers in the Modesto and Turlock Irrigation Districts will be limited to a maximum of 18 and 20 inches, respectively. Growers on the West Side have even less. Less water generally equals lower yield. Exactly how much your current and future yield will be reduced depends on how the water is allocated through the season.

Because flooding generally requires at least 3 – 3.5 inches per irrigation, MID & TID growers will get a maximum of five or six flood irrigations this season. Flood irrigators may try to use their water more efficiently by making furrows to irrigate only near the trees instead of flooding the entire basin. They may also try pulling berms and irrigate only every other drive row, alternating each time.

Deficit Irrigation Strategy In peach. There are three phases of peach fruit growth. Phase 1 begins after the flower is fertilized and is characterized by rapid initial fruit growth primarily due to cell division. While this stage of fruit development is sensitive to drought stress, it occurs early in the season when soil moisture is usually plentiful and transpiration demand is low. Because trees don't begin using water until leaves are present, significant water stress is not likely to occur for many weeks after bloom. Therefore it is not likely that peach trees will experience significant water stress during most of Phase 1. Peach growers with limited irrigation water should refrain from "wasting" water too early in the season.

Phase 2 is generally characterized by seed development and there is very little fruit growth. This is the least sensitive stage to water stress for peaches. Growers can recognize the beginning of Stage 2 by the earliest onset of pit hardening. Mild water stress applied during this intermediate developmental period of slow fruit growth has little effect on crop yields but can significantly reduce vegetative growth.

Phase 3 is a period of very rapid size and weight increase due primarily to cell expansion and ends with ripening. During this final growth phase, about 80% of a fruit's fresh weight is accumulated. Water is primarily what drives cell expansion and therefore this final period of rapid fruit growth is very sensitive to water stress. Withholding water during Stage 3 will result in significant yield reduction.

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The overall plan for peach growers should be to avoid irrigating too soon and save water during Phases 1 & 2 and use it during Phase 3. Significant water savings can also occur postharvest but growers should be aware that severe water stress during August and September can increase the number of double fruit the following year. Stone fruit growers with limited irrigation water might also want to thin a little more this year. Peach trees with heavy crops are more sensitive to drought stress.

Drought Irrigation Strategy for Almonds. The first thing that growers who rely on district water have to accept is that their trees will experience stress. If an orchard receives less than 20 inches, the trees will experience a lot of stress. All we can do is manage when and how much stress the trees will experience. Fortunately, University of California researchers, including David Goldhamer and Ken Shackel, have conducted some important drought irrigation experiments on almond. In Dr. Goldhamer's experiment, he imposed three levels of deficit irrigation, 34 inches, 28 inches and 23 inches of seasonal irrigation water (note that his "severe" deficit is more than the current MID and TID allotments). He also experimented with three strategies of when to use the water: 1) Using most of the water early in the season and stressing the trees late in the season; 2) stressing the trees early and saving the water for later, including post-harvest; and 3) spacing the irrigations out through the year to maintain an even level of stress throughout the season. The experiment was conducted for four consecutive years.

The results showed that the lower the amount of water applied, the lower the yield. However, the timing of the deficit made a big difference on how much yield was reduced. Trees that experienced an even deficit throughout the season always had higher yields than the other irrigation strategies. This means that almond growers with limited irrigation water should try to spread the pain and not use the water too early or save it until the end. There is a myth that almond flower buds develop during September & October. Research conducted by the University of California using an electron microscope showed that almond flower buds actually begin flower initiation around the first of July or even a few weeks earlier in a warm year. The process of flower bud differentiation continues through early October. Therefore severe stress during any of this time can significantly affect next year's crop.

Almonds by nature are pretty drought tolerant. They are farmed in many countries without irrigation. However, yield is very low under dry farmed conditions. In a 2009 experiment led by Dr. Ken Shackel at UC Davis, almond trees in a previously irrigated orchard survived the season without any applied irrigation. He also saw that unirrigated trees were better able to utilize deep soil moisture than irrigated trees. Yield was reduced significantly compared to irrigated trees. Yield was impacted even more severely the year after severe deficit, even though trees were returned to full irrigation. The good news is that all irrigation treatments regained full yields by the second year of full irrigation.

In summary:

Eliminate all vegetation on the orchard floor. Cover crops can use several inches of water.

