



*Pacific Gas and
Electric Company®*

presents

Advanced Pumping Efficiency Program
APEP- Bill Green, Education Manager





Importance of Proper Irrigation Management

Irrigation Management...

- Make sure water applied is used by the crop- High Irrigation Efficiency (IE) or Water Use Efficiency (WUE)
- Runoff and Deep Percolation of water are losses
 - Conserve water
 - Conserve energy
- Protect water quality, stop movement of pesticides and applied chemicals to groundwater and surface water
- Prevent leaching of nitrogen, fertilizers and salts to the aquifers

Basic Irrigation Management, Have a Plan...

- What are you trying to accomplish with each irrigation event?
 - Wetting the soil profile pre- plant (row crops)
 - Maintain soil moisture in root zone of plants
 - Deficit Irrigation to promote quality or aid harvest
 - Prevent leaching or deep percolation of chemicals (I.e. Nitrates) beyond the root zone
 - Prevent surface runoff into other water bodies
 - Leaching excess salt from the root zone (leaching on purpose)
 - A combination of the above



Irrigation System Performance

Measure Irrigation Performance...


- Flow meters
- Pressure gauges

- Know your water application rate
- Determine your crop water demand

- Visual metrics, runoff is a poor performance of the system
- Deep percolation, can be monitored, calculated

What is needed for good irrigation?

1. Distribution Uniformity (DU)- How evenly water is delivered to each plant or target area.
2. Water Use Efficiency (WUE):
 - a. placing the right amount of water
 - b. at the right time
 - c. in the right place
 - d. Reducing water applied



Distribution Uniformity
Can be Measured- simple catch can
tests or:

Global DU Test- ITRC Cal Poly

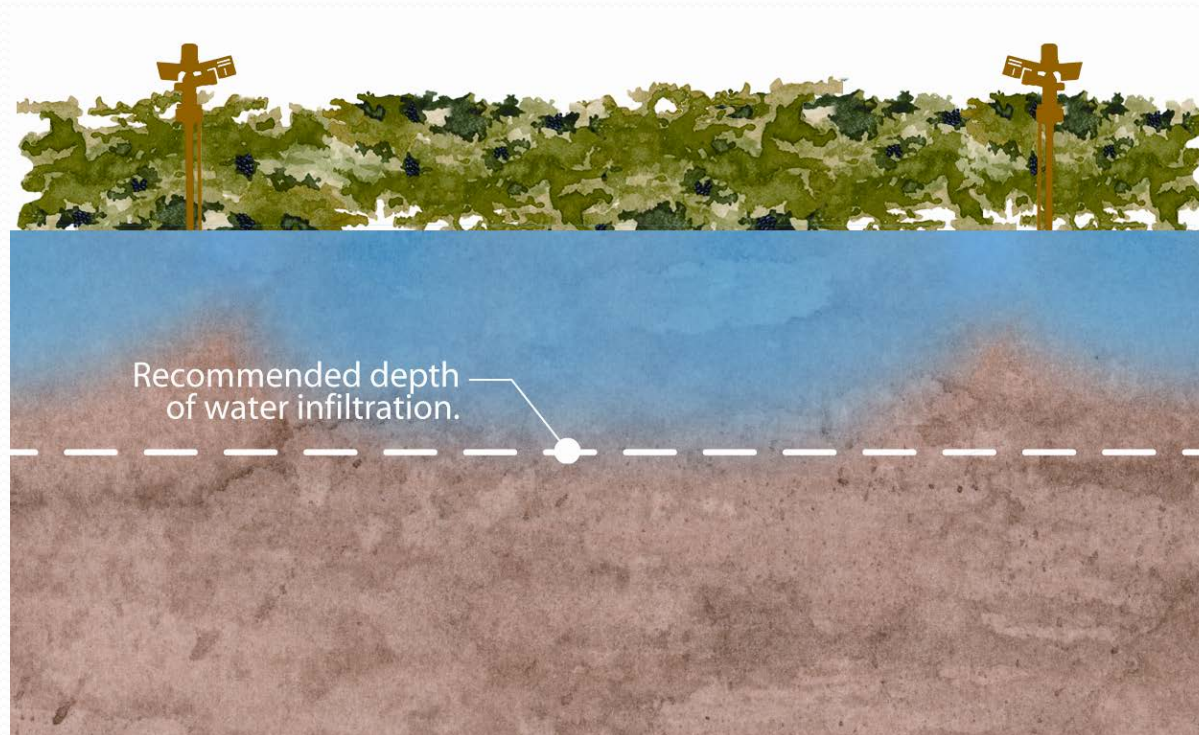
- Much longer, more involved process
 - Includes recording info from the pump and filter station
 - Pressure readings in the field
 - Volume readings in the field
 - Drip line observations
 - Good tool to determine where irrigation system problems lie

Example, DU test on drip system evaluation...

