

# Getting the Most From Your Irrigation System

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**Powerpoint at: <http://ucanr.edu/schwankl>**



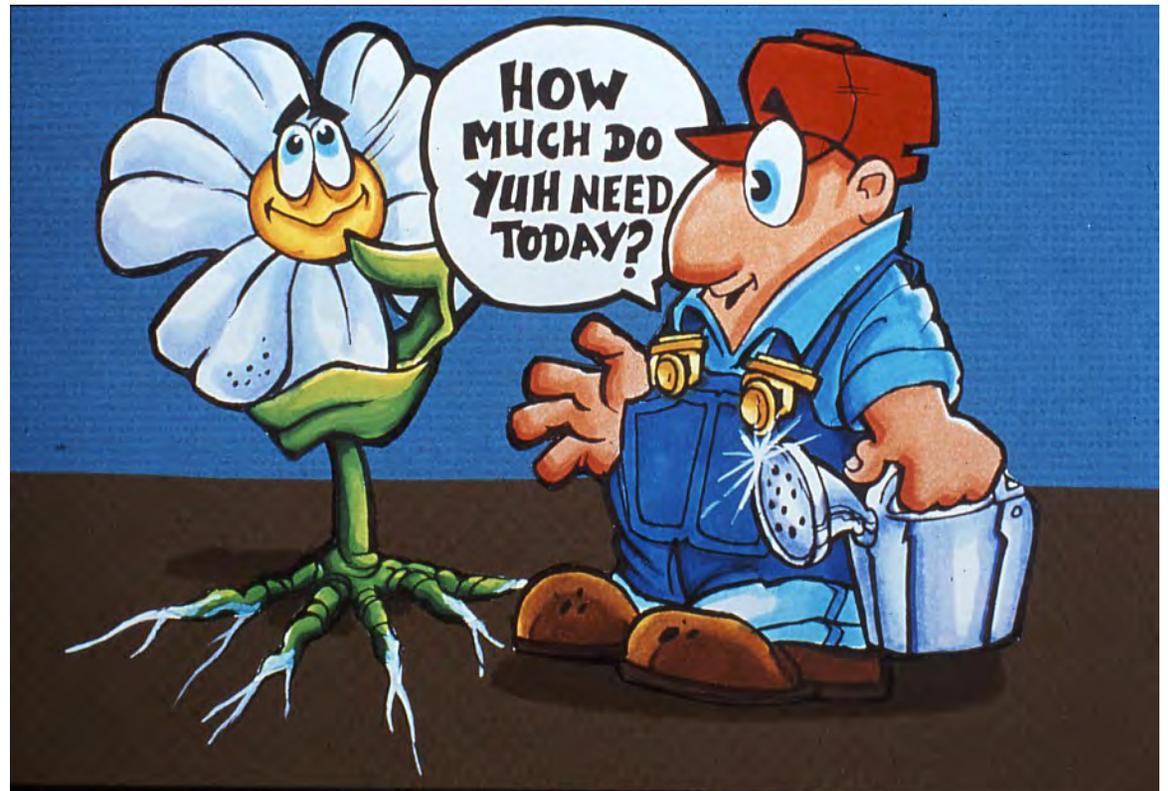
# Irrigation Systems

- Types of irrigation systems:
  - Surface irrigation – furrow and border strip



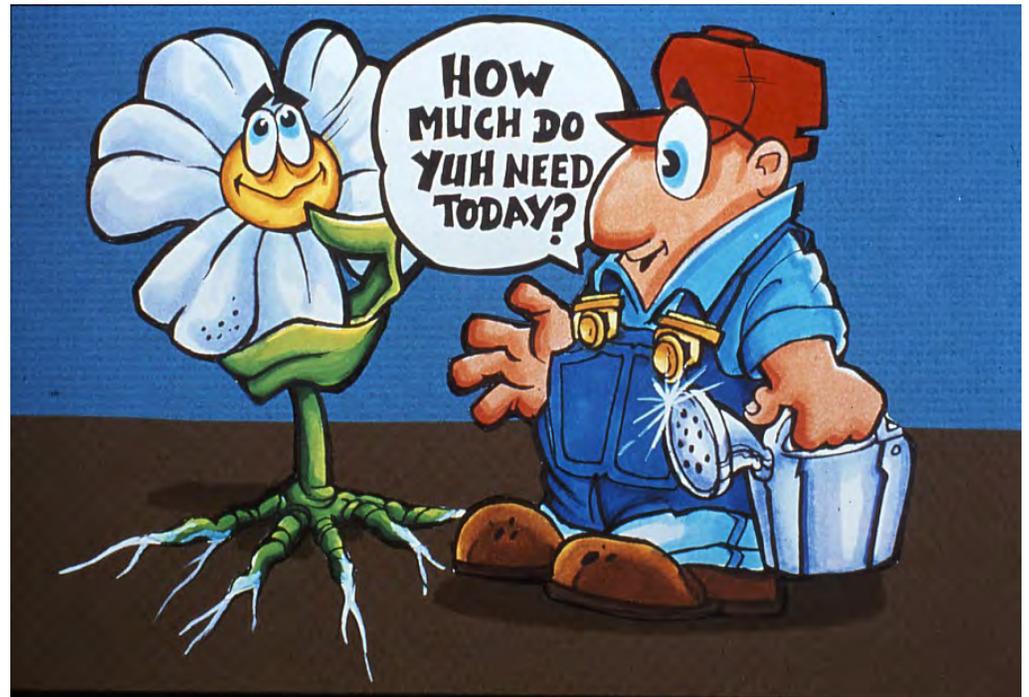
# How Do We Become Efficient Irrigators?

