



# **Irrigation Systems and Nutrient Management**

**Larry Schwankl**

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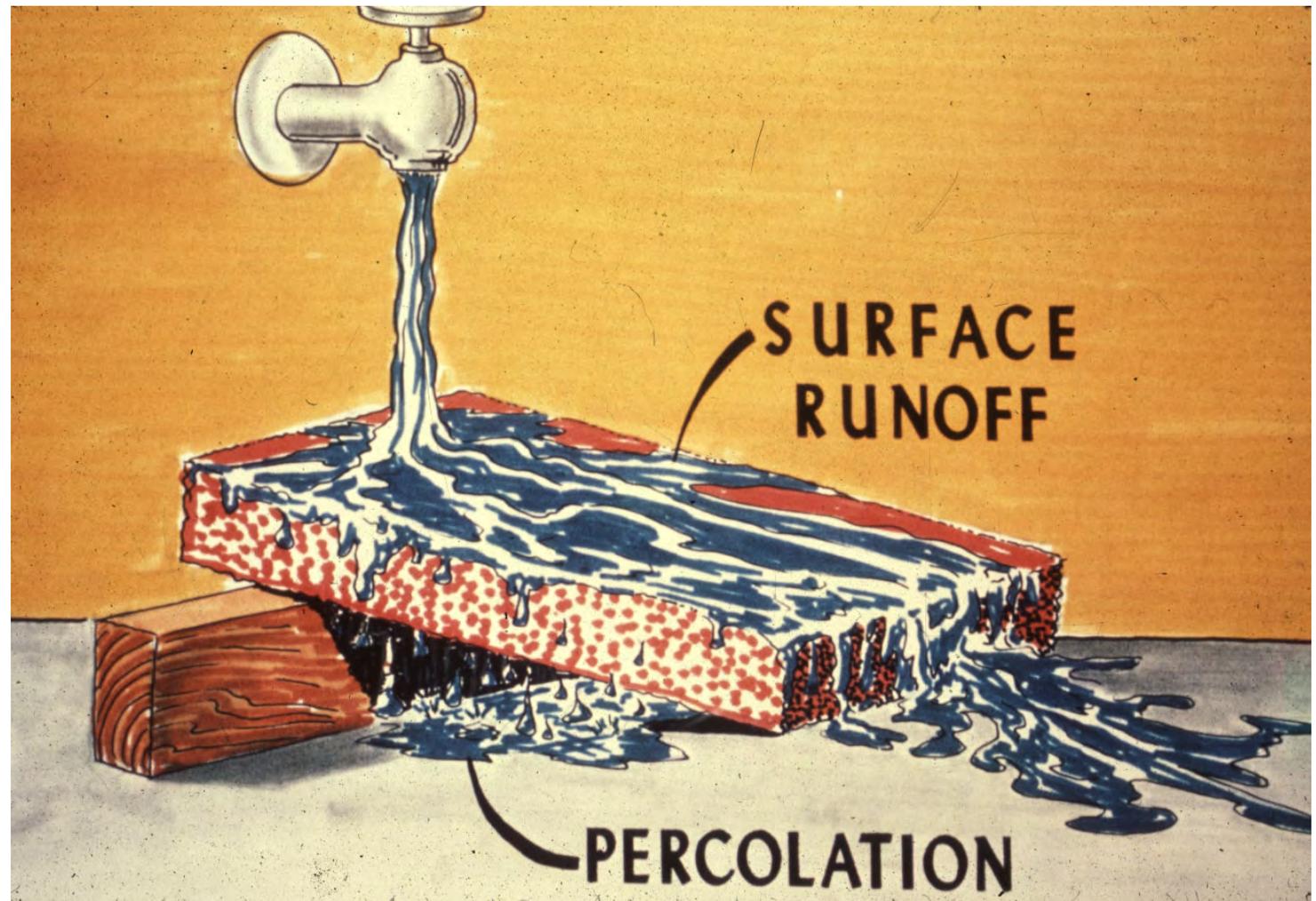
Presentation will be available at: <http://ucanr.edu/schwankl>

# Irrigation Management

- Why is irrigation a big deal when we're dealing with nitrate leaching?

