

**Tentative recommendation:
spread water out evenly over the season**

Example 5" and 10" strategy for Sacramento Valley Almonds (normal year)

Month	Normal ETc	5" (11%)	10" (22%)
March	3.41		
April	4.12	0.51	1.02
May	6.10	0.75	1.51
June	7.45	0.92	1.84
July	7.74	0.99	1.99
August	6.77	0.87	1.75
September	4.67	0.59	1.19
October	2.87	0.37	0.74
November	1.36		
Total	44.5	5.0	10.0

Nickels Drought Experiment, 2009

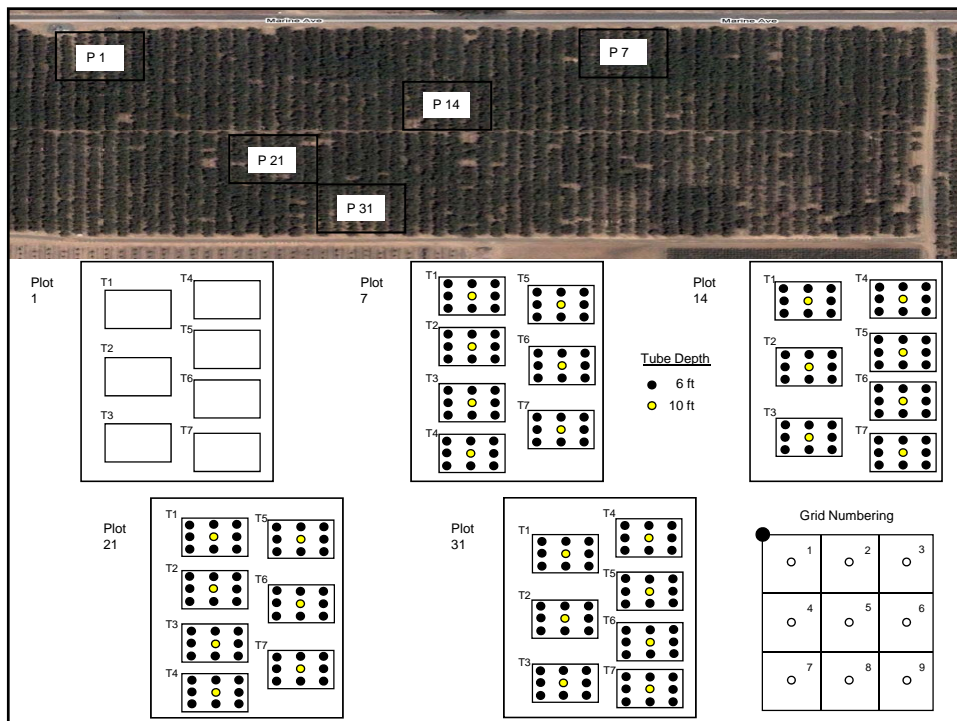
Objective: Determine "survival" water requirement of mature almond trees (current best guess is 12")

4 levels of seasonal irrigation:

- 1) Control (typically 40")
- 2) 10"
- 3) 5"
- 4) 0"

2 or 3 levels of Canopy Management:

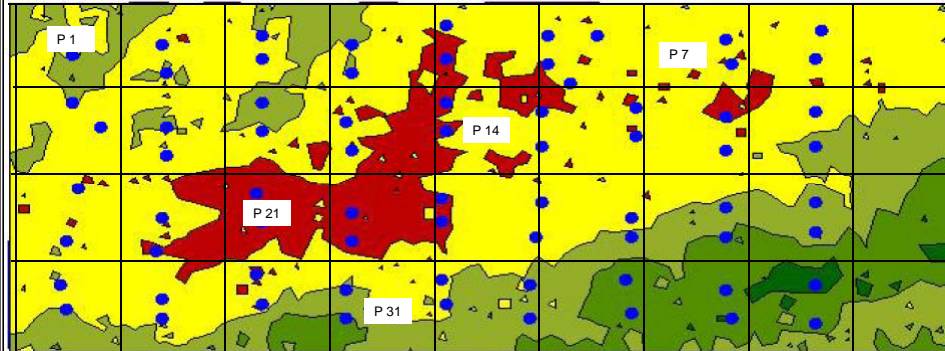
- 1) 50% reduction (0" only)
- 2) Surround Spray (0", 5", 10")
- 3) Do nothing (0", 5", 10")