- Know how much water to apply.



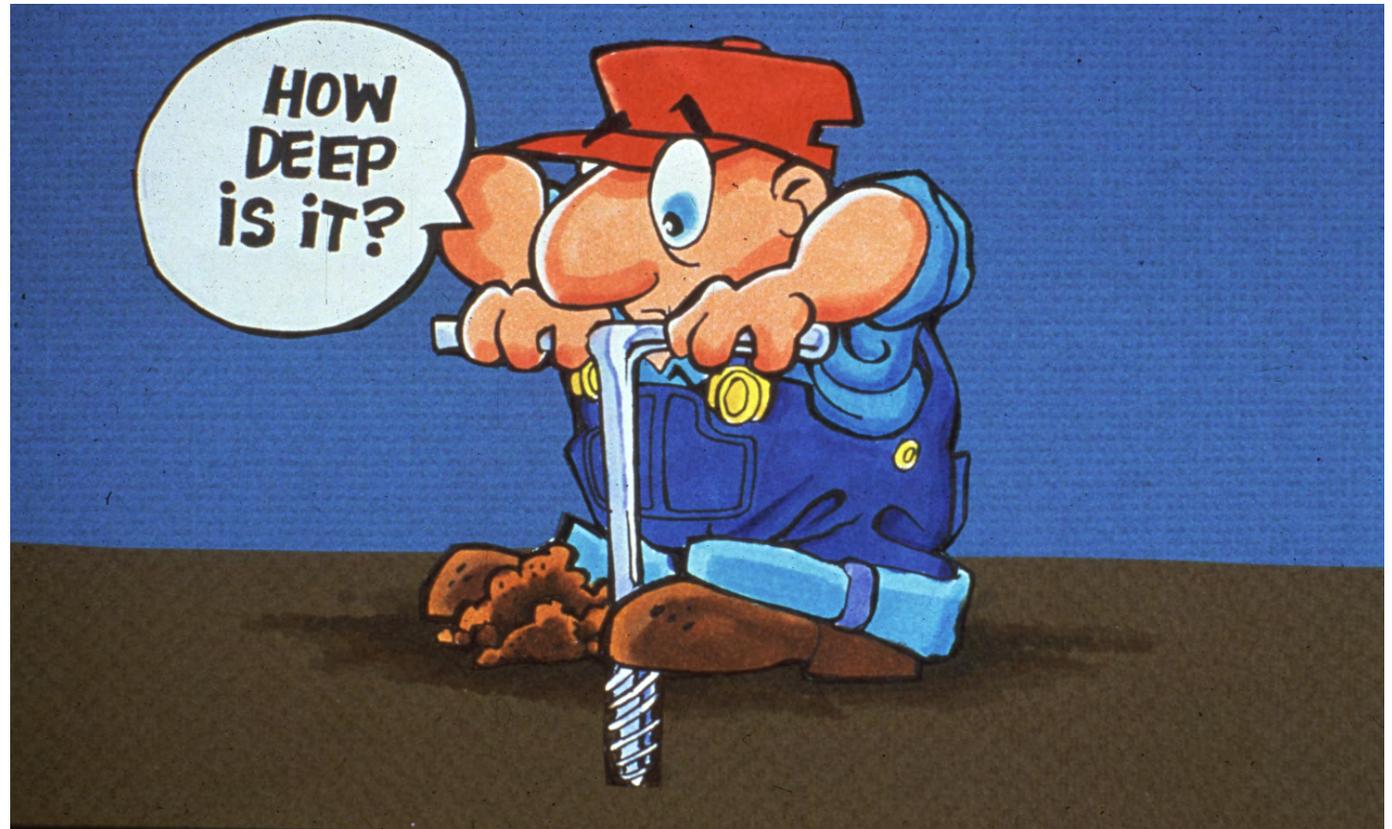
# How Do We Become Efficient Irrigators?

- Know how much water to apply.
  - Irrigation Scheduling.



# Irrigation Scheduling

- Approaches:
  - Monitor the soil



# Irrigation Scheduling

## Approaches:

- Monitor the soil

- There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.



# Irrigation Scheduling

## Approaches:

- Monitor the soil
  - There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.
  - Most tell when to irrigate, but not all provide how much to irrigate.**

