# Irrigation Management in Walnut

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# *Acknowledgements*


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- Larry Schwankl
- Terry Prichard
- Joe Grant

**Funding:**

- Walnut Marketing Board

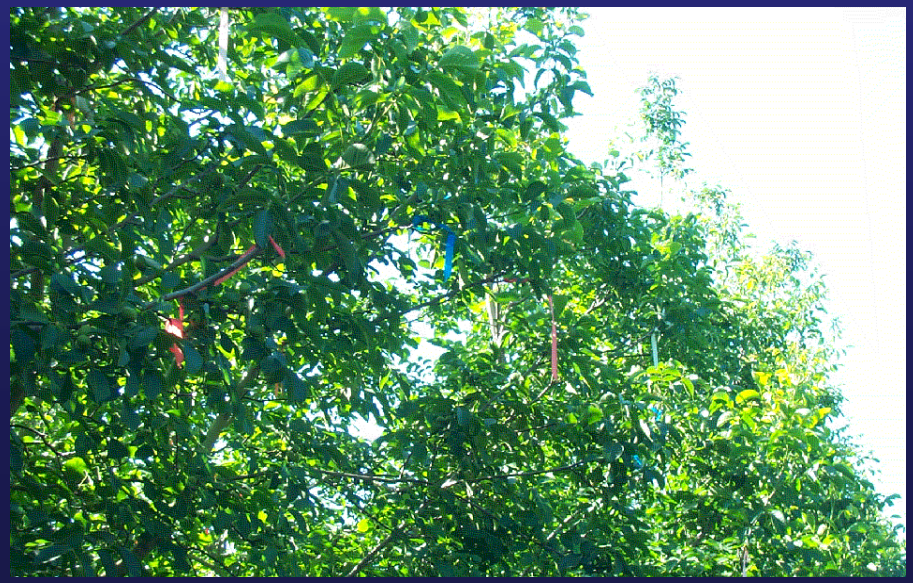
**Topics:**

- Walnut response to irrigation
- Time permitting – An irrigation management  reminder

# General strategy for evaluating water stress in walnut field trial

| Crop Development Stage | 3.5 ac-ft/ac | 2.4 ac-ft/ac | 1.9 ac-ft/ac |
|---|---|---|---|
| Root Growth (Feb/Mar) | Low | Low | Low |
| Bloom (Apr) | Low | Low | Low |
| Shoot Growth (Apr/May) | Low | Low | Low |
| Fruit Sizing (May/June) | Low | Mild | Mild |
| Kernel Development (Jul/Aug) | Low | Mild | Moderate |
| Bud Development (July/Aug) | Low | Mild | Moderate |
| Root Growth (Aug/Sept) | Low | Mild | Moderate |
| Post-harvest (Oct/Nov) | Low | Moderate | Moderate |
| **Range in Midday SWP (bars)** | -3 to -7 | -3 to -10 | -3 to -12 |
| **Range in Soil Water Tension** | -20 to -80 cb | -20 to -200 cb | -20 to -200 cb |

# Irrigation Effect on Shoot Growth



# Effect of irrigation on shoot growth of bearing Chandler Walnut on Paradox, 2002 - 2003

| **Two-year Average Applied Water** (ac-ft/ac) | **Average Seasonal Shoot Growth *** (feet per season) |
|---|---|
| 3.5 (low stress) | 3.5 a |
| 2.4 (mild stress) | 3.3 a |
| 2.0 (moderate) | 2.4 b |

* Average of about 64 pruned Shoots per irrigation level

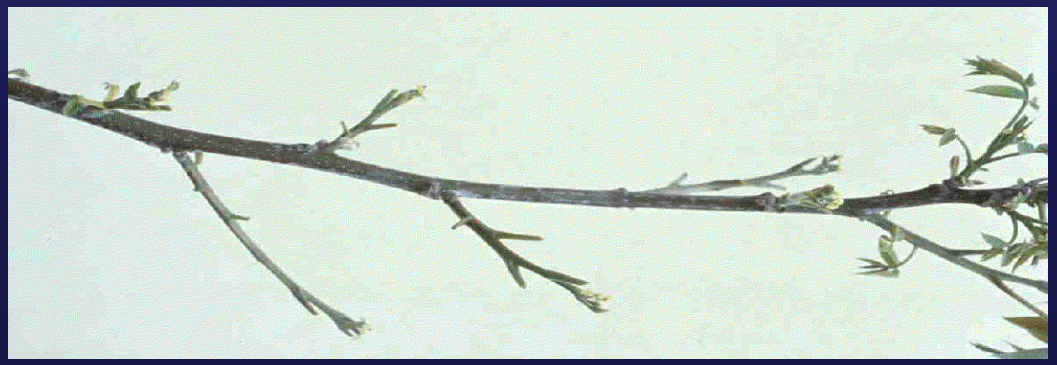
# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.