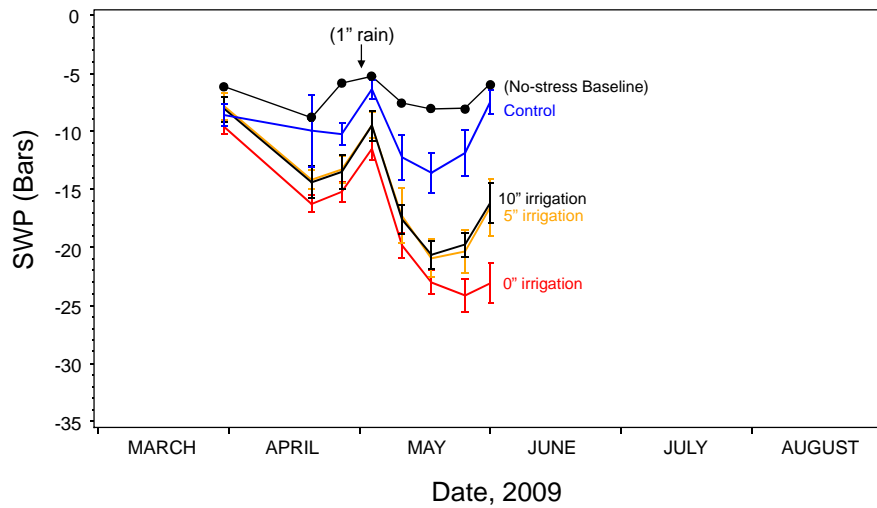
Nickels Soils Lab (Arbuckle, CA)

Majority of soil: 55% Sand, 20% Silt, 18% Gravel, 7% Clay

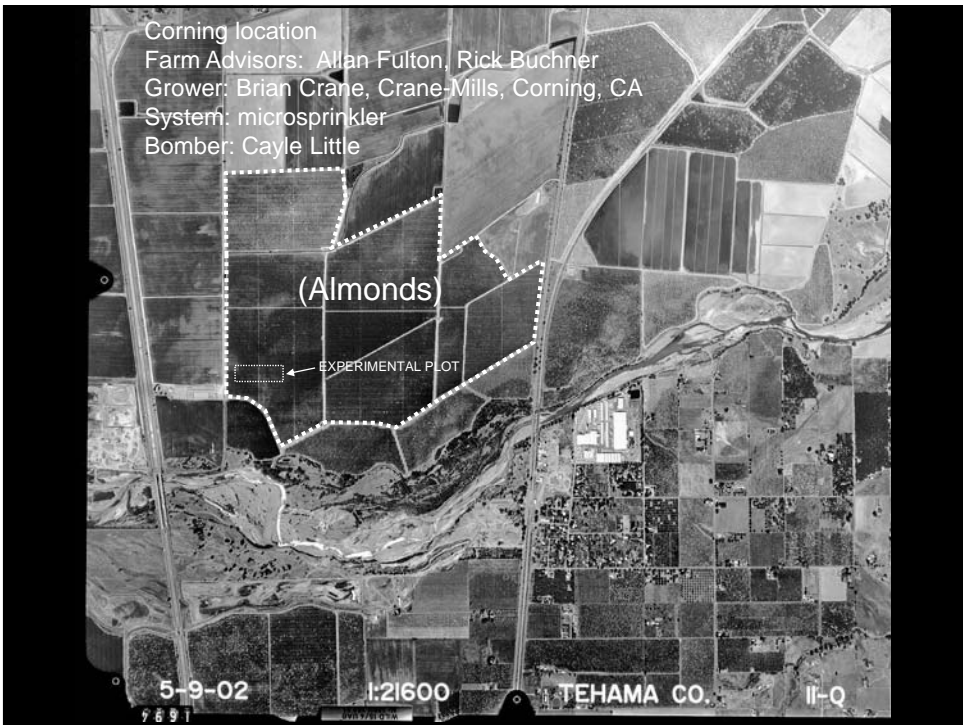
About 3' to a clay layer – under normal circumstances forms a “bathtub” with no water penetration and no root activity beyond this layer



Current trends in tree stress (SWP) at the Nickels Drought Experiment



Trees in the same orchard will respond differently depending on local soil conditions, especially under drought





% Hull Split, Carmel variety
 (East/West difference similar in all varieties)