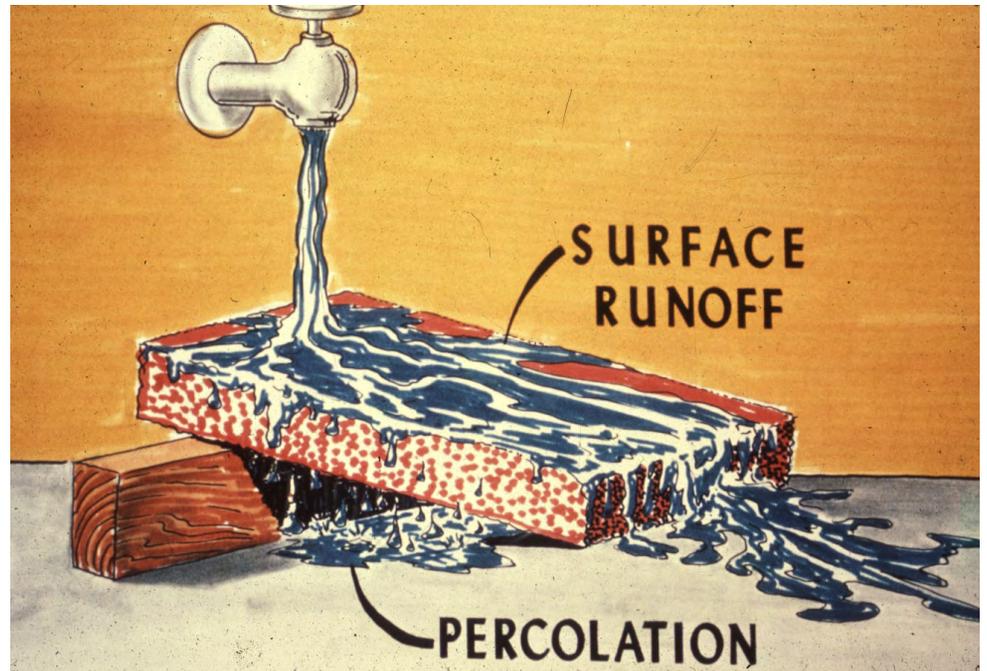


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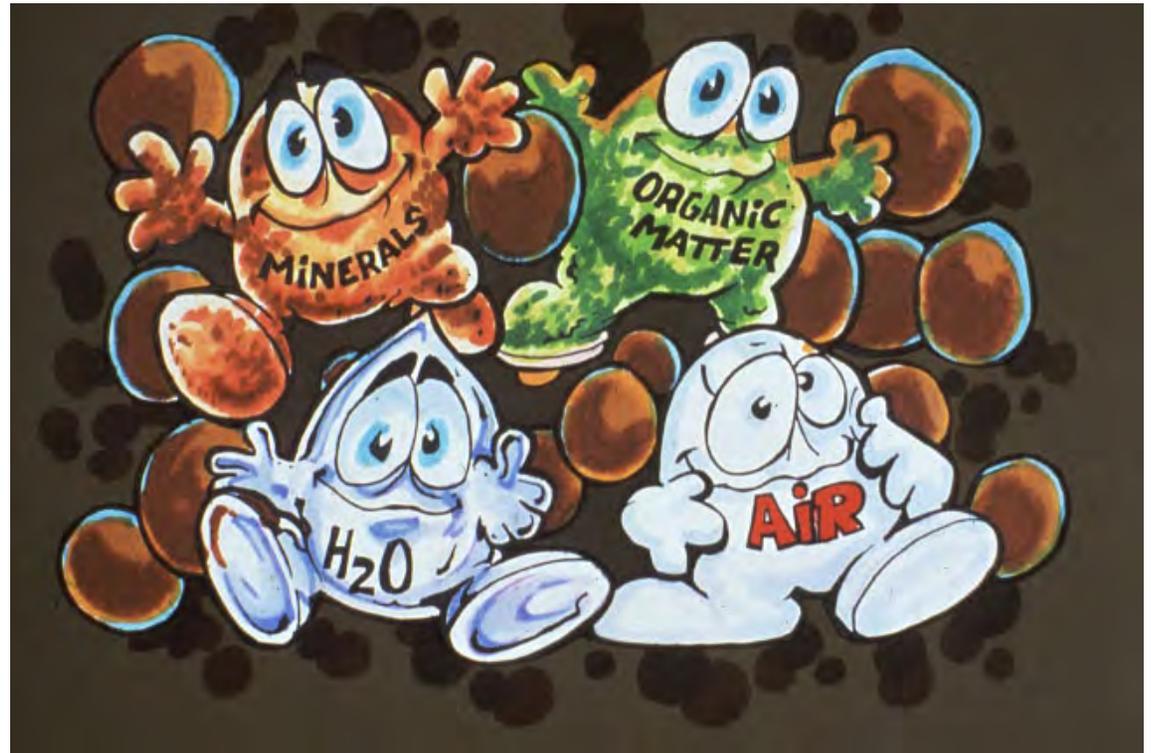
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  - Water can be irrigation water or it can be rainfall.