# Effect of Irrigation on Fruitfulness and Yield

# Effect of water stress on bud break and bloom, Chandler walnut grown on Paradox rootstock, 2004.

| Applied Water | Reduction in buds that opened (%) | Reduction in floral buds (%) | Reduction of flowers per floral bud (%) | Reduction in nut load (%) |
|---|---|---|---|---|
| 3.6 ac-ft/ac | 0 a | 0 a | 0 a | 0 a |
| 2.2 ac-ft/ac | -1 a | -18 b | - 3 a | - 24 b |
| 1.9 ac-ft/ac | -12 b | -12 b | - 9 b | - 31 b |



Remember Shoot Growth

# Effect of irrigation on dry in-shell yield of Chandler walnut on Paradox Rootstock, 2002 – 2005.

| Year | Applied Water (ac-ft/ac) | Yield (lbs/acre) | Percent less Yield |
|---|---|---|---|
| 2004 | 3.6 (low) | 5046 a | ----- |
| | 2.2 (mild) | 3770 b | 25 |
| | 1.9 (mod) | 3068 c | 39 |
| | | | |
| Four-Year Total | 3.5 (low) | 21,508 a | ----- |
| | 2.4 (mild) | 18,066 b | 16 |
| | 2.0 (mod) | 15,737 c | 27 |

# Effect of irrigation on dry in-shell yield of Chandler walnut on NCB Rootstock, 2002 – 2005.

| Year | Applied Water (ac-ft/ac) | Yield (lbs/acre) | Percent less Yield |
|---|---|---|---|
| 2004 | 3.6 (low) | 3614 a | ----- |
| | 2.2 (mild) | 2586 b | 28 |
| | 1.9 (mod) | 2044 c | 43 |
| | | | |
| Four-Year Total | 3.5 (low) | 14,323 a | ----- |
| | 2.4 (mild) | 11,248 b | 21 |
| | 2.0 (mod) | 10,007 b | 30 |

# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.
2. Crop water stress can reduce the number of buds that open and that are fruitful. Results in less nut load and near 40 percent less yield in some situations.

# Chandler Walnut Yield Response to Increased Irrigation, Paradox Rootstock, 2006 – 2007.

| Year | Applied Water (ac-ft/ac) | Yield (lbs/acre) |
|---|---|---|
| Four-Year Total | 3.5 (low) | 21,508 a |
| (2002 – 2005) | 2.4 (mild) | 18,066 b |
| | 1.9 (mod) | 15,737 c |
| | | |
| 2006 | 3.1 (low) | 5253 a |
| | 3.1 (mild) | 5529 a |
| | 3.1 (mod) | 5132 a |
| | | |
| 2007 | 3.3 (low) | 6867 a |
| | 3.3 (mild) | 6038 a |
| | 3.3 (mod) | 6134 a |

# Chandler Walnut Yield Response to Increased Irrigation, NCB Rootstock, 2006 - 2007

| Year | Applied Water (ac-ft/ac) | Yield (lbs/acre) |
|---|---|---|
| Four-Year Total | 3.5 (low) | 14,323 a |
| (2002 – 2005) | 2.4 (mild) | 11,248 b |
| | 1.9 (mod) | 10,007 b |
| | | |
| 2006 | 3.1 (low) | 4513 a |
| | 3.1 (mild) | 3564 a |
| | 3.1 (mod) | 4001 a |
| | | |
| 2007 | 3.3 (low) | 4994 a |
| | 3.3 (mild) | 4730 a |
| | 3.3 (mod) | 4216 a |

# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.
2. Crop water stress can reduce the number of buds that open and that are fruitful. Results in less nut load and near 40 percent less yield in some situations.
3. Irrigation effects on walnut yield may carry over one or more years after water stress is corrected.

