IRRIGATION MANAGEMENT FOR ALMOND TREES UNDER DROUGHT CONDITIONS

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For maximum growth, yield, crop quality and orchard longevity, almonds trees should receive a full water requirement. If water is limited, growers can adjust by applying water when trees are most sensitive to stress and by taking measures to minimize water losses that occur during irrigation. Water stress affects almond orchards not only in the year in which stress occurs, but also in the following seasons. Water stress reduces vegetative growth, causing a subsequent reduction in nut load and yield. Nut size is reduced in the year stress occurs.

Recent research indicates certain stages of almond fruit growth are more sensitive to water stress than others. Understanding these stages permits growers to withhold water while minimizing damage to trees, the current and subsequent crop

TIMING OF WATER STRESS

Early Season. Water stress is most harmful during the early season – from budbreak through fruit set. During this period, rapid vegetative development is necessary for canopy development and fruit positions for next season. In addition, orchard water use during this time is low, reducing potential water savings from deficit irrigation.

Fruit Growth and Development. Nuts undergo a rapid growth phase early in the fruit growth and development; however the trees can tolerate drought stress fairly well during the two months prior to harvest. This allows for the successful use of deficit irrigation strategies. By providing less than the full water requirement during this period, minimal impact on kernel weight has been noticed. However, severe water stress shortly before hull split significantly reduces hull split. Irrigation prior to hull split will reverse this trend and will improve hull split and reduce the number of hull-tights.

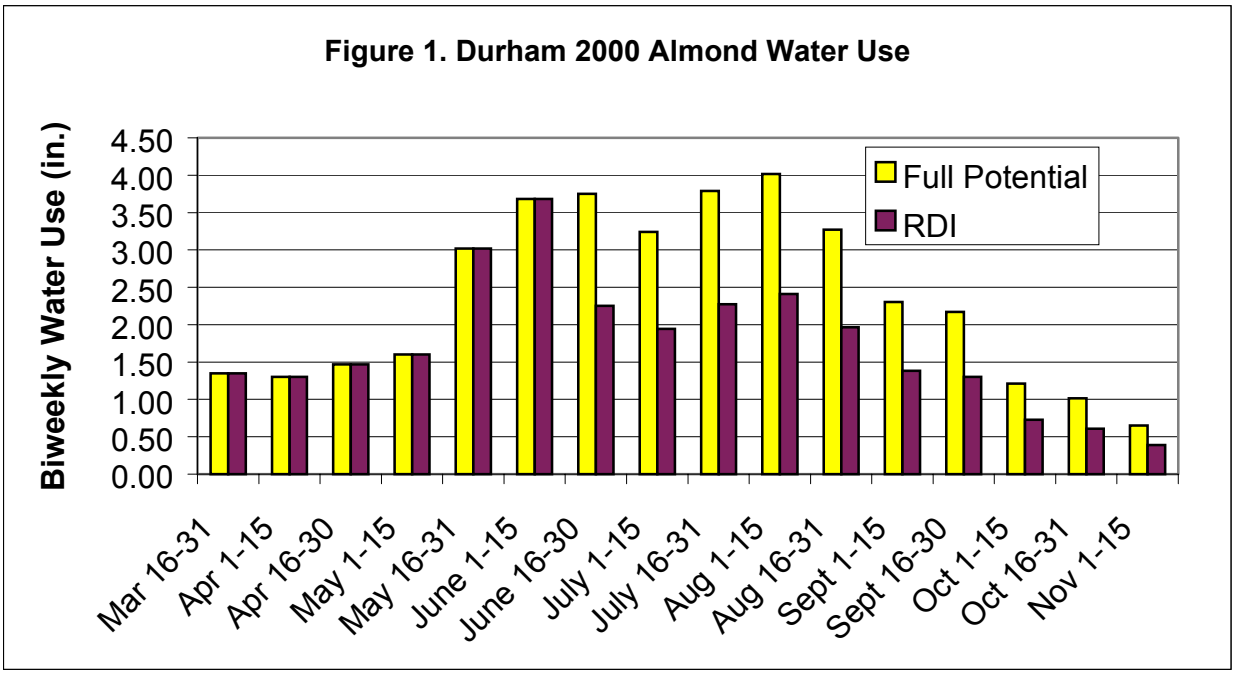
Postharvest. The effect of water deficits during the postharvest period is substantially affected by preharvest conditions and the quantity of water use for the remainder of the season. With almond trees, bud differentiation continues through mid-September. Severe water stress during bud differentiation has been found to dramatically reduce fruit set the following spring. In early harvest (early August) districts, more of the high water use season remains after harvest. This increases the necessity for postharvest irrigation. Late harvest (north State) districts are often fortunate to harvest just before the onset of fall rains, leaving a short water use period after harvest.