# Nitrogen and leaching

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- Nitrogen can also be present in the soil in the organic and ammonium forms.
  - These forms do not readily leach.
  - Plants can take up nitrogen in the nitrate or ammonium forms.



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- Mineralization: The organic form is converted by soil microorganisms into ammonium. Other microorganisms then convert the ammonium into nitrate.
- The rate of mineralization is dependent on the soil temp., oxygen supply, and moisture level.
  - The time of conversion can range from days to much longer (months or even years).

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- Nitrogen can also be present in the soil in the organic and ammonium forms.
- Mineralization: The organic form is converted by soil microorganisms into ammonium. Other microorganisms then convert the ammonium into nitrate.
- The rate of mineralization is dependent on the soil temp., oxygen supply, and moisture level.
- Whatever form of N you apply, if it is not taken up by the tree, it is eventually going to be converted to nitrate. If there is water moving through the soil (irrigation or rainfall), it can pick up the nitrate and transport it.

# Nitrate and leaching

- So, water is the transport vehicle for the nitrates.
- If we can minimize the excess water applied to the trees (only apply the water that the trees need), we minimize the nitrate moving below the tree's root zone.
  - The tree water requirements = evapotranspiration (ET)



# Nitrate and leaching

- Good irrigation water management goes a long ways toward achieving good nutrient management.
  - Is it true that “because we use microirrigation, we don’t cause any leaching?”

