Irrigation Water Management

USDA

NRCS

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I. What's an Irrigation Water Management?

Way to
save water

Monitor
soil moisture

Eliminate
excess irrigation

Reduce labor, cost, & Increase crop yields

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II. Tools for Irrigation Water Management

1. We need:

test.
2. Type of irrigation
3. Type of soil
4. Type of crop
5. Size of the farm
6. Soil moisture sensors

Irrigation scheduling

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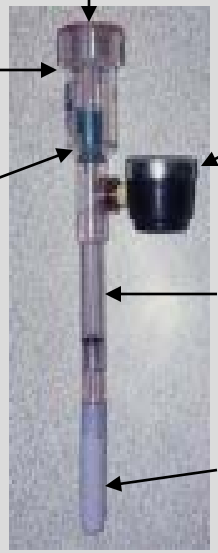
Soil moisture sensors

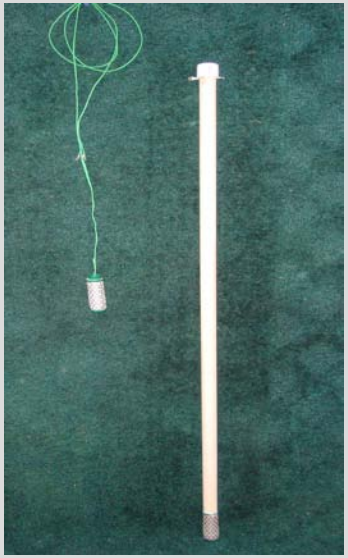
1. Tensiometers



2. Electrical Resistance Blocks (ERB)

Granular matrix or Watermarks

Watermarks meter



3. Wireless devices

4. Feel & appearance method. Ref. (IWM–10b)

Irrigation scheduling

1. Use soil moisture sensors to schedule the next irrigation.

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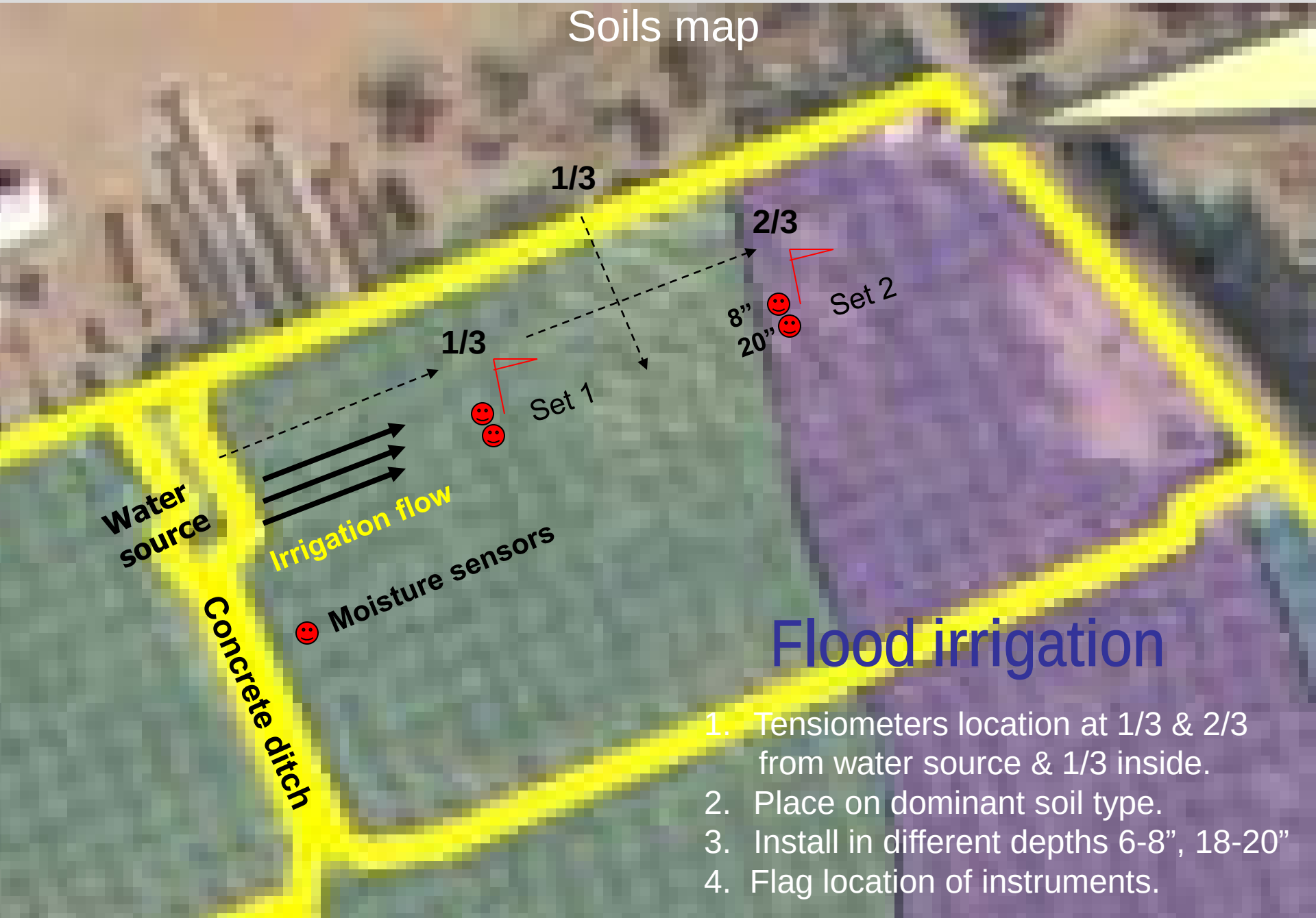
III. Location of soil moisture sensors in the field