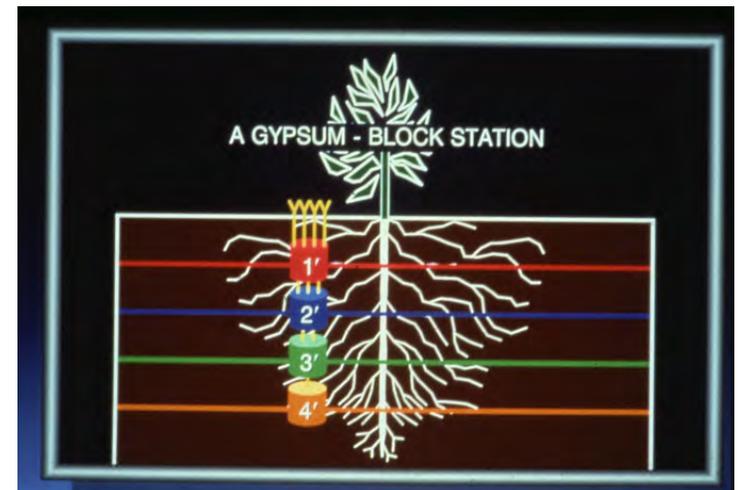


# Irrigation Scheduling

## ▪ Approaches:

### ▪ Monitor the soil

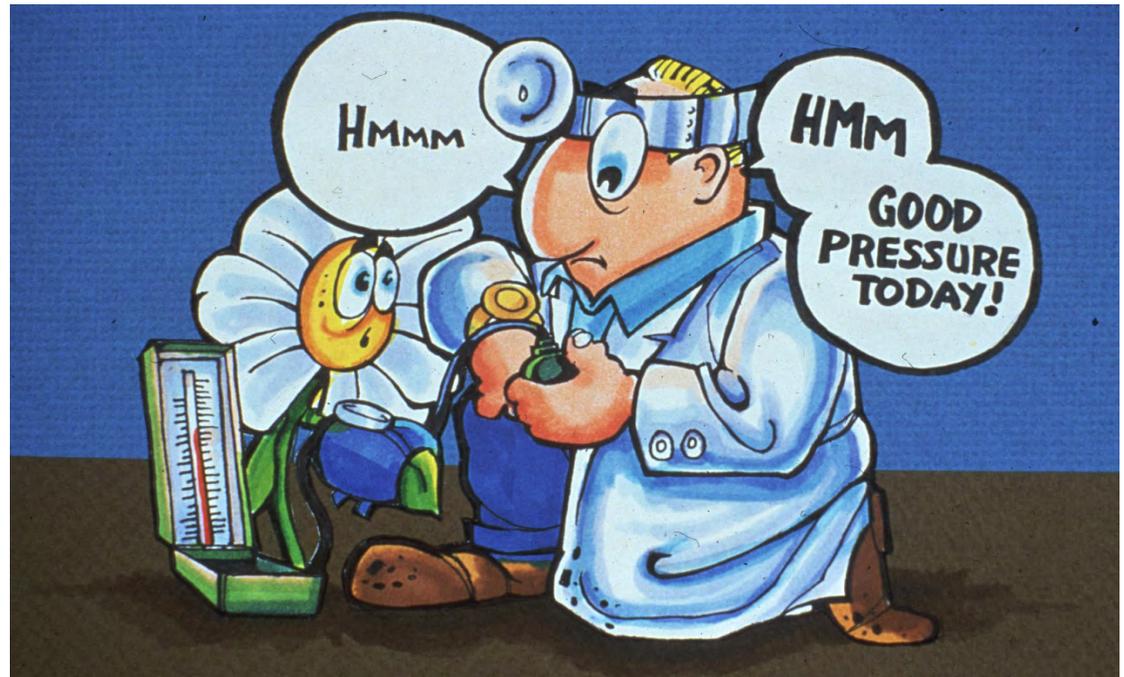
- There are numerous techniques, soil moisture monitoring devices, and soil moisture monitoring services available.
- Most tell when to irrigate, but not all provide how much to irrigate.
- **Effectiveness is subject to representative placement of sensors and good understanding of the crop root zone.**



# Irrigation Scheduling

## Approaches:

- Monitor the soil
- Monitor the plant



# Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure chambers, etc.).



# Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure bombs, etc.).
    - **Information available for some crops & not for others.**
    - **Methods tend to be labor intensive – working towards automation.**



# Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
    - Relatively new approach (infrared thermometers, pressure bombs, etc.).
    - Information available for some crops & not for others.
    - Methods tend to be labor intensive – difficult to automate.
    - **Readings tell you When to irrigate (plant is stressed) but not How Much.**



# Irrigation Scheduling

- Approaches:

- Monitor the soil

- Monitor the plant

- Relatively new approach (infrared thermometers, pressure bombs, etc.).
    - Information available for some crops & not for others.
    - Methods tend to be labor intensive – difficult to automate.
    - Readings tell you when to irrigate (plant is approaching critical stress level) but not How Much.

- **How much water is needed can be learned with experience or by coupling plant monitoring with other approaches (i.e. ET).**



# Irrigation Scheduling

- Approaches:

- Monitor the soil

- Monitor the plant

- Monitor the weather**

- Climatic conditions drive the water use of plants.**



# Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - **Monitor the weather**
    - Monitor the weather and use it to estimate crop ET.



# Irrigation Scheduling

## Approaches:

- Monitor the soil
- Monitor the plant
- Monitor the weather
  - California has the CIMIS network to provide the weather info. and estimates of Reference Crop ET (ET of pasture grass).



# Irrigation Scheduling

- Approaches:

- Monitor the soil
- Monitor the plant
- Monitor the weather
  - Monitor the weather and use it to estimate crop ET.
  - **Tells us both When and How Much to irrigate.**



# Irrigation Scheduling

- Approaches:
  - Monitor the soil
  - Monitor the plant
  - Monitor the weather
    - California has the CIMIS network to provide the weather info. and estimates of Reference Crop ET (ET of pasture grass).
    - **Sometimes a challenge with annual crops due to canopy development.**



