Final Report (2004 and 2001 - 2004 summary): Deficit Irrigation Management During Hull-Split

Project leader: Ken Shackel, Dept. of Pomology, UC Davis

Sub-Project Leaders: Rick Buchner, Joe Connell, John Edstrom, Allan Fulton, Brent Holtz, Bruce Lampinen, Wilbur Reil, Mario Viveros

Objective: The objective of this project is to test the practicality and benefits of a plant-based deficit irrigation strategy during hull split. The expected short term benefits are: 1) water savings, 2) reduced incidence of hull rot, 3) improved harvestability, and 4) an overall reduction in the level of tree water stress during and after harvest. The potential long term benefits include increased return bloom and improved overall tree health, but such benefits may not become apparent during the course of the project.

Background: Irrigation management is a key element in almond production, and previous almond board funded research by B. Teviotdale and D. Goldhamer has shown that hull rot and sticktights can both be reduced by deficit irrigation during hull split, but the best way to manage this deficit has not been determined. Deficit water management during this period is particularly difficult, because by the end of hull split, irrigation must be suspended for harvest, and hence the grower runs the risk of causing excessive late season tree water stress, which has also been shown to be detrimental to return bloom and ultimately to almond production. A plant-based approach to managing deficit irrigation (midday stem water potential, "SWP") has been very successful in prunes, and we have previously shown that the same technique can be applied in almonds.

Procedures: 2004 was the fourth year of the project, which was performed on grower demonstration plots in the main almond growing regions of the state (Table1). In each plot the growers normal irrigation practice was compared to a Regulated Deficit Irrigation (RDI) practice, which was based on achieving a "target" level of midday stem water potential (SWP). Midday SWP was measured with a pressure chamber on at least 10 trees per treatment in each plot. The target level of SWP prior to hull split was from -7 to -9 bars, which is the value that is expected for fully irrigated almonds under typical midday weather conditions. During hull split, the target SWP was from-14 to -18 bars (mild to moderate stress), and following hull split the target was returned to the baseline value (from -7 to -9 bars). The progression of hull split was monitored, as well as yield, nut size, harvestability and the occurrence of hull rot strikes. Observations were also made regarding any differences between the treatments in barking injury or other important production characteristics.

Table1. Sites and site information for the 2004 almond RDI trials.

County	Location	Soil type	Orchard age (yr)	Irrigation system type	Approximate dates of hull split
Tehama	Corning (A)	Silt-Loam	10	Microsprinkler	July 9 - August 6
Tehama	Corning (B)	Gravel-Loam	10	Microsprinkler	July 9 - August 6
Butte	Chico	Vina-Loam	10	Solid-set Sprinkler	July 7 - August 3
Colusa	Arbuckle	Gravel-Loam (Class 2)	14	Single line drip	July 6 - August 9
Solano	Dixon	Yolo Silty Clay Loam	9	Sprinkler	July 17 - August 12
Madera	Madera	Dinuba FSL	11	Microsprinkler	July 7 - August 2
Kern	Shafter	Sandy Loam	16	Microsprinkler	June 23 - July 28

Results and discussion **(2004)**: Table 2 summarizes the results from each site for the 2004 year, and as was noted in the 2002 almond board report, **a number of the growers participating in this study have started using our RDI recommendations to guide irrigation for the rest of their orchards.** This is a very positive outcome, but in some cases it has made it difficult for us to maintain the control plots in the desired "wet" range (-7 to -9 bars), and as has occurred in pervious years, this year few growers kept their orchards this wet prior to the onset of hull split (Table 2, first column). The range of values that we have observed in the growers plots however, also supports our position that **the current RDI recommendation of -14 to -18 bars during hull split does not represent a severe or damaging stress to the almond tree.** It is also important to note that the use of RDI did not result in severe water stress after hull split or harvest because SWP recovered well (Table 2, sixth column). This means that **growers can use irrigation management to effectively adjust the degree of water stress in the orchard.**.

In 4 of the 7 sites there was scoreable hull rot this year, and hull rot was always reduced (or, when at a very low level unaffected) by RDI (Table 2). As reported earlier, RDI generally advanced hull split, and at the Kern site a better harvistability was noted (Table 2). As in previous years, there was little to no barking injury observed during harvest in any treatment.

Four year summary **(2001 - 2004)**: Tables 3 - 5 summarize the pervious years results in the same format as that used for Table 2.