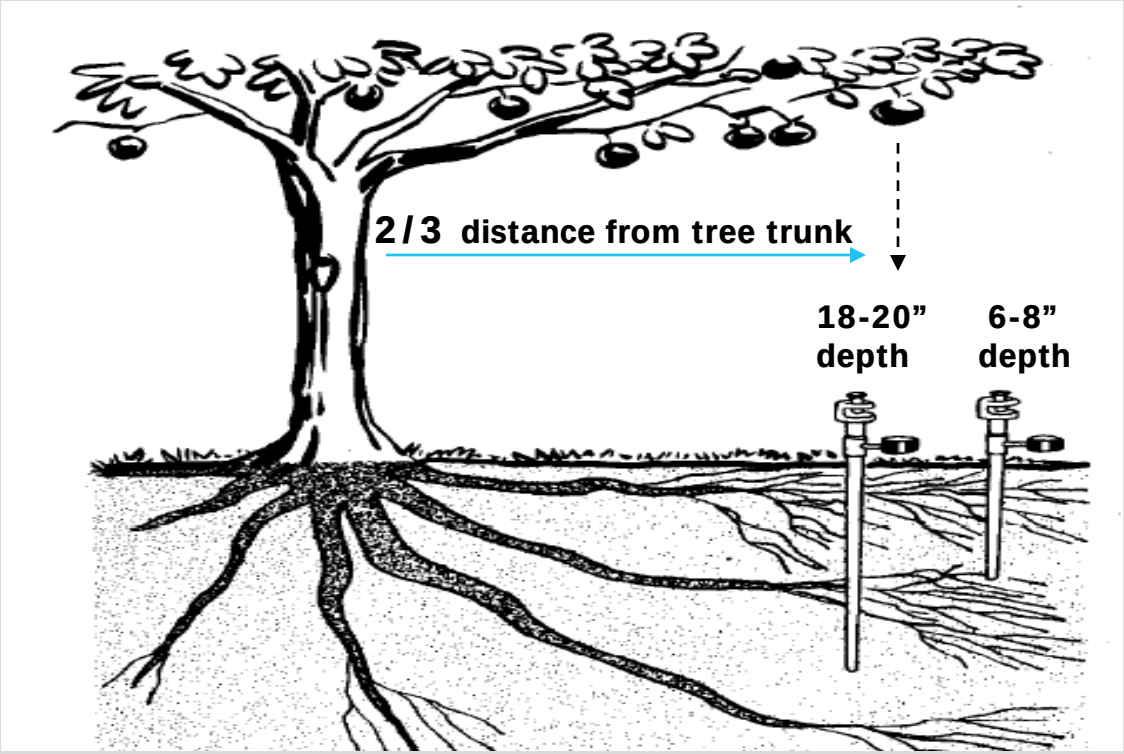


Flood irrigation

1. Tensiometers location at 1/3 & 2/3 from water source & 1/3 inside.
2. Place on dominant soil type.
3. Install in different depths 6-8”, 18-20”
4. Flag location of instruments.