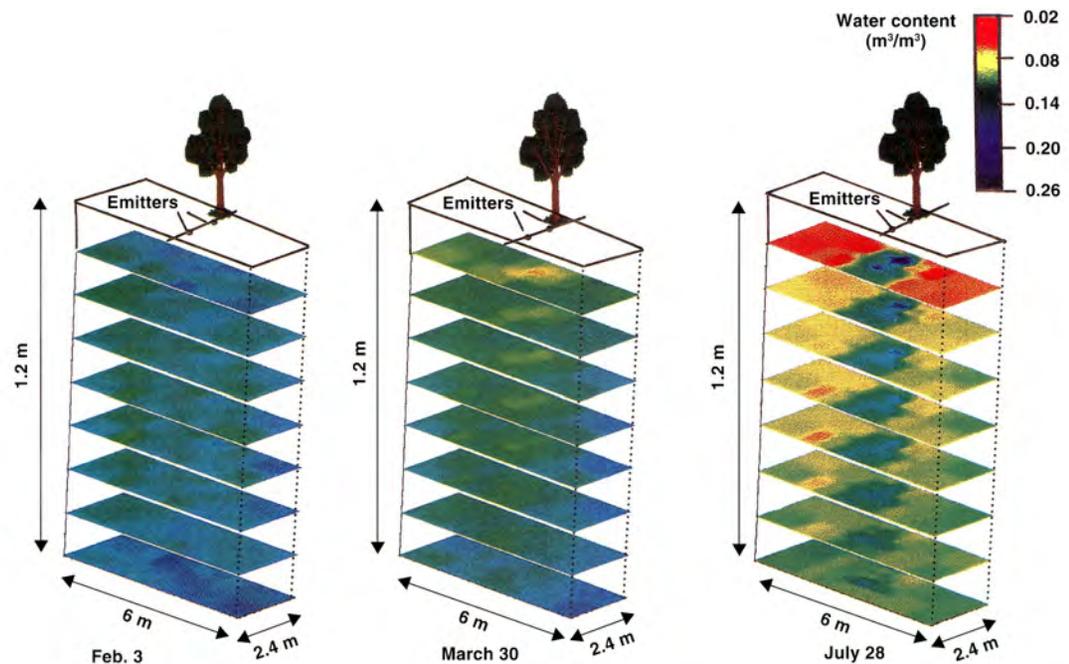


Fig. 1. Soil moisture distribution around an almond tree for 3 days in 1995: Feb. 3, soil moisture profile refilled by winter rains; March 30, soil moisture profile just before beginning irrigations; and July 28, soil moisture profile typical of that under surface drip irrigation during the growing season.

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**How do we reconcile these two?**

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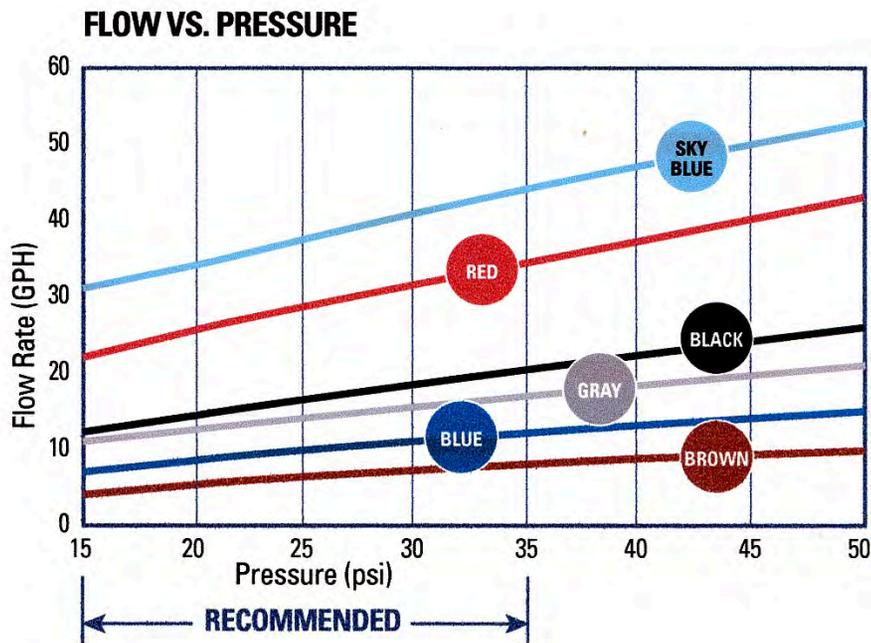
$$\begin{array}{ccccccc} \text{Tree} & & \text{Tree} & & \text{Tree} & & \\ \text{Water use} & = & \text{Water Use} & \times & \text{Spacing} & \times & 0.623 \\ \text{(gal/day)} & & \text{(in/day)} & & \text{(ft}^2\text{)} & & \end{array}$$