# Effect of Irrigation on Walnut Quality

# Effect of irrigation on quality of Chandler Walnut grown on Paradox Rootstock

| Year | Applied Water (ac-ft/acre) | Relative Value [1] $/1000 lbs |
|---|---|---|
| **2003** | **3.7** (low) | **1116.75 a** |
| | **2.2** (mild) | **1012.33 b** |
| | **1.8** (mod) | **959.35 c** |
| | | |
| **Four-Year Average** | **3.5** (low) | **972.60 a** |
| | **2.4** (mild) | **927.32 b** |
| | **2.0** (mod) | **922.95 b** |

[1] Darker kernel color and higher off-grade main quality parameters affecting walnut value. Significant differences 3 out of 4 years.

# Walnut Response to Irrigation

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3. Irrigation effects on walnut yield may carry over one or more years after water stress is corrected.
4. Irrigation management may influence walnut value. Darker kernel color and higher off-grade can be more common in water stressed trees.

# Importance to Rootstock Performance

# Effect of irrigation on performance of Paradox and Northern California Black Rootstock, 2002 – 2005

| Rootstock | Four-year Average Applied Water (ac-ft/ac) | Four-year Total Dry In-shell Yield (lbs/acre) |
|---|---|---|
| Paradox | **3.5** (low) | **21,508 a** |
| Paradox | **2.4** (mild) | **18,066 b** |
| **Paradox** | **2.0** (mod) | **15,737 c** |
| **Black** | **3.5** (low) | **14,323 c** |
| Black | **2.4** (mild) | **11,248 d** |
| Black | **2.0** (mod) | **10,007 d** |

# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.
2. Crop water stress can reduce the number of buds that open and that are fruitful. Results in less nut load and near 40 percent less yield in some situations.
3. Irrigation effects on walnut yield may carry over one or more years after water stress is corrected.
4. Irrigation management may influence walnut value. Darker kernel color and higher off-grade can be more common in water stressed trees.
5. If mismanaged, irrigation can negate investments in other walnut culture i.e. hybrid rootstock, etc…

# Irrigation, Crown Rot, and Tree Longevity

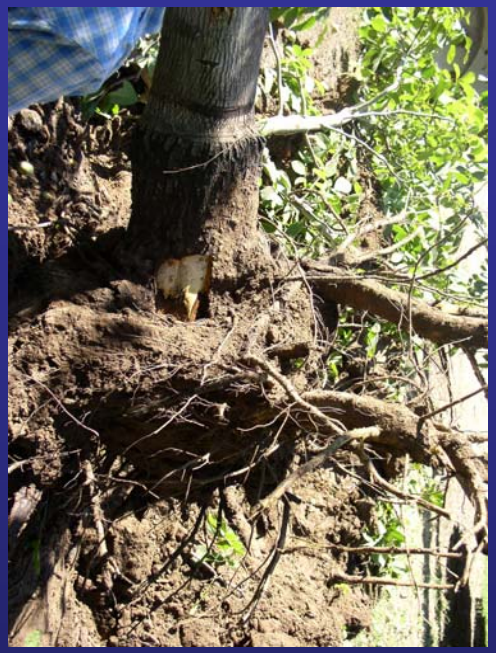
# Effect of irrigation on longevity of trees grown on Paradox and Northern California Black Rootstocks

| Rootstock | Average Applied Water (ac-ft/ac) | Percentage trees in severe decline |
|---|---|---|
| Paradox | 3.5 | 0.0 |
| Paradox | 2.4 | 1.3 |
| Paradox | 1.9 | 1.3 |
| Black | 3.5 | 24.2 a |
| Black | 2.4 | 3.0 b |
| Black | 1.9 | 0.0 b |

# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.
2. Crop water stress can reduce the number of buds that open and that are fruitful. Results in less nut load and near 40 percent less yield in some situations.
3. Irrigation effects on walnut yield may carry over one or more years after water stress is corrected.
4. Irrigation management may influence walnut value. Darker kernel color and higher off-grade can be more common in water stressed trees.
5. If mismanaged, irrigation can negate investments in other walnut culture i.e. hybrid rootstock, etc…
6. Tree loss on Paradox rootstock was not influenced by irrigation. Tree loss on Black rootstock increased significantly with more intense irrigation.