IV. Location of soil moisture sensors by crop

Pecan orchard



1. The moisture sensors shall be placed 2/3 of the distance from the tree trunk to the edge of canopy.
2. Install two locations per field, two sensors per location and two different depths.
3. Moisture sensors may be of tensiometers, Electrical Resistance Blocks (ERB) or any wireless type.
4. Install a shallow depth sensor at 6-8”, where majority of the roots are growing. It will be used for irrigation scheduling purposes.
5. Install a deeper depth sensor at 18-20”, to measure deeper moisture and potential leaching of nutrients and water.

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V. (IWM-14) Soil Moisture monitoring & Irrigation Record keeping

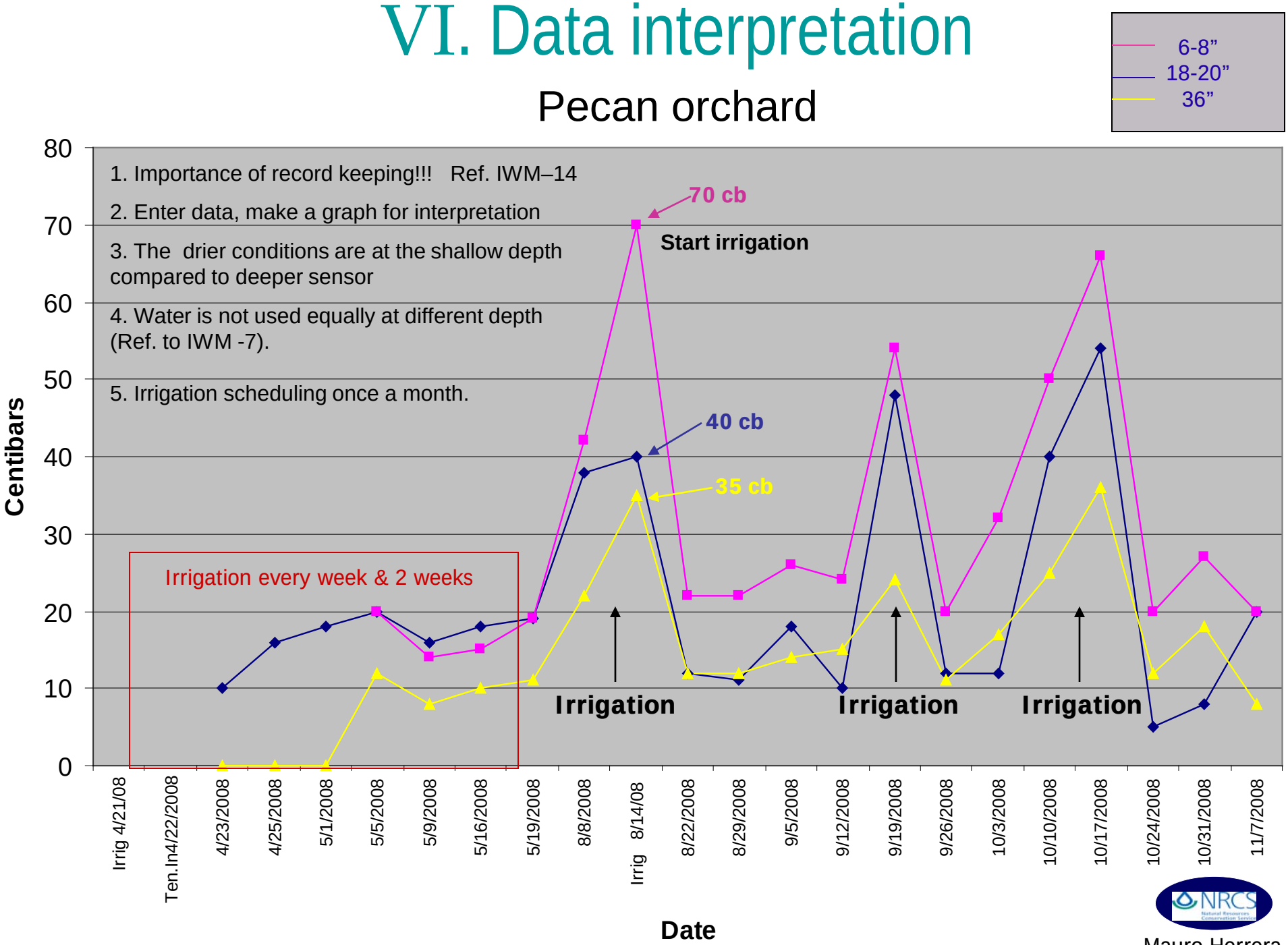
Important: Monitoring the rate of change of the soil moisture tension, is just as important as the actual reading used to schedule the irrigation.	**Coarse:** Sands, f. sands, very f. sands, Loamy sands, Loamy f. sands & Loamy very fine sands	**Moderately Coarse:** Sandy loam fine Sandy loam	**Medium:** v. f. Sandy loam Loam Silt loam Silt	**Moderately Fine:** Sandy clay loam Silty clay loam Clay loam	**Fine:** Sandy clay Silty clay Clay
	***Approximate** Soil Moisture Sensor readings at the time of Irrigation (Units: centibars - cb) (NOTE: Irrigation scheduling is typically based on sensor readings in the 6" – 9" root zone depth)				
	30 – 40 cb	40 – 50 cb	50 – 60 cb	60 – 70 cb	70 – 80 cb
	Enter the date of Irrigation and the sensor reading (read at least once a week)				
April		6-8" 18-20" 21/09 Irr. 16 2 cb 22/09 Te.In 18 4 25/09 20 6		6-8" 18-20" 21/09 Irr. 6 2 cb 22/09 Te.In 18 4 25/09 20 6	
May		2/09 26 8 10/09 34 12 20/09 42 18		2/09 24 8 10/09 28 10 20/09 31 12	
June					
July					
August					
September October					