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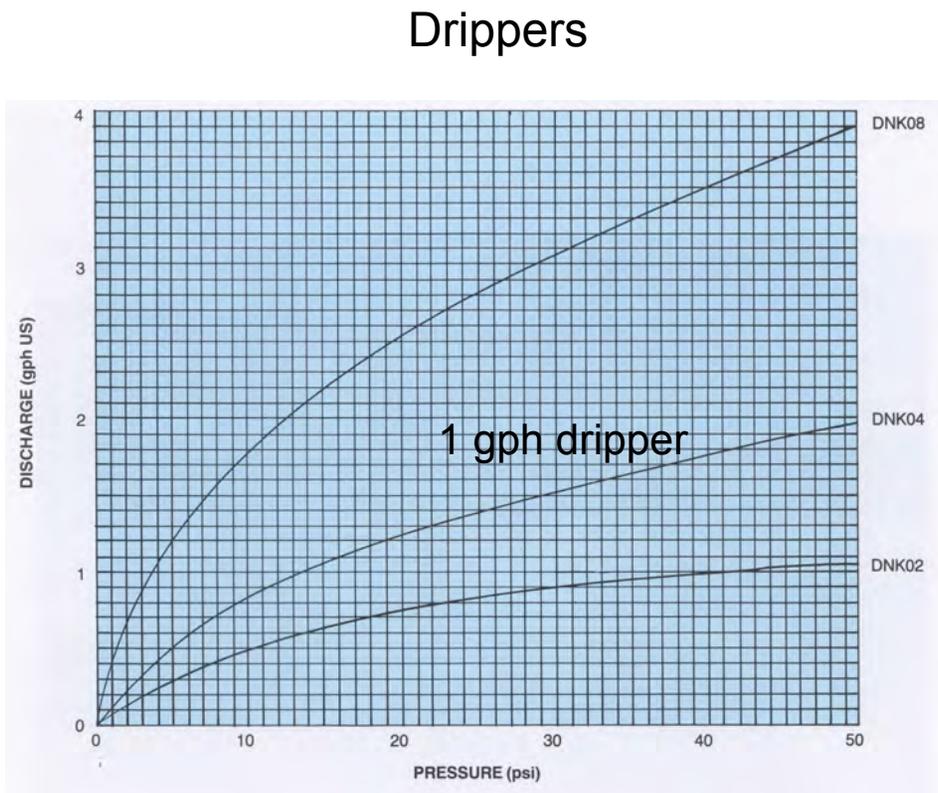
- Determine the tree water needs so you can apply the correct amount of water at the correct time.
- Operate the irrigation system the correct amount of time to replace the soil water used since the last irrigation.
  - Application rate of the irrigation system.
  - Uniformity of the the irrigation system.

# Microirrigation Application Rate

- Do you know what the discharge rate is of your microsprinklers or drippers?



Microsprinklers



# Microirrigation Application Rate

- Do you know what the discharge rate is of your microsprinklers or drippers?
  - Easy to measure in the field.
- See handout at <http://ucanr.edu/schwankl> for more information. It will be under the Powerpoint presentations next to this presentation.

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## Orchard Irrigation Determining the Application Rate & Uniformity of a Microirrigation System

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Determining the application rate of microirrigation systems can be confusing because irrigation scheduling and tree water use information is usually presented in inches per day (in/day), while discharge from microirrigation emitters is measured in gallons per hour (gph). The following may be helpful in determining required operating times for microirrigation systems.

# Microirrigation Application Rate

- Do you know what the discharge rate is of your microsprinklers or drippers?
  - Easy to measure in the field.
  - You will find that the discharge from the drippers or microsprinklers will vary, sometimes quite a bit.
    - Caused by pressure differences and possibly by clogging.



# **Microirrigation Application Uniformity**

- A measure of how evenly water is applied to the orchard. Quantifies the variability of the field measurements.