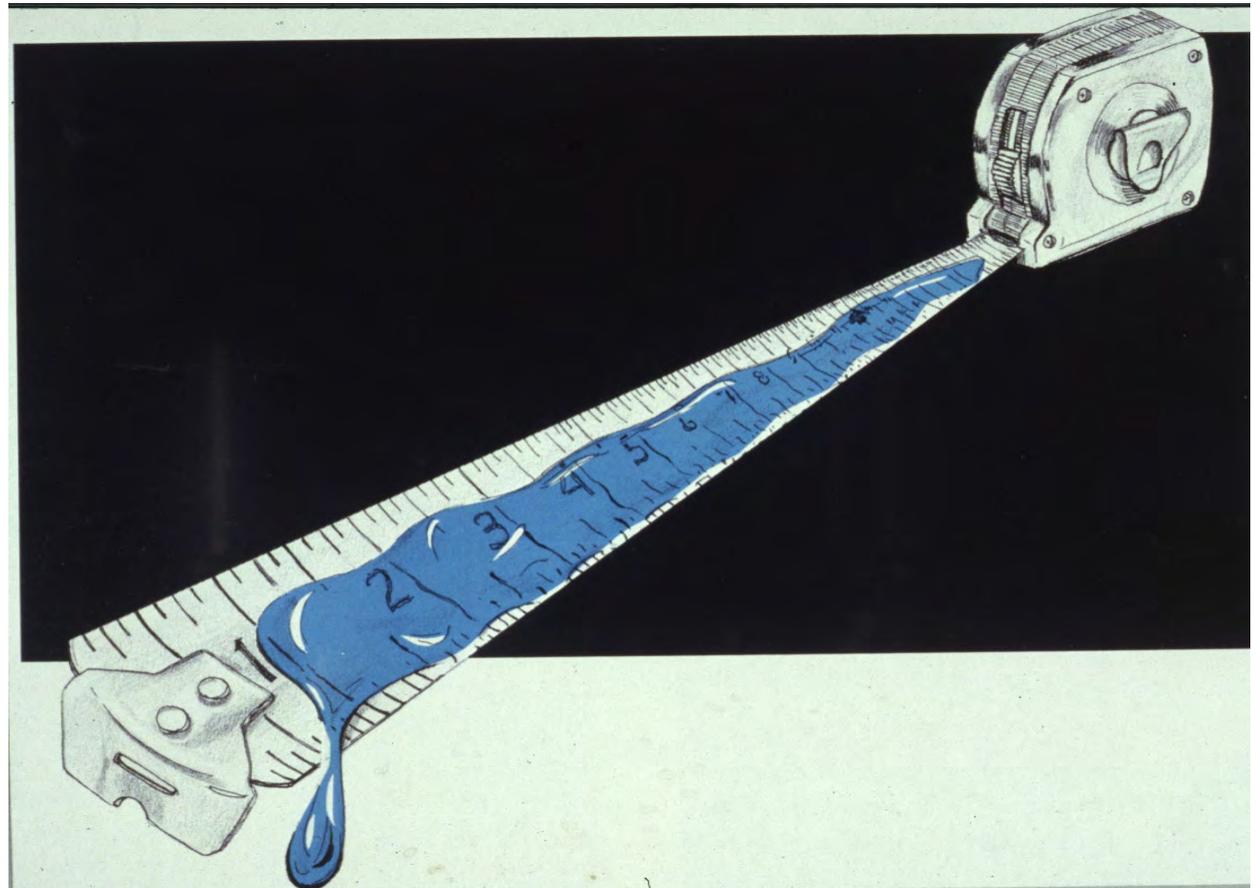
# How Do We Become Efficient Irrigators?

- Know how much water to apply.
- Apply the correct amount of water with a good irrigation system.



# Applying the Correct Amount of Water

- Need to know how much water is being applied – critical.



# Need to Measure the Applied Water



# Measuring Applied Irrigation Water

- **How much water is being applied?**
  - **Measure with a flow meter.**
    - **They need to be installed correctly and they have their challenges, but every irrigation system should have a flow meter.**



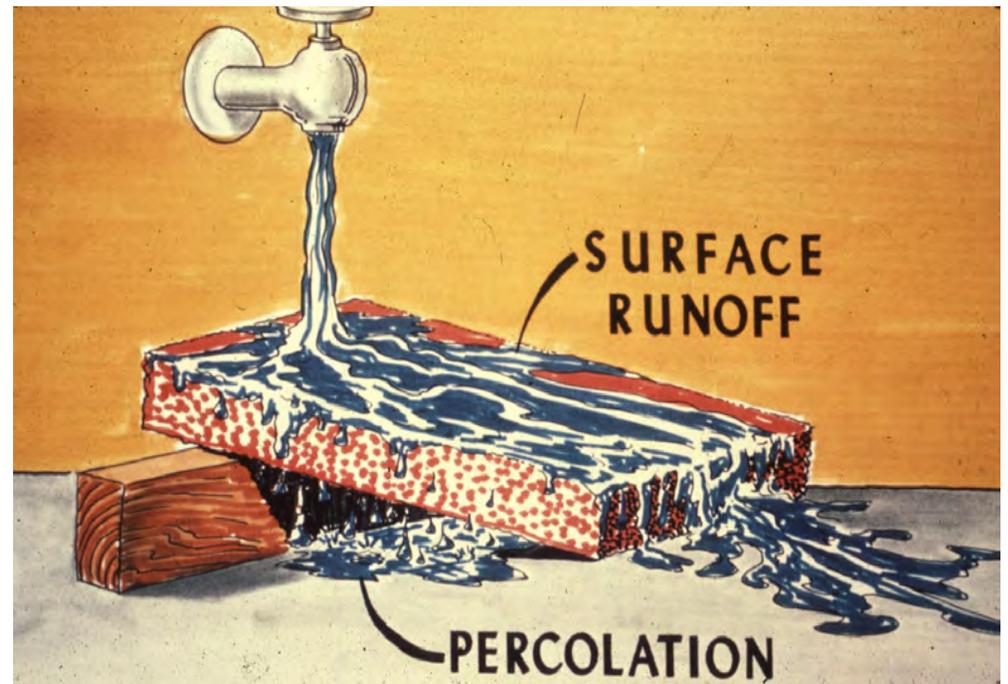
# Surface Irrigation Systems:

- What is a “good irrigation system”?