Irrigation scheduling will depend of the type of soil

1. Very important to record data!!! Ref. (IWM–14)
2. Select the soil type.
3. Select the month, take readings twice a week for each depth & date it.
4. If it is a Sandy loam soil, irrigate when tensiometer reads 40-50 centibars

VI. Data interpretation

Pecan orchard



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VII. Formula to calculate amount of water per irrigation

1. $$QT=DA$$

Ref. to (IWM-20) Handbook

Q = Water flow rate of the well or canal in cubic foot per second (cfs). One cfs = 450 gpm.

T = Time of irrigation in hours

D = Irrigation application depth in inches per acre (in/ac)

A = The area irrigated in acres

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2.

Example

Q=7.5cfs **A=** 6 ac **T=** 2 hrs **D= ?** Sandy loam soil

D=QT/A = 7.5 cfs x 2 hrs**/**6 ac = **2.5** in/ac **……** High flow turn outs

3. **Application efficiency:** * 2”/2.5” = 80% * 2” Ref. (IWM-6) table.
Follow the soil type, at 36” depth of irrigation, & it shows for sandy loam soil you need to apply 2” of water.

4. **For conventional irrigation:**
a. Very difficult to apply less than 2” of water per irrigation due to system constraints.
b. Drip and Center pivots can be managed and control irrigation application amounts and timing.

5. Conduct field evaluations to determine the best application efficiency for a specific farm, by increasing or reducing border size & amount of water. You may use the NRCS Irrigation Software.

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6.