# Irrigation, Crown Rot, and Tree Longevity



# Effect of Irrigation on Tree Longevity

Crown Rot

# Walnut Response to Irrigation

1. Water stress is likely to decrease shoot growth.
2. Crop water stress can reduce the number of buds that open and that are fruitful. Results in less nut load and over 40 percent less yield in some seasons.
3. Irrigation effects on walnut yield may carry over one or more years after water stress is corrected.
4. Irrigation management may influence walnut value. Darker kernel color and higher off-grade can be more common in water stressed trees.
5. If mismanaged, irrigation can negate investments in other walnut culture i.e. hybrid rootstock, etc…
6. Tree loss on Paradox rootstock was not influenced by irrigation. Tree loss on Black rootstock increased significantly with more intense irrigation.
7. Cutting back on irrigation reduced tree loss on Black rootstock but at the expense of walnut yield and quality. Possibly some practices affecting water placement such as stream splitters might address problem.

## Topics:

- Walnut response to irrigation
- An irrigation management reminder

# THANK YOU!

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# Agriculture
farm & ranch

## own Palace hotel catered to cattle

bulls owned by Dan Thornton who were given the red-carpet treatment when they arrived at the Brown Palace.

Thornton later served as governor of Colorado from 1951 to 1955.

Another book I bought at a book signing for the American National CattleWomen Foundation, when Mardie Hanson autographed her latest book "Ranch Hands, Rhubarb and Radishes." It is a collection of stories about the ranch hands they had on ranch over the years. Part of their pay, in addition to housing, was three meals a day, seven days week.

Cooking for the crew was Mardie's job if she was unable to hire a suitable cook, so she also included recipes that she used with comments.

"Changing ranch hands and changing cooks added drama to life on the ranch.

"Changing the menu added some interest for me.

"Cooking three meals a day, seven days a week can become boring in a hurry, especially if the food stays the same. Sometimes I would add new touches to dishes I knew the crew liked, most to deal with my own boredom.

"One day I added radicchio to the green salad. At the end of the meal, all the plates were clean except for the radicchio, which had been carefully separated out and pushed to the side of every plate, including the boss'.

"As he left the dining room, one of the men asked, 'What was that stuff in the salad?'

"'Radicchio.'

"'Huh! We used to have ordinary stuff. Like rhubarb.'

"After that I stuck to radish-or color.

"These men were different from each other in many ways, but they shared one common attribute. They liked plain, simple food. Meat, potatoes, bread, beans, and dessert were what they expected.

Branding 30 years ago at a Colorado ranch where Mardie Hanson was an occasional cook.

ed. They also expected that menu to vary little. They wanted to sit down to a table of food that was familiar and plentiful."

When we reminisced about Lew Brockman last summer, he would have fit in with the crew because I heard the menu at cow camp at gathering time never changed: Bacon, eggs, pancakes, and coffee for breakfast. The crew took a lunch, and the evening meal was steak, boiled or fried potatoes and gravy, beans and coffee.

Waynette sent cans of corn for a vegetable, and they were never opened. Each year, they made the trip to cow camp until the labels fell off. Potatoes and beans were the veggies.

I remember many years ago when my parents, sister and I drove down the Honey Lake Valley in Lassen County to visit cousin Philip we would see stacks of loose hay at the various ranches. Mardie's description of haying brought back memories of those hay stacks.

"During the early years Fred spent in our mountain valley, the ranchers still stacked loose hay. The cured grass was raked into a windrow, then swept with a hay rake as they swept to the bottom of a beaver slide. The pile of hay, about 5 feet high and 12 feet wide and weighing approximately 800 pounds, was then pushed up the slide some 18 feet and over the end, falling down around the two men waiting below. Their job was to spread the hay into a steadily growing stack measuring 20 feet by 25 feet and reaching as high as 21 feet by the time the stack was finished.

"Fred hated stacking hay. He hated the pitchfork; he hated the hay down his shirt collar; he hated having to set his pace to match another man's; he hated the dust in his ears and eyes. Mostly he hated the hard, steady work required to do the job right. Oh, he'd do it if told that was what he needed to do. And he'd do it well, which was the reason he was assigned to the stacking crew so often. But he made it known how much he hated it, just the same."

"Ranch Hands, Rhubarb and Radishes" by Mardie Hanson, a cattlewoman who lived more than 20 years on a 120,000-acre ranch at 8,000 foot altitude watching a string of characters play out dramas that no playwright could ever imagine. These were the ranch hands who worked on the ranch over the years." A fascinating book.

Jean Barton has been writing her column in the Feed Stuff Daily News since the early 1970s. She can be reached by e-mail at jbarton@theskytel.com. Her column appears on Saturdays.