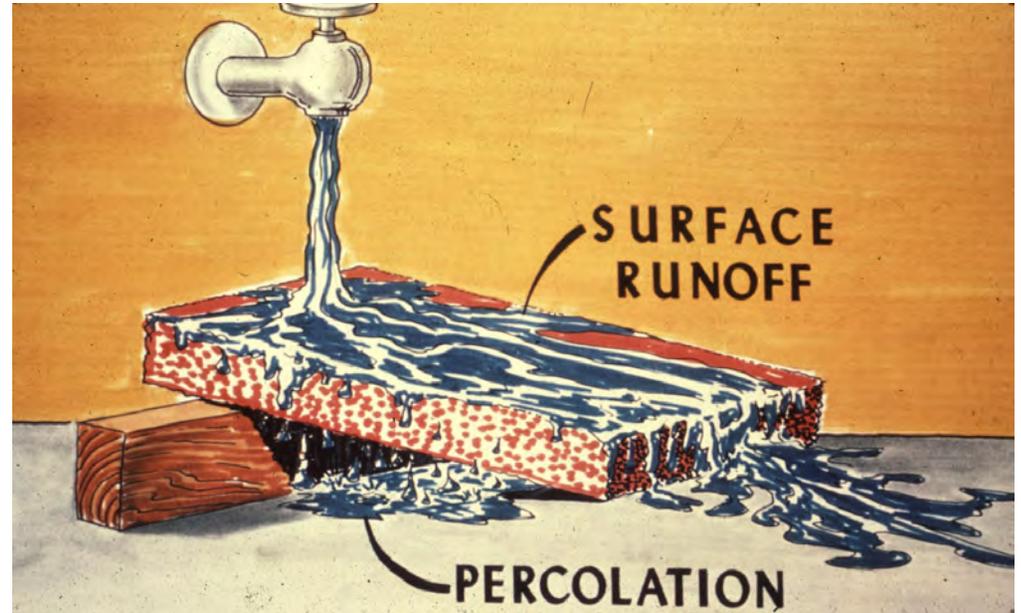
# Surface Irrigation Systems:

- What is a “good irrigation system”?
- Allows you to put on just the right amount of water to refill the crop’s root zone – Irrigation Efficiency.



# Irrigation Efficiency

$$\text{Irrigation Efficiency (\%)} = \frac{\text{Beneficially - Used Water}}{\text{Total Water Applied}} \times 100$$

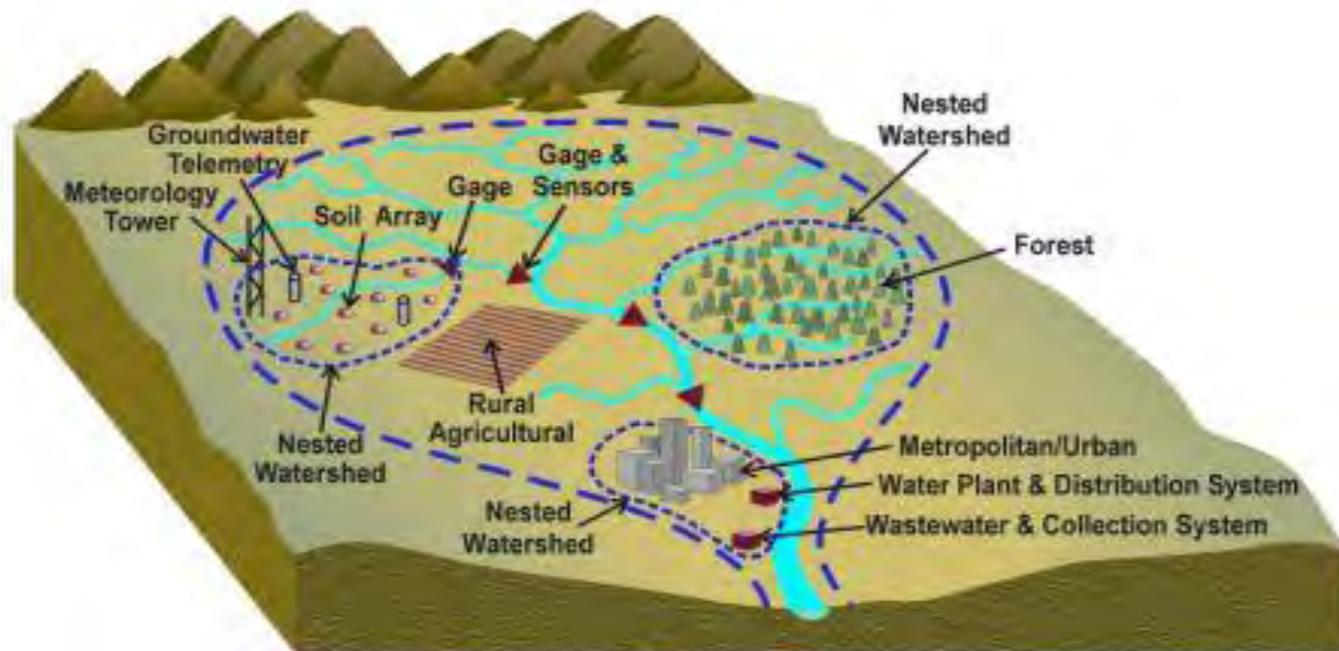


# Irrigation Efficiency

Different people arrive at different estimates for Irrigation Efficiency. Why?