Water test

ECw =1.0 mmhos/cm or dS/m

1. ECw=1.0 x **1.5**cf = ECe = 1.5 mmhos/cm - Conventional irrigation
2. ECw=1.0 x **3.0**cf = ECe = 3.0 mmhos/cm – Drip irrigation (low leaching fraction)

7. Practices to manage salts in the root zone:

1. Flood irrigation to leach salts (National Engineering Handbook).
2. Enhance drainage for leaching operation.
3. Apply soil amendments (gypsum, elemental sulfur) to replace Na+ by another element.
4. Use salt tolerant crops. Crop salt tolerance table (WQ-6).
5. Use bedding methods to reduce salinity near root zone.
6. Add green manure crops into the soil.
7. Residue management to improve soil quality.

*ECw=Electrical Conductivity of water
*ECe=Electrical Conductivity of soil
cf=coefficient to determine how salty the soil will be.

VIII. Manage for soil quality

Residue

Earthworms activity

Chile

Benefits of residue management

1. Increases water stable aggregates due to more crop residue.
2. Provides better water infiltration, good structure and reduces water run off.
3. Allows good microbes environment: increasing oxygen and carbon exchange, increases nutrient cycling, and lowers soil temperature (majority of the water is used to produce biomass).
4. Stores more water and reduces nutrients leaching potential.
5. Increases crop yields and efficiency of irrigation water use.

New Mexico NRCS, open the page and click on Irrigation.

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- Soil Moisture Sensors
- Installation

IX. Installation of soil moisture sensors

1. Prepare soil moisture sensors

Fill with water

Prime with suction pump

Place the lid back

In water overnight

1. Prepare the tensiometers the day before installation
2. Fill the tensiometer with water
3. Prime it with a tensiometer suction pump to get air out
4. Place the lid back on the tensiometer
5. Place tensiometers and Electrical Resistance Blocks in water for 24 hours.
6. Transport them to the field in a bucket with water.

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2. Install moisture sensors in the field

Soil probe

Soil in cup

Add water

Make paste

Make a hole

1. Select the field, and the location in the crop to install the tensiometers.

2. Make a hole in the soil using a soil probe at 8” depth (shallow sensor).

3. Take the last 3-4 inches of the soil from the end of the soil probe and place it in a cup.

5. Add water into the cup to make a slurry like a paste.

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3. Install moisture sensors in the crop

Paste into hole

Priming

1. Pour the soil paste into the hole to provide good soil contact.
2. Place the tensiometer or the ERB inside the hole.
3. Compact the soil around the tensiometer to seal it with the ground.
4. Prime the tensiometer with a suction pump to get the air out, add water into the water reservoir if needed.
5. Repeat the same procedure for each recommended depths.
6. Place a flag on location & protect them from equipment damages.

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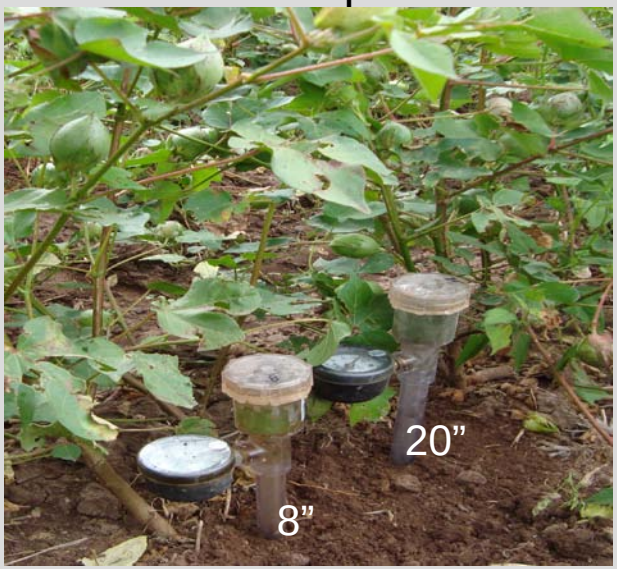
4. Soil moisture sensors installed

Pecan orchard

Row crop



1. Now the tensiometers are installed at 8”, 20” & 36” depth.
2. Tensiometers needs maintenance—adding water, priming or resetting them when they loose suction.
3. Manufacturers provide guidelines to prepare the moisture devices for installation and maintenance.
4. Take readings twice a week for irrigation scheduling.

*Moisture Sensors Website: Forestry Suppliers Inc, Frostproof.com , then click on agriculture supplies.

The end

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