## Breeders honored for 'proven' bulls

Local Angus breeders were recognized for owning proven bulls in 2007 Fall Sire Evaluation Report published by the American Angus Association SM in Saint Joseph, Mo. Issued in both the spring and fall, the new report features the latest performance information available on 6,679 sires, and is currently accessible at www.angussiresearch.com.

The local Angus breeders recognized are:

- Tehama Angus Ranch, Gerber, 11 bulls listed.
- Tyler R. Byrd, Red Bluff, one bull listed.
- Dan and Chris Byrd, Red Bluff, one bull listed.
- Brooke Anne Byrd, Red Bluff, two bulls listed.
- JCL Cattle Co., Red Bluff, one bull listed.
- David J. Holden, Red Bluff, one bull listed.

"This report provides both Angus breeders and commercial cattle producers with accurate, Angus genetic [illegible] predictable selection tools for improving their herd," said Bill Bowman, American Angus Association director of performance programs. Expected Progeny Differences (EPDs) are generated from the performance database of the American Angus Association, which includes information submitted by more than 9,600 Angus breeders this past year through the Association's Beef Improvement Records (BIR) program.

EPDs are available for 17 traits. Decision-making tools also include seven dollar values in the suite of bio-economic indexes designed to assist commercial producers in simplifying the genetic selection process.

The semiannual analysis for the Sire Evaluation Report contains more than 15 million measures used to generate nearly 38 million EPDs for the Angus breed.

The American Angus Association with headquarters in Saint Joseph, Mo., provides programs and services for more than 34,000 members nationwide and thousands of commercial producers who use Angus genetics. Go to www.angus.org for more information.

**WEEKLY SOIL MOISTURE LOSS IN INCHES**
(Estimated Evapotranspiration)
07/20/07 through 07/26/07

| West of Sacramento River | | | East of Sacramento River | |
|---|---|---|---|---|
| Weekly Water Use | Accum'd Seasonal Use | Crop (Leafout Date) | Weekly Water Use | Accum'd Seasonal Use |
| 1.81 | 32.55 | Pasture | 1.68 | 30.10 |
| 1.74 | 31.55 | Alfalfa | 1.61 | 29.10 |
| 1.38 | 24.58 | Olives | 1.26 | 22.73 |
| 1.18 | 21.21 | Citrus | 1.11 | 19.64 |
| 1.74 | 29.11 | Almonds (3/1) * | 1.61 | 26.72 |
| 1.74 | 28.09 | Prunes (3/15) * | 1.61 | 25.86 |
| 2.09 | 23.23 | Walnuts (4/1) * | 1.90 | 21.03 |
| 1.68 | 29.81 | Urban Turf Grass | 1.61 | 27.65 |

Accumulations started on February 23, 2007. Criteria for beginning this report are based on the season's last significant rainfall event where the soil moisture profile is at full capacity.
* Estimates are for orchard floor conditions where vegetation is managed by some combination of strip applications of herbicides, frequent mowing or tillage, and by mid and late season watershrink. Weekly estimates of soil moisture loss can be as much as 25 percent higher in orchards where cover crops are planted and managed for maximum growth."

| | | |
|---|---|---|
| 0.00 | Precipitation (Inches) | 0.00 |
| 2.77 | Accum'd Precip (Inches) | 3.46 |

**WEEKLY APPLIED WATER IN INCHES***

| 80% | 60% | 70% | 80% | 90% | ← Efficiency → | 80% | 60% | 70% | 80% | 90% |
|---|---|---|---|---|---|---|---|---|---|---|
| 2.6 | 2.3 | 2.0 | 1.7 | 1.5 | Olives | 2.5 | 2.1 | 1.8 | 1.6 | 1.4 |
| 2.4 | 2.0 | 1.7 | 1.5 | 1.3 | Citrus | 2.2 | 1.9 | 1.6 | 1.4 | 1.2 |
| 3.5 | 2.9 | 2.5 | 2.2 | 1.9 | Almonds (3/1) | 3.2 | 2.7 | 2.3 | 2.0 | 1.8 |
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| 4.2 | 3.5 | 3.0 | 2.6 | 2.3 | Walnuts (4/1) | 3.8 | 3.2 | 2.7 | 2.4 | 2.1 |

## ucers fire back in food vs. fuel debate

Some food companies argue at escalating corn prices, arked by the increasing mand for ethanol, has forced em to raise prices for items containing corn, excluding meat and iry products from animals that e fed the grain. It's been dubbed way that that small increase in the price of popcorn that the farmer gets justifies the large increases that they're talking about at the movie theater," he said. "And, this is true for so many other things."