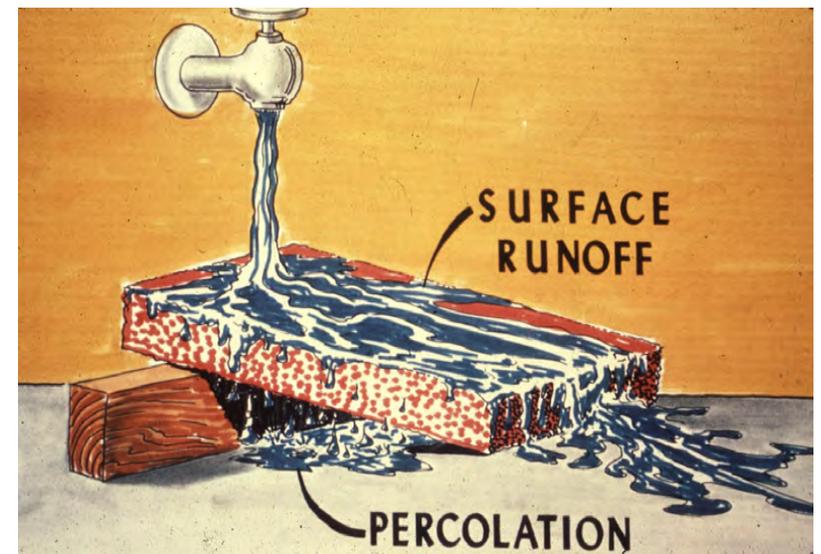
Field scale – vs – Watershed or basin scale

Single irrigation – vs – Sum of several irrigations in a season



# Surface Irrigation Systems:

- What is a “good irrigation system”?
  - Allows you to put on just the right amount of water to refill the crop’s root zone - Efficiency.
  - Apply the same amount of water to all portions of the field – Irrigation Uniformity.