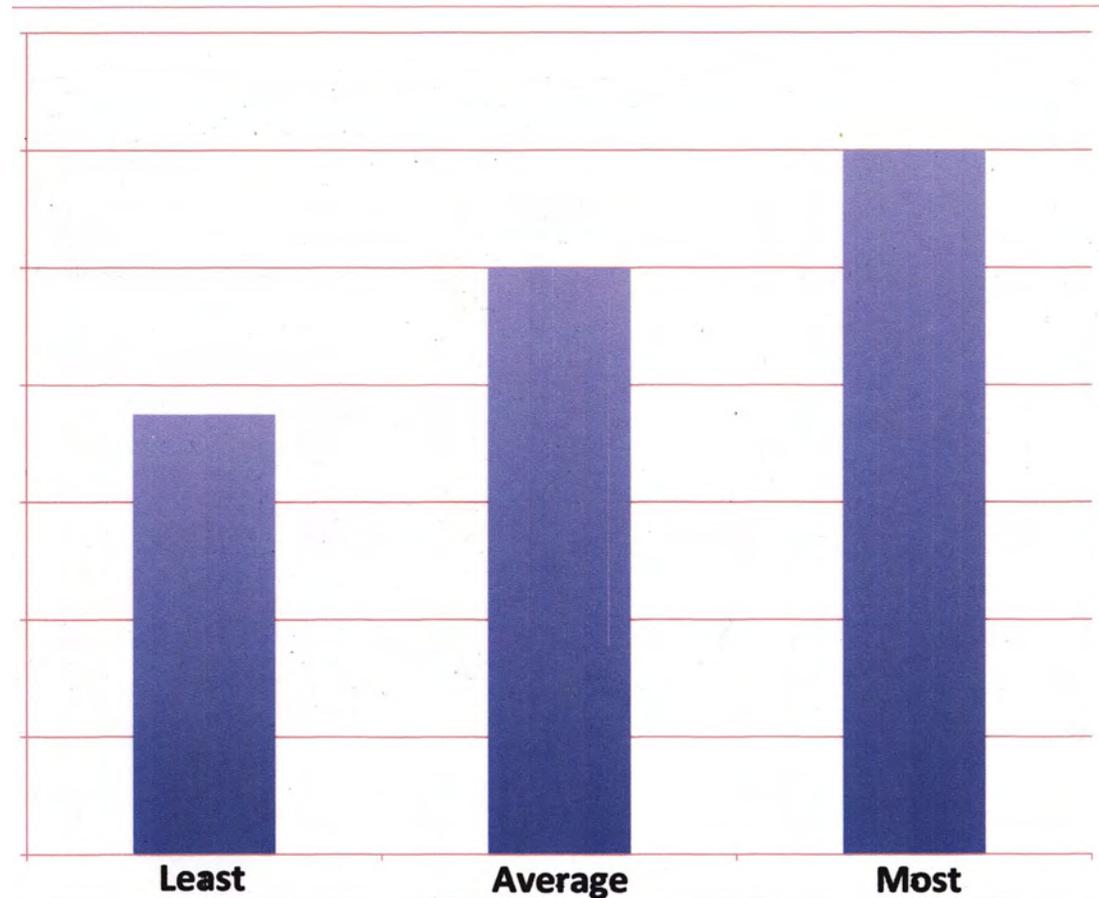
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- If the irrigation system is non-uniform, you have to apply additional water (to the entire orchard) to make sure the areas of the orchard receiving the least water get adequately irrigated.