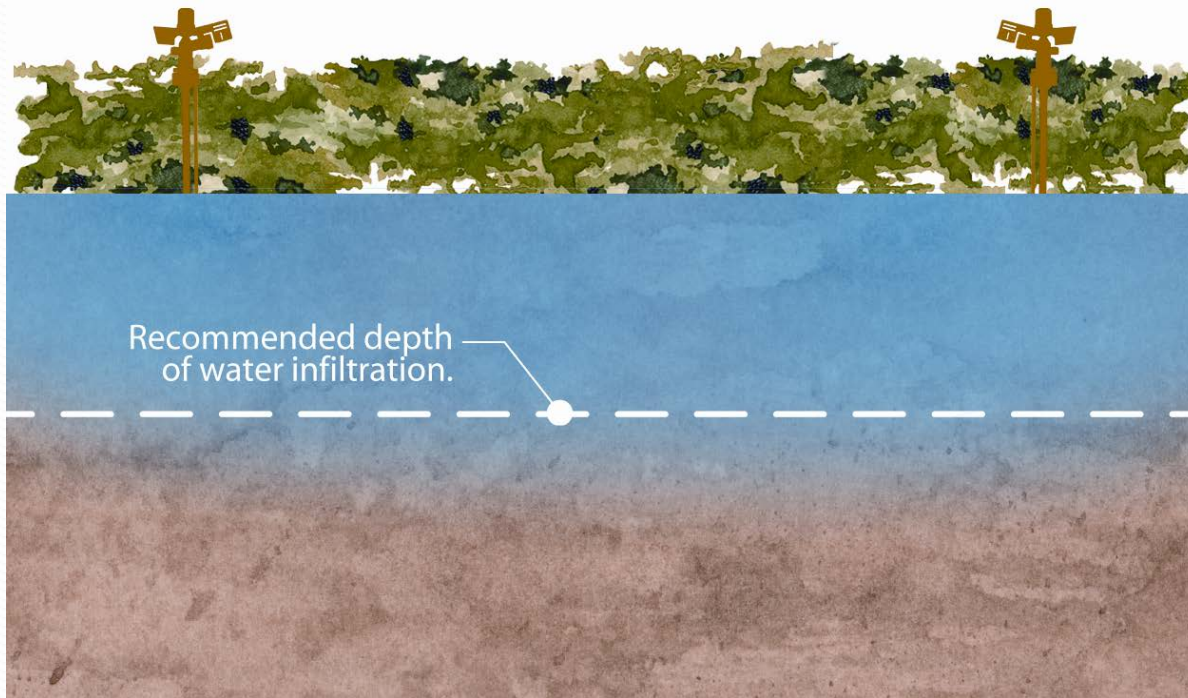
- Catch cans
 - Take volume samples
 - Pressures
-
- Feasible and achievable DUs per irrigation system, .8-.95



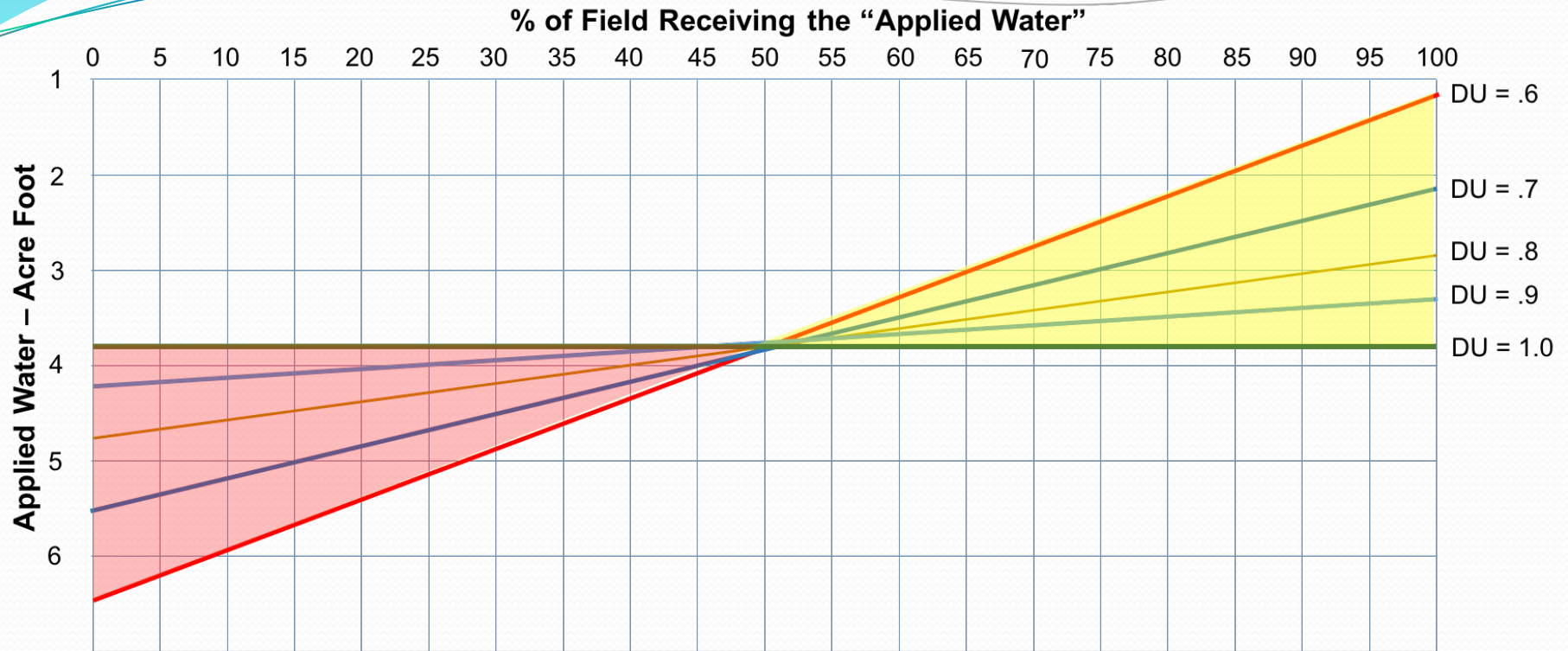
Poor DU- (Good WUE?)