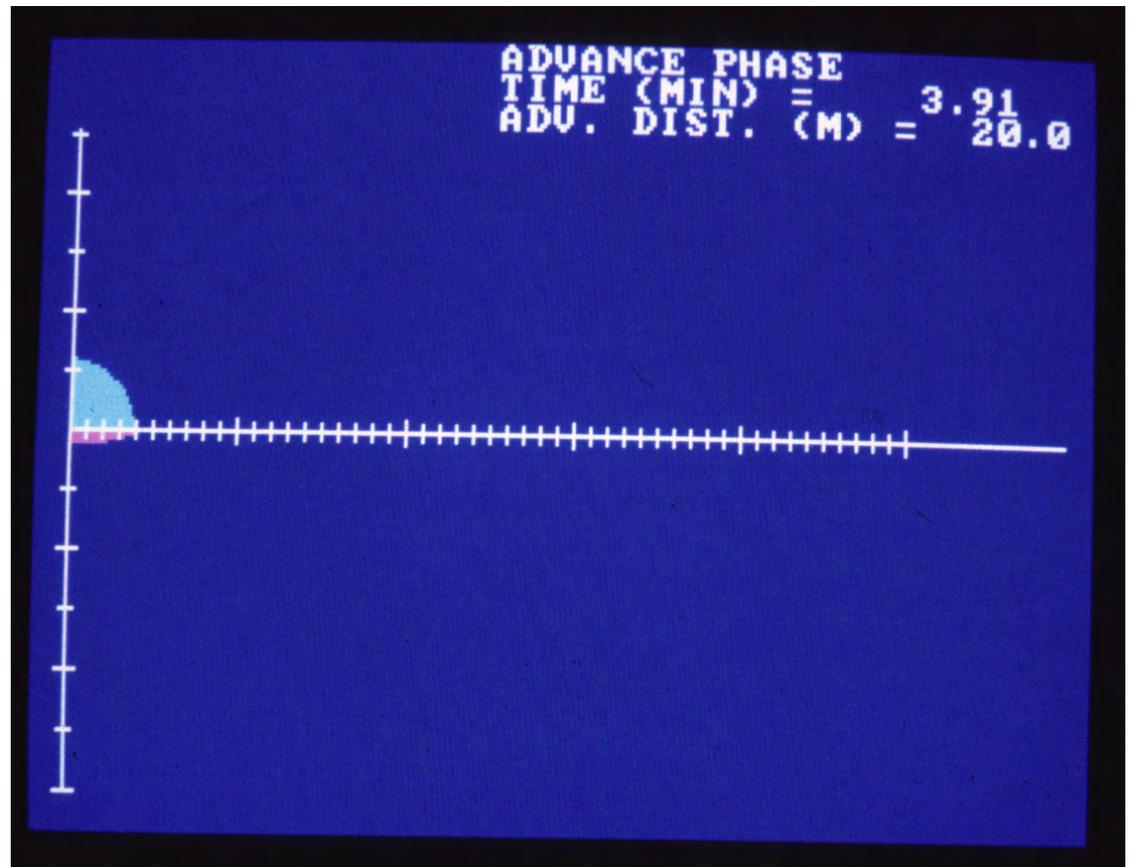


# **Irrigation Uniformity**

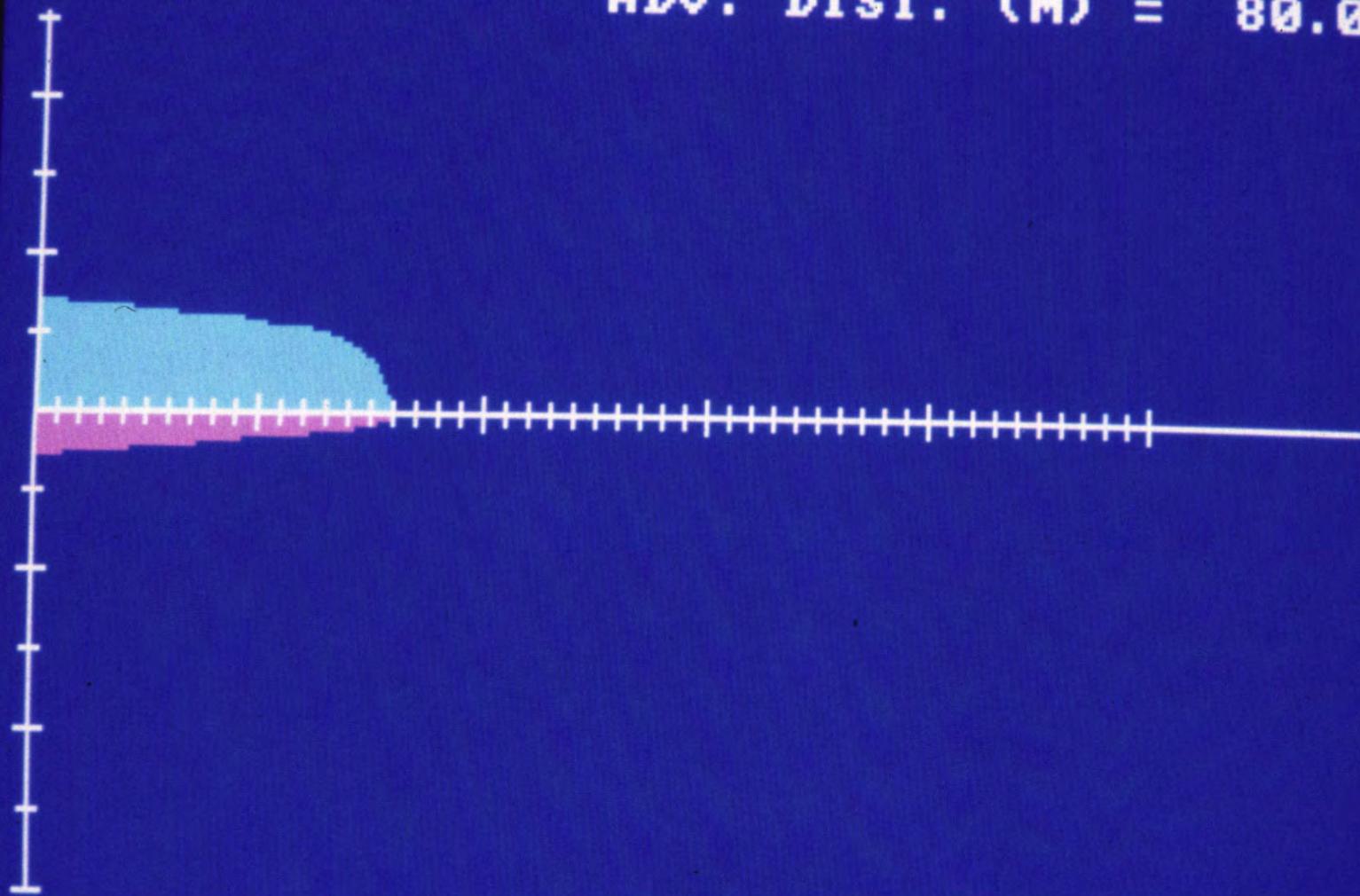
- **Measure of how evenly water is applied to the field.**

# Irrigation Uniformity

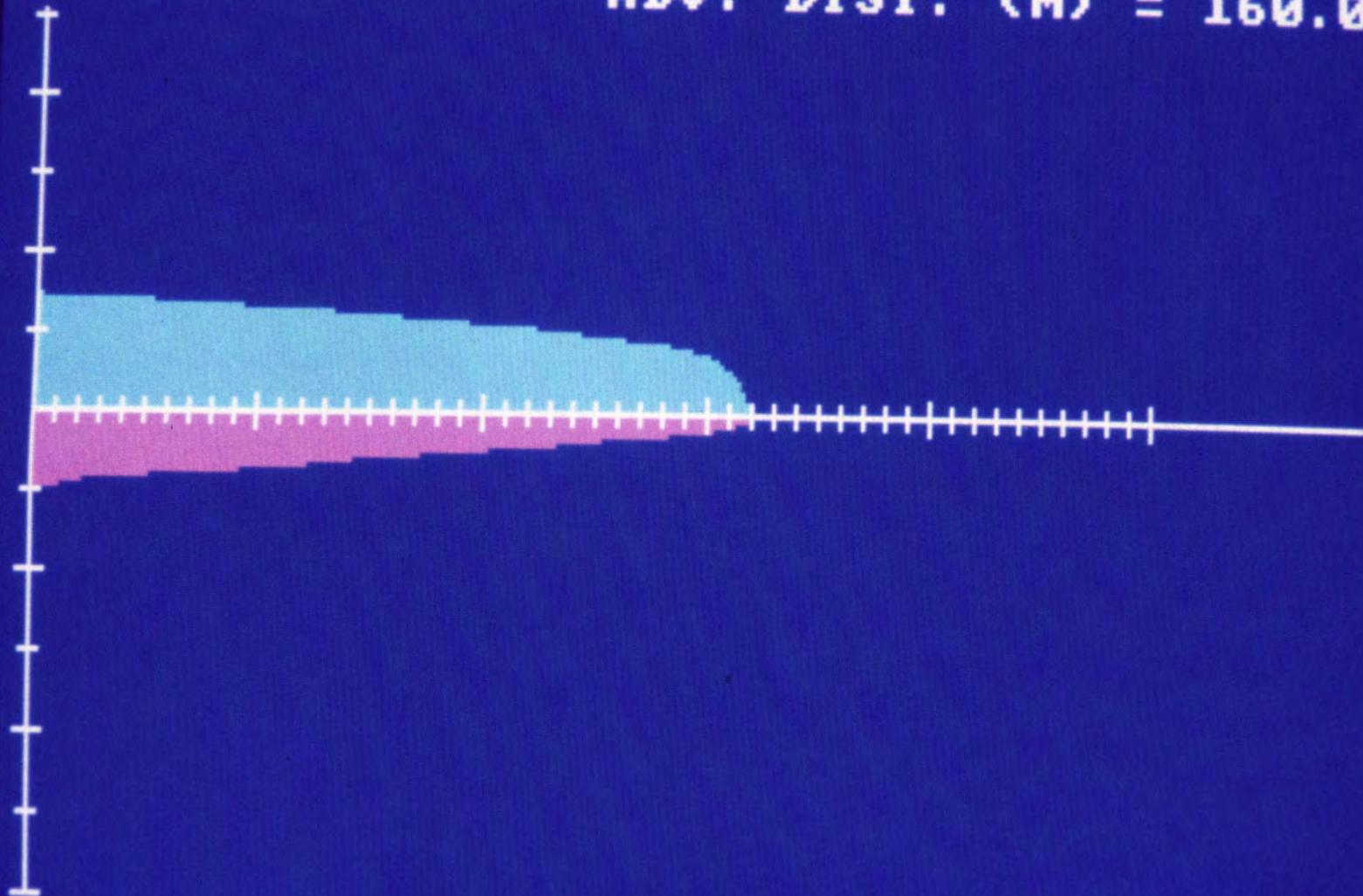
- What's happening when we irrigate?