	Date, 2000					
	10 Aug	16 Aug	22 Aug	31 Aug	6 Sep	14 Sep
East (Average SWP = -8.4 bars)	0%	0%	5%	13%	32%	40%
West (Average SWP = -14.1 bars)	4%	23%	60%	83%	85%	91%

Problems with uneven hull split timing:

- Uncertain timing for hull split spray
- Irrigation management problems
- Uneven/delayed harvest

Corning location –irrigation summary (RDI)

Soil	2002		2003		2004	
	Water applied	Cutoff date	Water applied	Cutoff date	Water applied	Cutback date
East (silt)	24"	10-Jul	14"	1-Jul	18"	7-Jun
West (gravel)	40"	25-Aug	41"	4-Sep	36"	16-Sep
ETc	43"		40"		42"	

Very long cutoff/cutback OK on East (silt) soil

2001 - 2004 Almond RDI sites:

County	Location	Soil type	Age (yr)	Irrigation
Tehama	Corning(E)	Silt-Loam	9	Microsprinkler
Tehama	Corning (W)	Gravel-Loam	9	Microsprinkler
Butte	Chico	Vina-Loam	9	Solid-set Sprinkler
Colusa	Arbuckle	Gravel-Loam (II)	13	Single line drip
Solano	Dixon	Yolo-S/CLoam	8	Solid-set Sprinkler
Madera	Madera	Dinuba FSL	10	Microsprinkler
Kern	Shafter	Sandy Loam	15	Microsprinkler

Question: Can we use RDI in the same location(s) over many years without reducing yield?

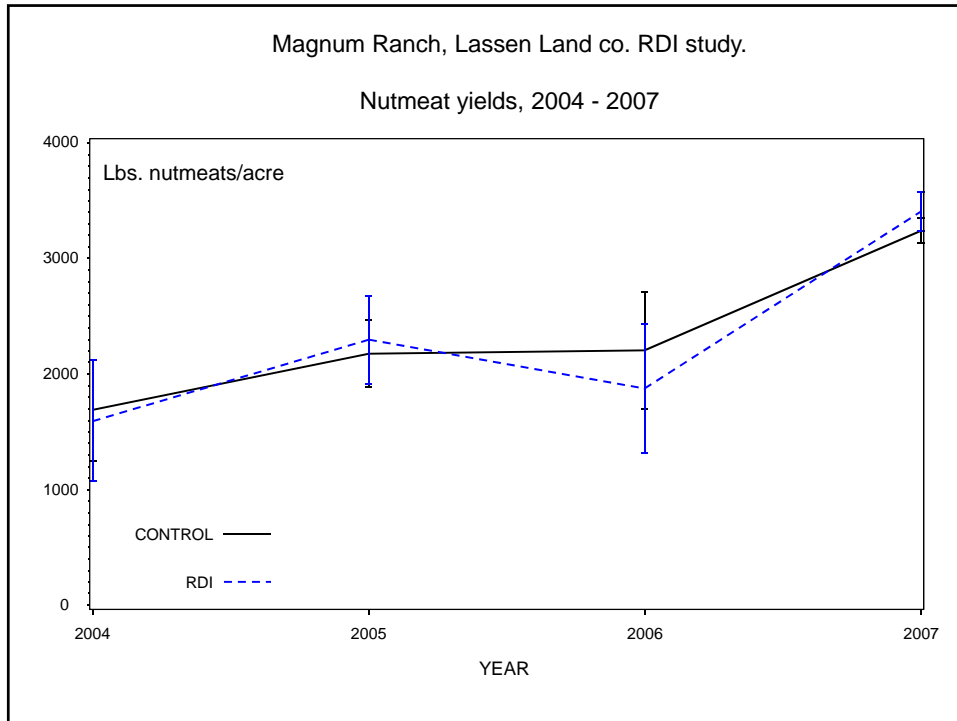
Four year yield summary

(lbs. nutmeats per acre)

	2001 (2 sites)	2002 (7 sites)	2003 (7 sites)	2004 (7 sites)
<u>Treatment</u>				
Grower	2,400	3,170	2,860	2,650
RDI	2,430	3,080	2,660	2,680

Four year (2001 – 2004) harvest effects summary

Location	Hull rot (strikes/tree)		Days RDI advance in HS	Other effects
	Grower	RDI		
Corning (silt)	0.0	0.0	5	
Corning (gravel)	0.0	0.0	6	
Chico	1.1	2.2	0	
Arbuckle	0.0	0.0	0	
Dixon	4.4	2.4	1	60% mummy reduction, '02
Madera	20.1	5.1	4	Grower required 2 shakes, '02
Kern	24.0	17.5	0	50% sticktight reduction, '03, '04