Good DU- proper depth of water penetration, (good IE)



Effects of Poor Distribution Uniformity



This graph shows the relative severity of poor Distribution Uniformity. As an example a system that is operating at a distribution uniformity of 0.60 and has a crop that needs an average of 3.7 feet of water per year, would have areas in the field that received 1.5 feet while in the same field other areas would receive 6.5 feet of water. Generally, a .80 D.U. or better is considered to be acceptable, .90 is good.



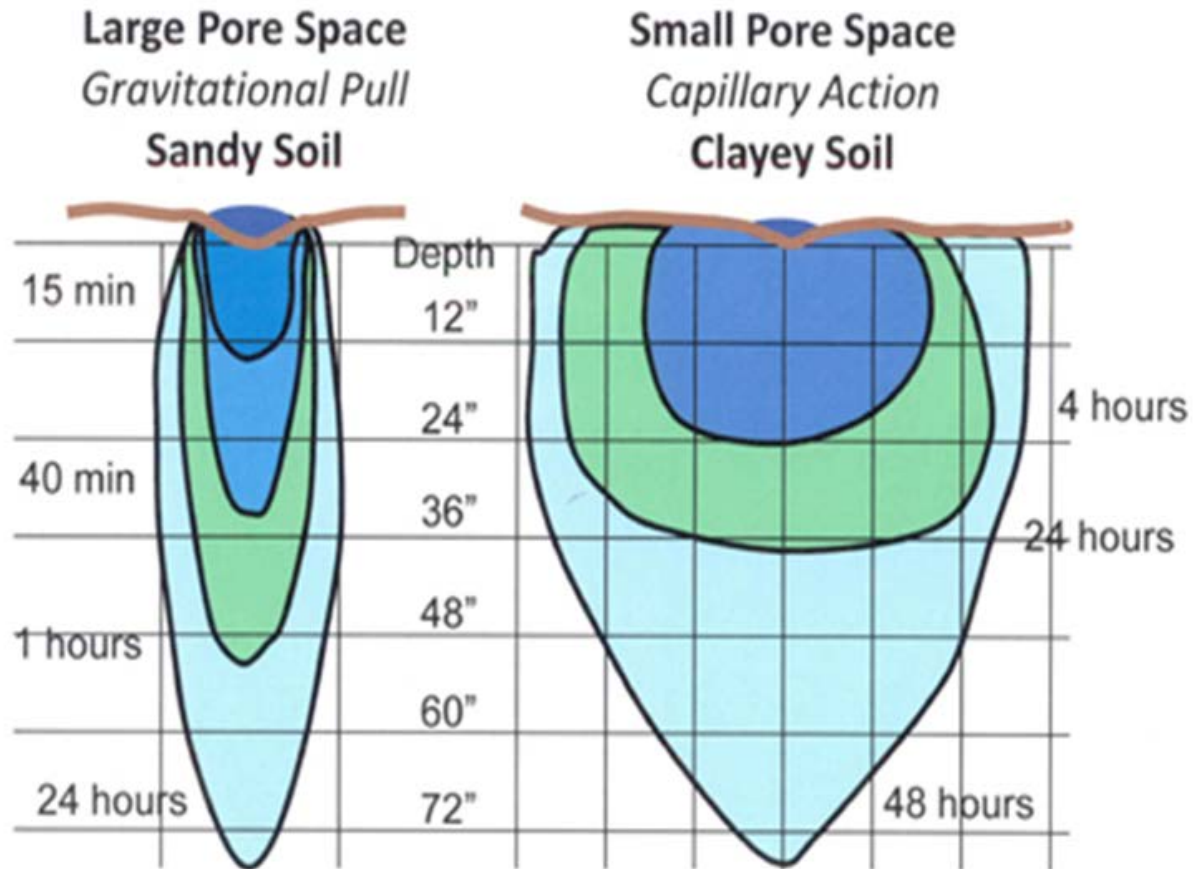
Proper Irrigation Scheduling

Planning, Recordkeeping
and Soil Management

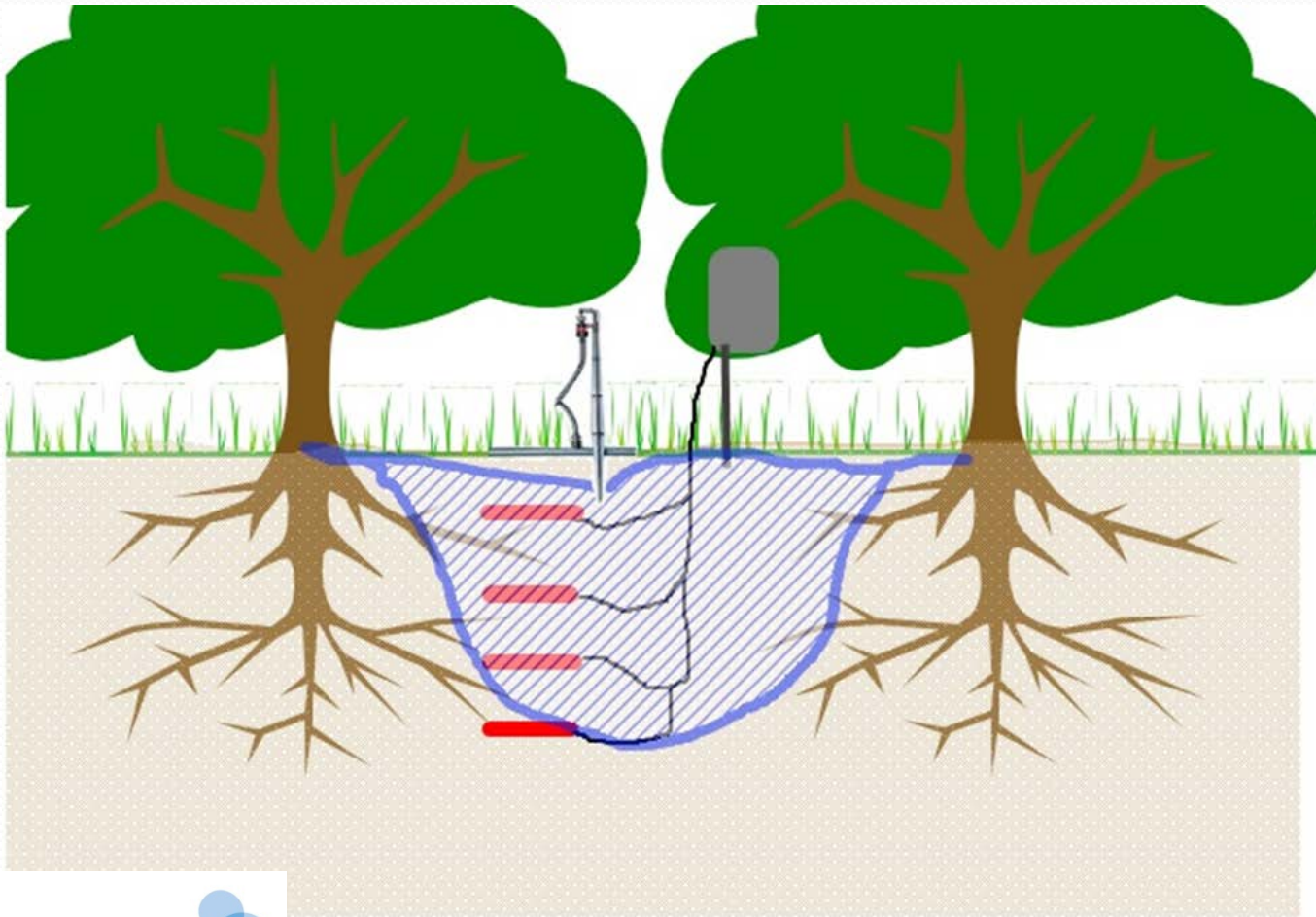
Timing and duration of irrigation events crucial...