For example, a six-pack of soda

corn grower," he said.

Tracy Boever, a spokeswoman for the American Pop Corn Co. in Sioux City, which makes Jolly Time brand popcorn, said the company hasn't been blaming anyone for higher prices, but "the fact remains that

# Newspaper Distribution

- Happy Valley Times
- Anderson Valley Post
- Red Bluff Daily News
- Corning Observer
- Orland Press-Register
- Chico Enterprise Record
- Willows Journal
- Colusa County Sun Herald

# Web Distribution

- **http://cetehama.ucdavis.edu**
  - ✓ **Irrigation and Water Resources Page**
  - ✓ **Irrigation Scheduling Tools Menu Item**

## WEEKLY SOIL MOISTURE LOSS IN INCHES

(Estimated Evapotranspiration)

**07/20/07 through 07/26/07**

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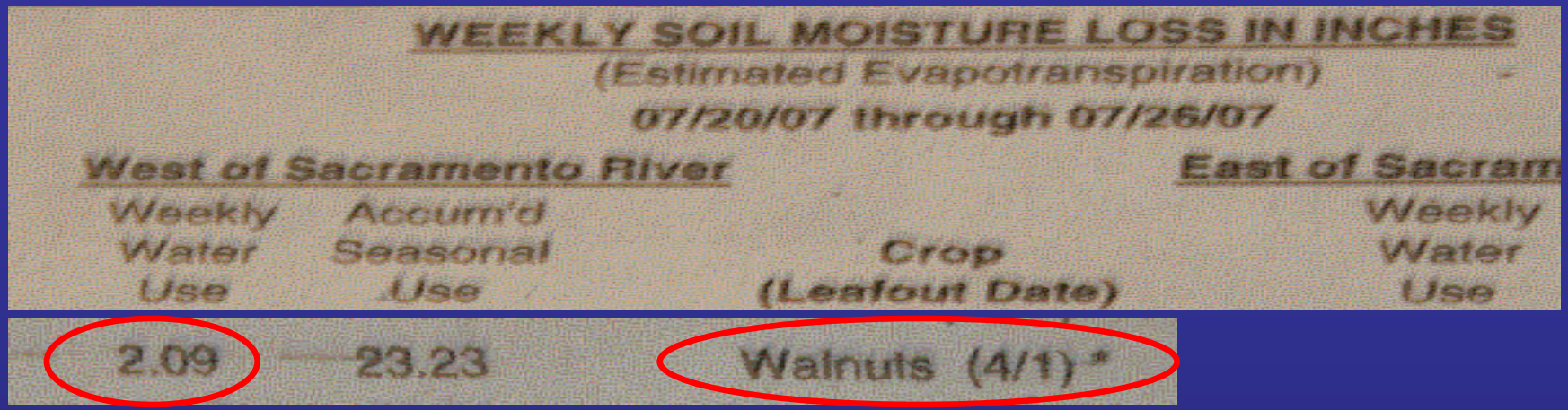

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| West of Sacramento River | | | East of Sacram |
|---|---|---|---|
| Weekly Water Use | Accum'd Seasonal Use | Crop (Leafout Date) | Weekly Water Use |
| 2.09 | 23.23 | Walnuts (4/1) * | |

**If hourly irrigation rate = 0.05 inches per hour**

**2.09 inches weekly use ÷ 0.05 inch/hr = 42 hours**

**Then, estimated hours of weekly irrigation run time = 42 hours during week of July 20 – 26, 2007**

*** May add hours in consideration of Irrigation Uniformity**

# Irrigation application rate is unknown?

**OPTIONS:**

- **Contact Tehama County RCD Mobile Irrigation Lab 527-3101 x 119**
- **Estimate it yourself based upon irrigation system design**

# Make your own estimate of hourly irrigation rate

**Example:**

- 81 microsprinklers per acre
- 16.8 gph emission per sprinkler

**81 x 16.8 gph = 1358 gph per acre**

**1358 ÷ 27,154 = 0.05 inch/hr**

**Conversion factor from gph per acre to inches per acre per hour**

# THANK YOU!

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