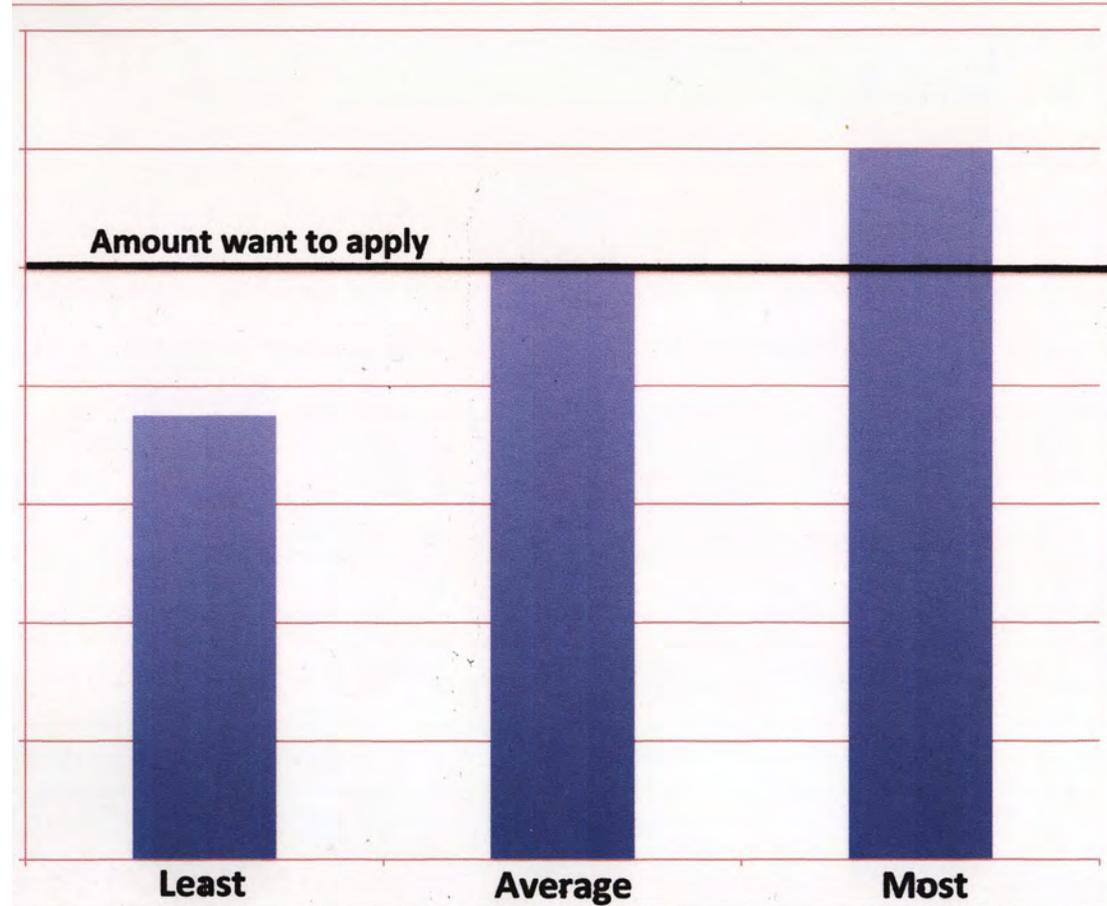
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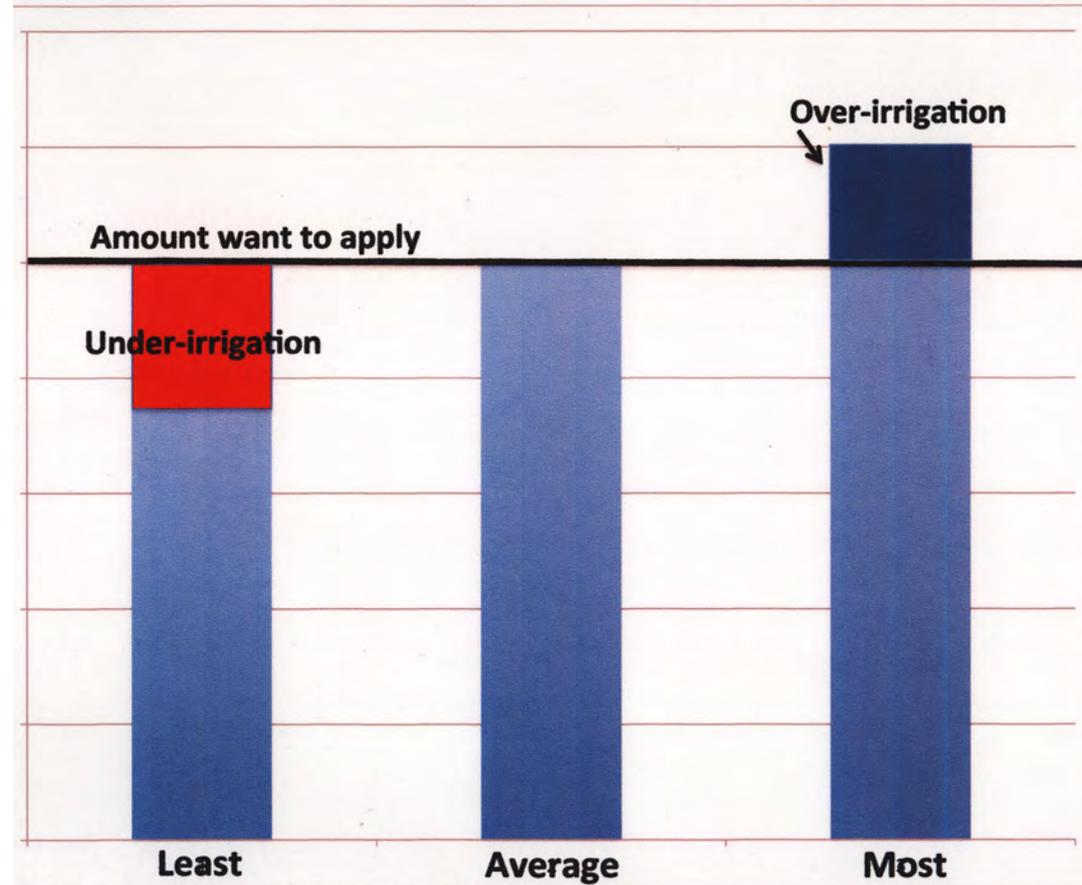
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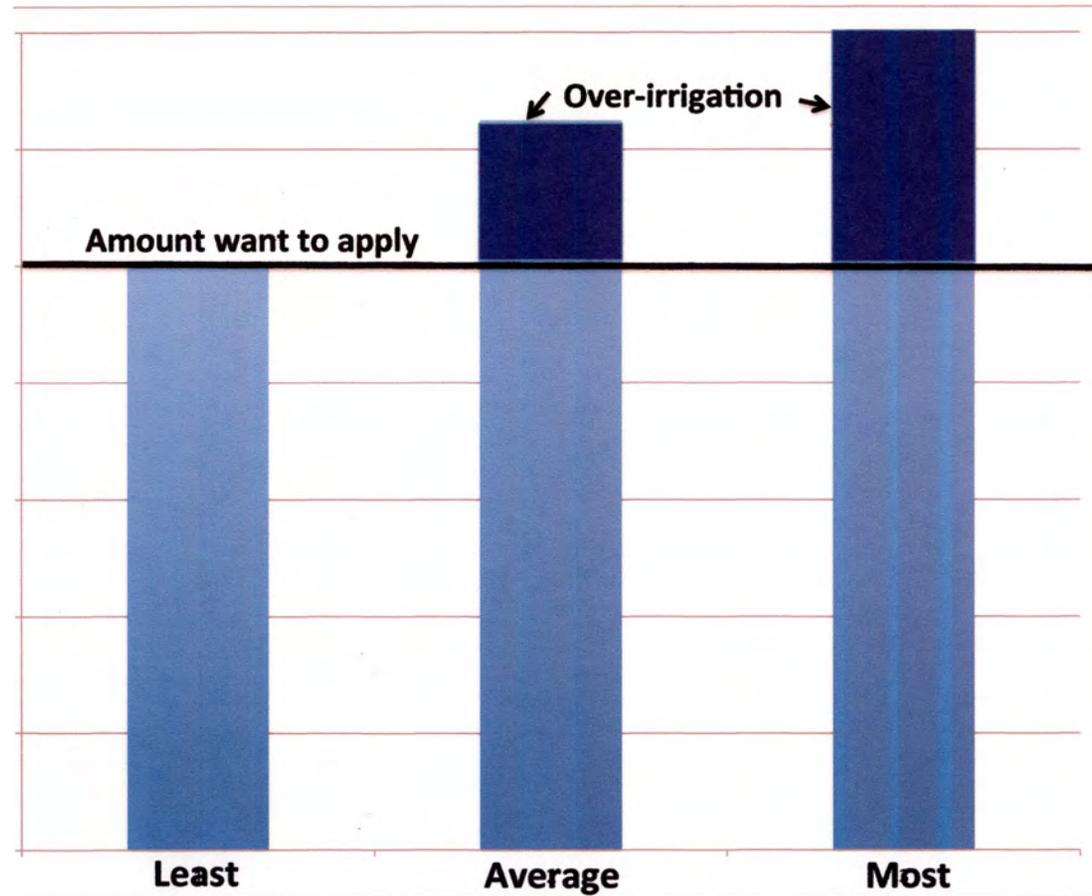
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- Operate the irrigation system the correct amount of time to replace the soil water used since the last irrigation.
- Apply the N at the correct amount and at the correct time.
- Don't want excess nitrate in the soil going into winter rains since it could be leached by rainfall.

# Questions?

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