Don't irrigate too soon. We start the season with at least 5 or 6 inches of water in the root zone. Trees do not begin to use water until leaves appear. Because evapotranspiration (Et) is relatively low early in the season, it is almost impossible to significantly stress trees during the first couple of months after bloom.

If you have considered buying a pressure chamber to schedule irrigations in the past, this is the year to do it. With only 18-20 inches of water, almond growers should wait until trees reach about -12 to -14 bars for their first irrigation. This is only very moderate stress. This may not occur until late April or early May. Leaves produced under moderate water stress have thicker cuticles, fewer stomata and will use less water.

Spread the deficit through the season. If you normally apply about 40 inches of water in a season but this year you only get 20 inches, apply 50% of your normal irrigation amount at each irrigation. For instance, if you normally run your irrigation system for 16 hours once per week in May, run it for eight hours once per week. If you normally irrigate for 20 hours twice each week in July, run the system for 10 hours twice per week.

Don't do anything radical like eliminate the crop. This will only result in excessive shoot growth and lead to a larger demand for water. Spraying trees with kaolin clay (i.e. Surround) did not mitigate drought conditions in recent UC tests.

For information on how to use a pressure bomb to manage irigation, go to the Stanislaus County UCCE webpage at cestanislaus.ucdavis.edu. Go to the almond publications section and you will find "Using Midday Stem Water Potential to Refine Irrigation Scheduling in Almond" written by Bruce Lampinen, et. al. There are three companies that

sell pressure chambers (a.k.a. bombs) on the West Coast. PMS has one that is pressurized like a bicycle pump. Specialty Engineering uses a small CO2 canister to pressurize their cylinders.

- Specialty Engineering; Waterford, CA. 209-874-1085
- PMS Instrument Company; Corvallis OR. 541-704-2299
- Soilmoisture Equipment Company; Goleta, CA. 805-964-3525

For more information on irrigating in a drought year, go to ucmanagedrought.ucdavis.edu.

Salt Tolerant Rootstocks

With lower than average winter rainfall and an expected increase in ground water usage, we might expect to see an increase in salt accumulation and leaf burn in tree crops this year. Whether increased salt levels will become "normal" in the future is yet to be seen. Growers planning new orchards may want to choose alternative rootstocks to protect themselves against potential yield losses due to salt toxicity. I have been evaluating rootstocks for almonds and peaches in Stanislaus County under various disease and soil challenges for almost 20 years. We are to the point now where we have better rootstocks than Nemaguard, Lovell and Marianna 26-24 and growers should consider other options.

Over the past couple of years, almond trees in a Keyes-area rootstock trial have been exhibiting increasing signs of salt burn. Severe leaf burn symptoms correlated well with high sodium leaf levels. The table below shows the levels of sodium and chloride in leaves sampled in early September. In general, the peach rootstocks Nemaguard, Lovell and Guardian had extensive salt burn symptoms and very high sodium and chloride levels in the leaves. Atlas, a complex hybrid rootstock, appeared to be as salt sensitive as the peach rootstocks. The most salt tolerant rootstocks included the peach x almond hybrids like Cornerstone, Hansen and Paramount (also known as GF 677). Empyrean 1, a peach hybrid from Italy, appears to be as salt tolerant as Hansen and is reported to be more tolerant of wet soils than peach x almond hybrids. Viking and Cadaman appear to be moderately tolerant of sodium and chloride (better than peach but not as tolerant as a peach x almond hybrid). If I was planning to plant an orchard on the West Side, I would strongly consider a peach x almond hybrid rootstock, Viking or Empyrean 1 instead of Nemaguard or Lovell.

Late Season Sodium and Chloride Leaf Levels of Almond Trees on Various Rootstocks. Keyes, CA. September 2013.

	% Sodium	% Chloride
Most Salt Tolerant Rootstocks		
Cornerstone	0.04	0.05
GF 677 (Paramount)	0.04	0.05
Adesoto	0.06	0.04
Hansen	0.09	0.07
Empyrean 1 (a.k.a. Barrier 1)	0.09	0.07
Moderate Salt Tolerance		
Nickels	0.28	0.15
Viking	0.29	0.21
Penta	0.30	0.41
Julior	0.35	0.16
Cadaman (Avimag)	0.38	0.25
Salt Sensitive Rootstocks		
Nemaguard	0.99	0.51
Atlas	0.94	0.29
Guardian	0.76	0.41
Lovell	0.70	0.50
July Critical Levels	< 0.25	<0.30