Benefits of RDI (mild stress)
for almonds during hull split:

- 1) Speed up Hull Split (use water as a management tool)
- 2) Reduce Hull rot
- 3) Reduce Sticktights (Improve Harvestability)
- 4) Save Water
- 5) No negative impact on yield

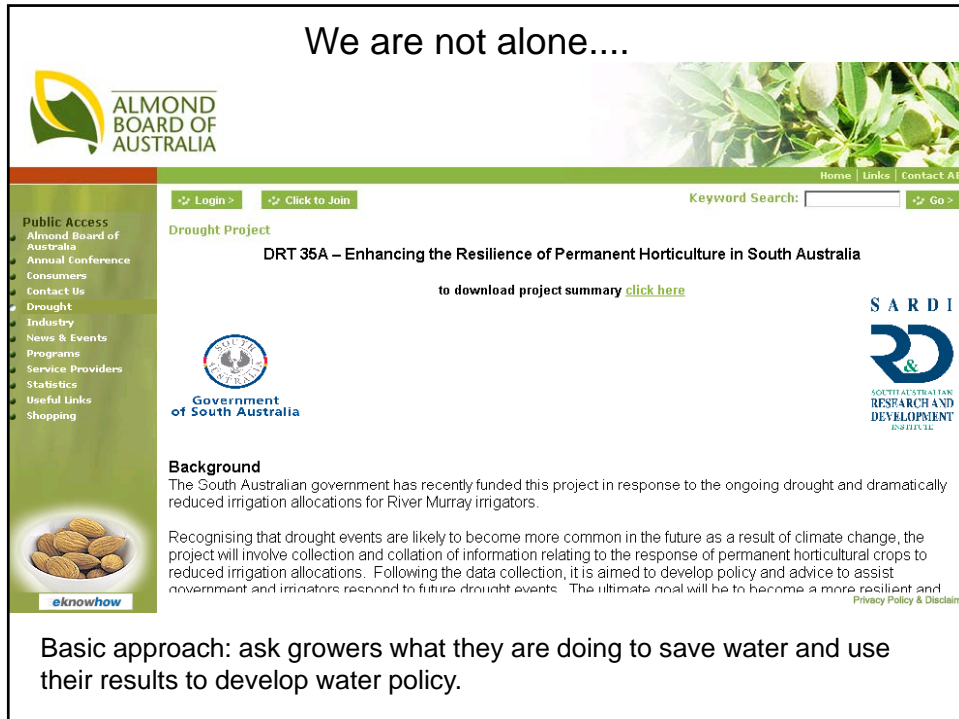
Drought recommendations: saving water

- 1) Control weeds.
- 2) Expect to see differences where soils are different – manage irrigation differently if at all possible.
- 3) Hull split period is a good time for saving water.
- 4) Use a pressure bomb to manage irrigation.

Drought recommendations: Triage situation

- 1) Control weeds.
- 2) Expect to see differences where soils are different – manage irrigation differently if at all possible.
- 3) If water is available, use a pressure bomb or look for visual symptoms to determine the areas that need water the most. Interior leaf yellowing means mild/moderate stress (around -15 bars). Wait for mild stress to start irrigating, and spread water evenly over the season after that.
- 4) If no water is available and stress is severe, pruning may improve tree survival.

We are not alone....



The screenshot shows the Almond Board of Australia website. At the top left is the logo for the Almond Board of Australia. The main heading is "We are not alone....". Below this is a navigation bar with "Home | Links | Contact AB" and a "Keyword Search:" field. A "Drought Project" section is highlighted, featuring the title "DRT 35A – Enhancing the Resilience of Permanent Horticulture in South Australia" and a link to "download project summary [click here](#)". Logos for the Government of South Australia and SARDI (South Australian Research and Development Institute) are visible. A "Background" section explains that the project is funded in response to drought and aims to help growers become more resilient. A small image of almonds is shown with the "eknowhow" logo. At the bottom of the screenshot, the text reads: "Basic approach: ask growers what they are doing to save water and use their results to develop water policy."

A lot more research on irrigation and almond production than irrigation and almond survival, but a practice that's for maintaining production should also be good for maintaining survival.

Questions?