- **Don't irrigate too long-** result is water and nutrient move past the effective root zone of the plant, eventually leach in to groundwater
 - I.e.- Sandy soil might require shorter irrigation duration, greater frequency
- Observe where the applied water is going
 - **Infiltration rate** (precipitation rate) greater than the soil will allow, results in run-off, carrying water and chemicals to lower elevations and potentially contaminate streams, canals, and/or well heads where contaminated water collects
- May require **changing** emission devices or irrigation scheduling

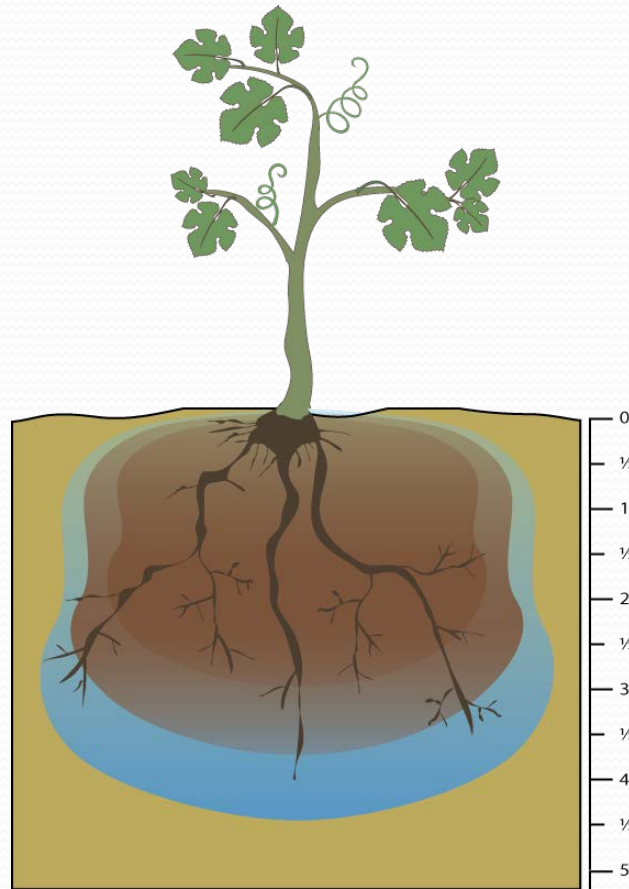
Difference of Water Infiltration Rates Sandy versus Clay Soil



Soil Moisture Sensors



Keep the water and fertilizer in the root zone, don't over irrigate, spoon feed if possible, soil sensors can help...





CONSEQUENCES OF POOR IRRIGATION MANAGEMENT

Irrigation System Leaks



- Water and Chemicals will travel with the water- here next to a well head.
- Especially when injected into the irrigation system.