Tree response to postharvest stress is influenced by the type of irrigation system used. Low volume systems with limited soil water reserves can result in severe water deficits very quickly after cut off. In the southern San Joaquin Valley where harvest is earlier than in the north or with drought-sensitive varieties, postharvest irrigation is a necessity. Deep-rooted,

conventionally-irrigated trees may have enough preharvest moisture to carry them through the critical period of bud differentiation, especially in the north when harvest often occurs after bud differentiation and fall rains are more likely to occur.

DEVELOPING A DEFICT IRRIGATION STRATEGY

Crop Water Use. Almond orchard water use begins when the leaves develop and increases rapidly as full canopy is achieved. Concurrent with canopy development, the climate is mild at leaf out and increased as the season progresses increasing the climatic water demand, driven by longer days and higher temperatures and low humidity conditions. Almond trees in the Northern Sacramento Valley require about 37 inches of water in an average year of full, unrestricted water use. Figure 1 shows a typical water use pattern for fully irrigated almond in the Chico area. Figure 1 shows a typical water use pattern for fully irrigated and a deficit irrigation regime for almond in the Chico area. The deficit irrigated orchard used 27 inches of water or about 30 percent less than the full potential orchard.



Water Deficits. Water deficits occur when the climatic water demand exceeds the water absorbed from the root zone. Water deficits are measured from the leaf using a pressure chamber to determine the trees water status.

Deficit Irrigation. Deficit irrigation occurs when water is withheld causing tree water deficits. Deficit irrigation can be conducted to have different timings and severities of water deficit. Sources of water include soil-stored moisture, in-season rain and frost protection water applications in addition to irrigation. They all total the seasonal water use of the orchard. From the previous discussion, it can be concluded that the water use from bud break through mid June should not be compromised. From mid June through harvest, 50 to 70 % of full water use will

result in only minimal reductions in kernel weight. It is important to supply the trees with water near hull split to avoid hull-tights.

Scheduling Deficit Irrigation. The most effective method for scheduling irrigations is using the pressure chamber to assess the tree water status by measuring mid-day stem water potential. Irrigations should be scheduled when stem water potential reaches a predetermined threshold--after irrigation measurements are again made, until the threshold is again reached, followed by another irrigation. Irrigations should be in the volume of a normal set as performed with a full irrigation regime.

A deficit irrigation study was conducted on mature almond in Manteca, California using this strategy. A threshold value of –16 bars mid-day stem water potential resulted in 33% less water consumed by the trees while having no significant influence on yield for the 4 year measurement period. It should be noted that reductions in vegetative growth was noticed in this treatment indicating that using this threshold for a longer term strategy may reduce yields by reducing nut numbers.

Irrigation System Management. All non-beneficial water losses should be minimized. Maximum effort should be directed toward increasing the percentage of applied water stored in the rootzone for use and toward applying irrigation water as evenly as possible throughout the orchard.

- Do not exceed the soil moisture deficit (holding capacity) of the rootzone or water will be lost to deep percolation from early season irrigations.
- Eliminate runoff from one area to another.
- Use off-peak power
- Evaluate and upgrade irrigation systems to improve application uniformity and distribution uniformity
- Eliminate or minimize cover crops or weeds, which can compete for water use

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