Example of Improper Irrigation Management in the Central Coast



Photos were taken in the Central Coast region









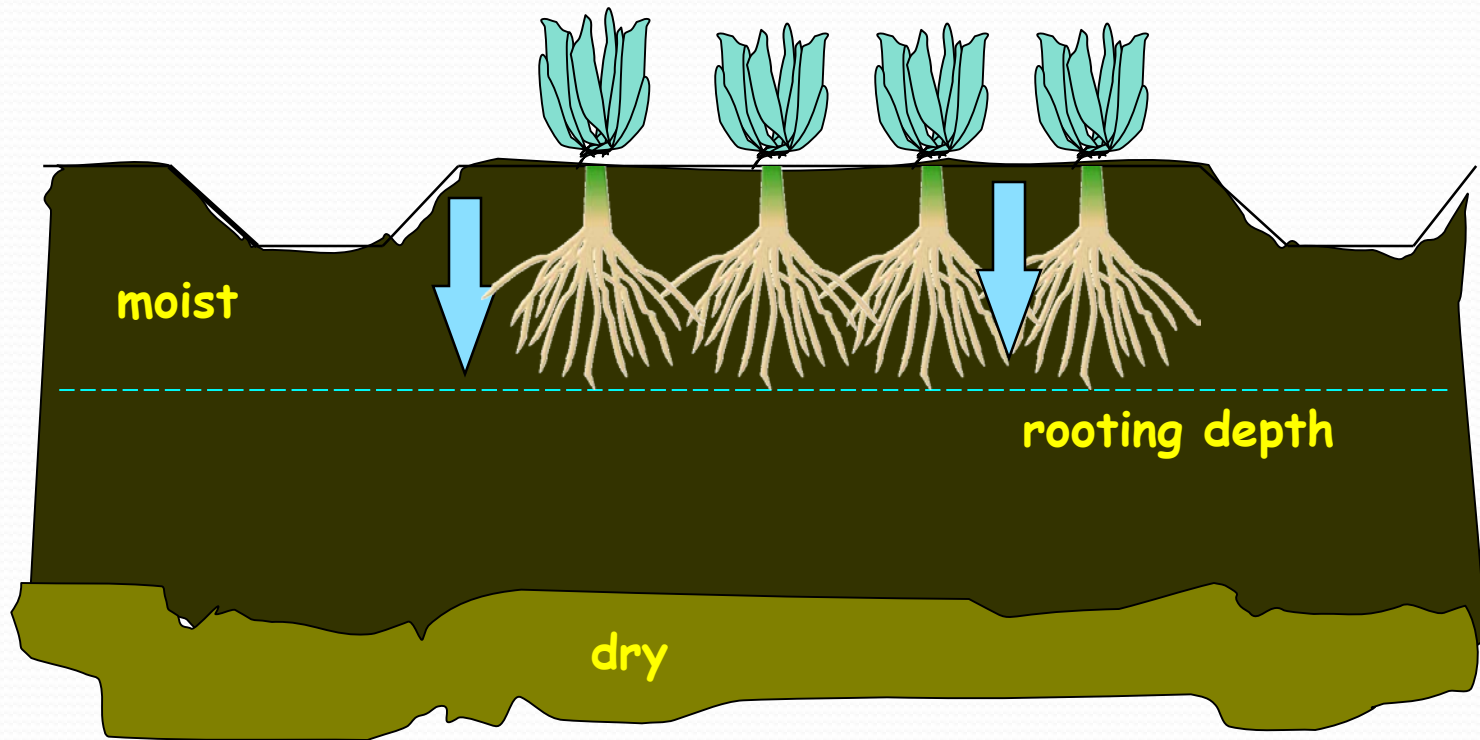


Slides above illustrated movement of surface water from the target area and impact of poor irrigation;

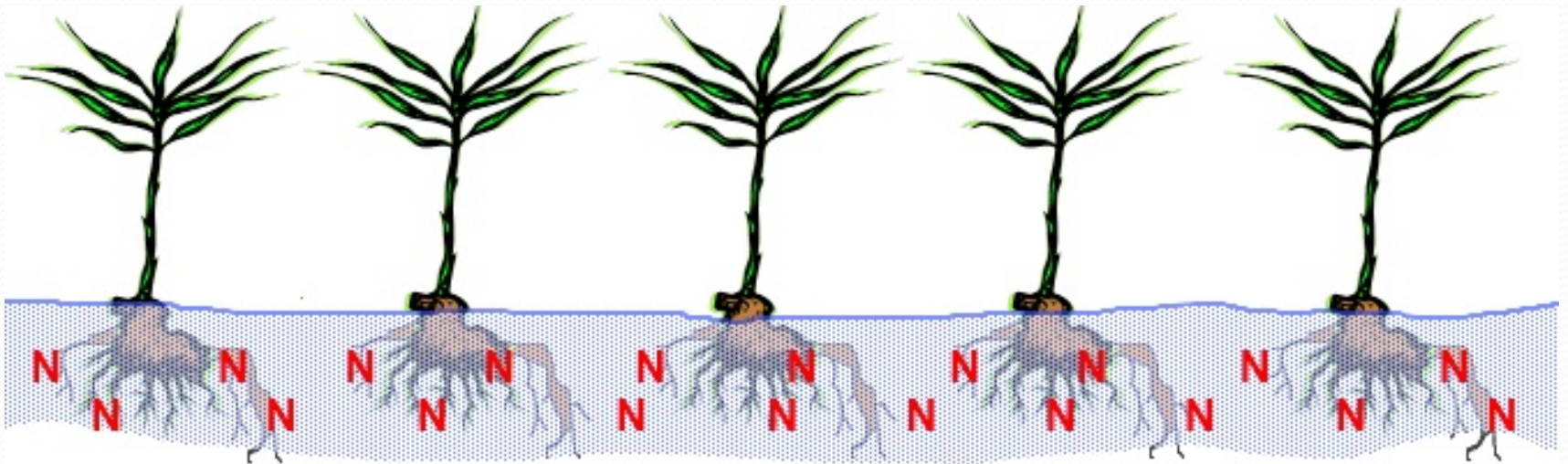
Below we illustrate leaching to groundwater

Losses

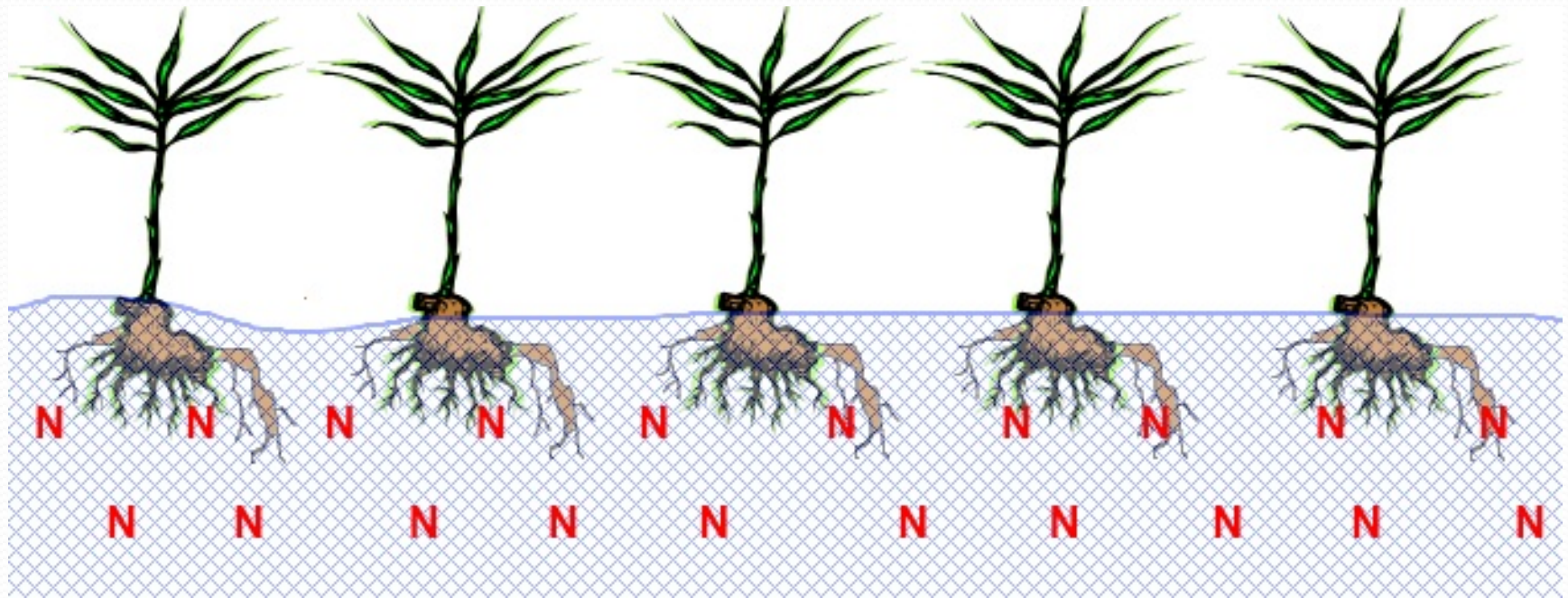
Deep Percolation

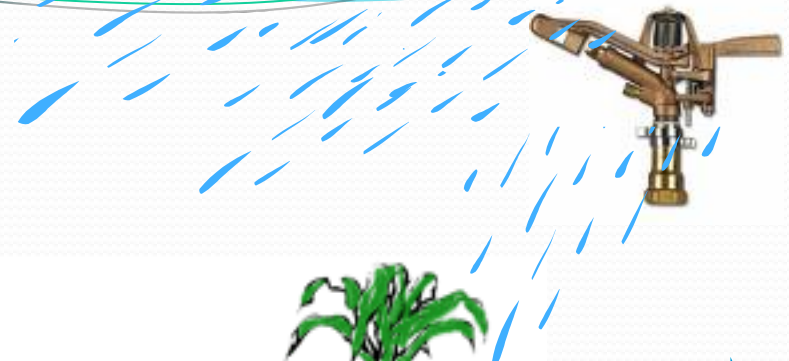


Good Irrigation Management, keeping Nitrates in the root zone

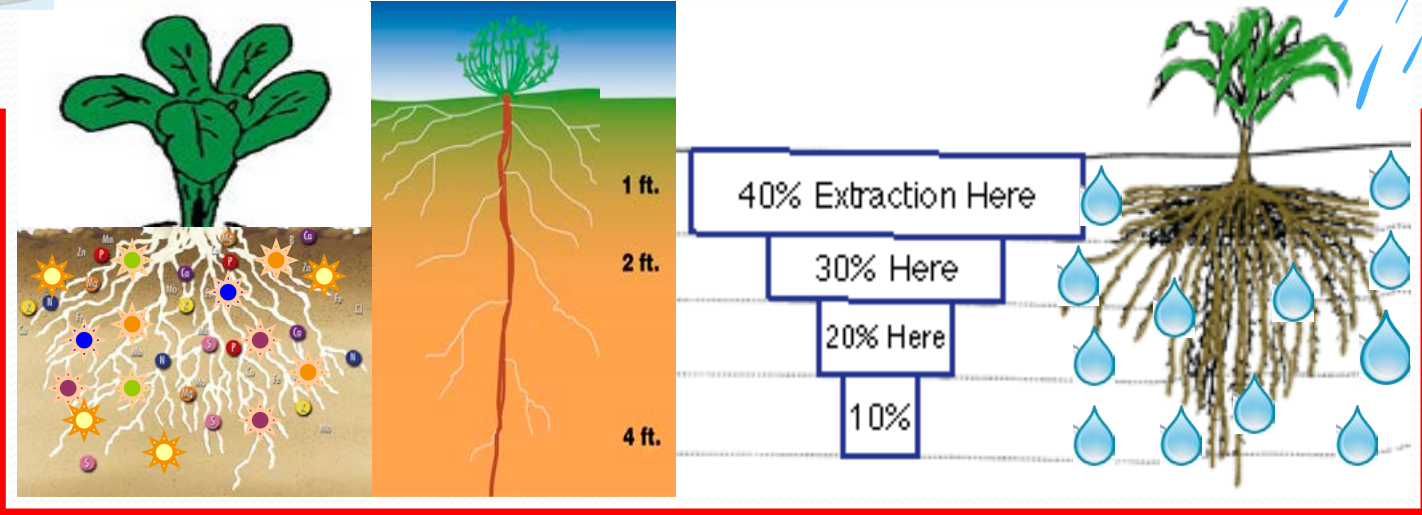


Deep percolation of water and leaching of Nitrates beyond the root zone. The N will eventually end up in groundwater





off site movement



runoff

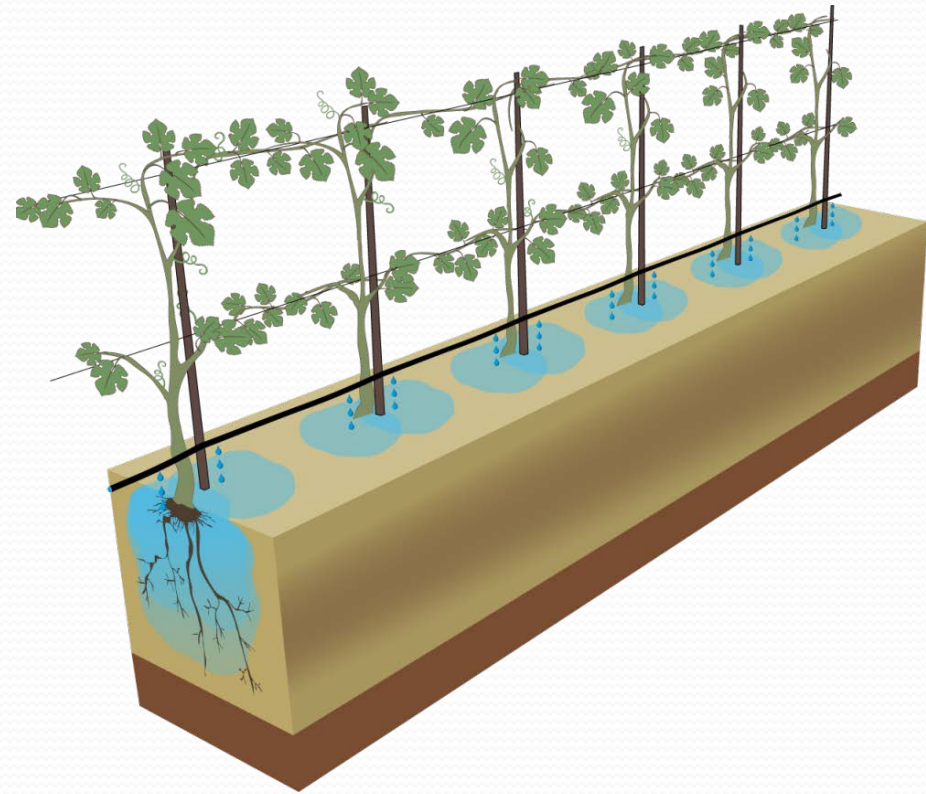
leaching

deep percolation

DU and IE (WUE) to maximize energy and water use efficiency

The irrigation scheduling should keep the water, nutrients and chemicals in the root zone for maximum efficacy,

ELIMINATE SURFACE RUNOFF
REDUCE LEACHING, PROTECT
WATER SOURCES.



Pump Efficiency and Performance...



- Overall Pump Efficiency (OPE)- Measurement of energy in to the pump (Electricity or Fuel Source) versus water energy coming out of the pump
- Advanced Pumping Efficiency Program (APEP) managed by CIT at Fresno State
 - Pump Efficiency Tests
 - Incentives for pump retrofit/ repair

www.pumpefficiency.org



APEP Funding and Organization...

- Funding through PG&E under the auspices of California Public Utilities Commission (CPUC)
- PG&E is Program Manager and has ultimate responsibility
- Center for Irrigation Technology- CIT (a part of CSUFresno) for design and field implementation
- CSU, Fresno Foundation is the sub-contracting entity on behalf of CIT



Conclusions...

1. Efficient irrigation management is vital to protect water sources and water movement
2. Metrics exist to assess irrigation performance
3. Water loss can be minimized, eliminated in many cases
4. Efficient irrigation system is achievable for all growers-but requires regular attention