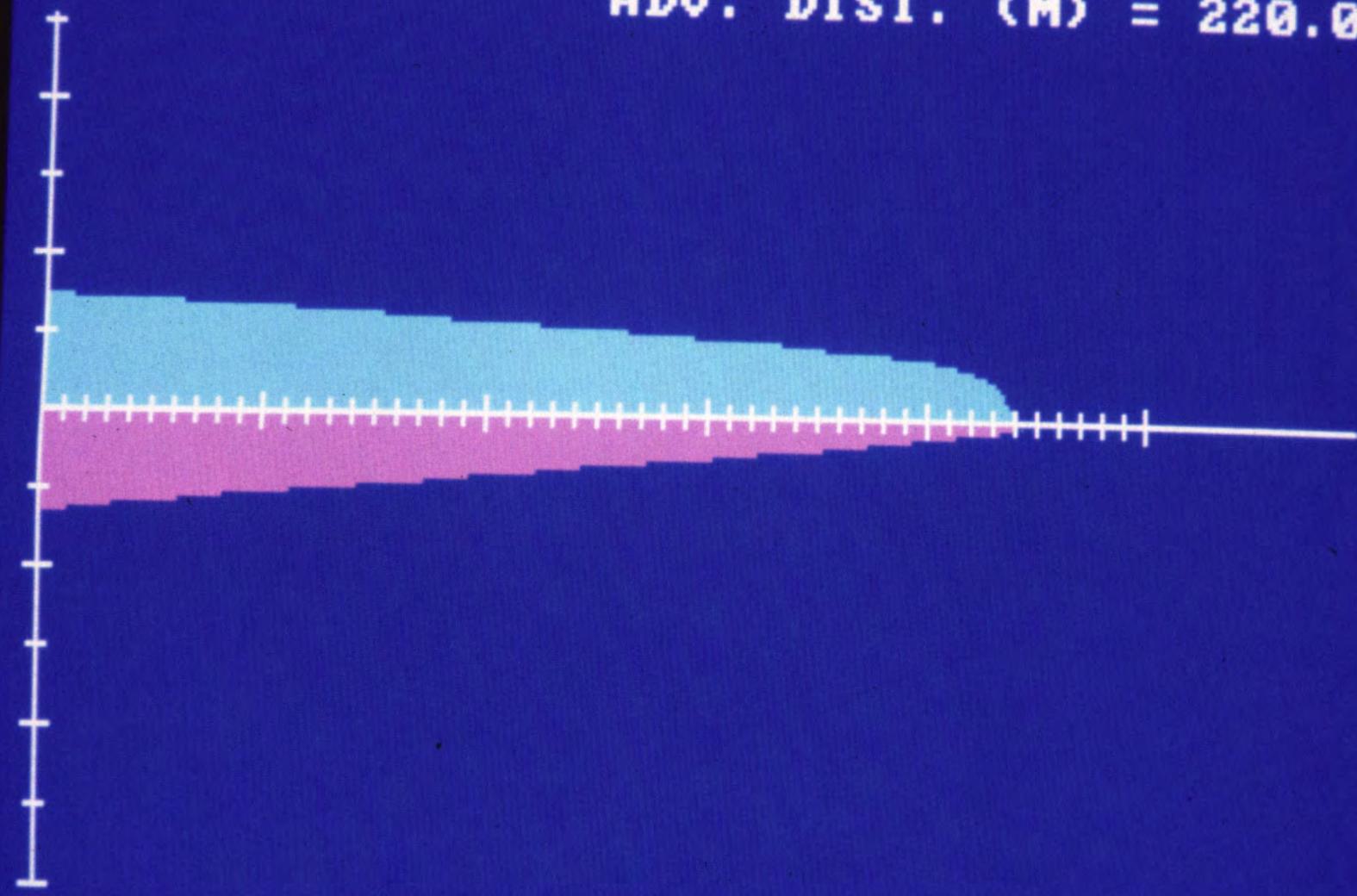
ADVANCE PHASE  
TIME (MIN) = 27.79  
ADV. DIST. (M) = 80.0



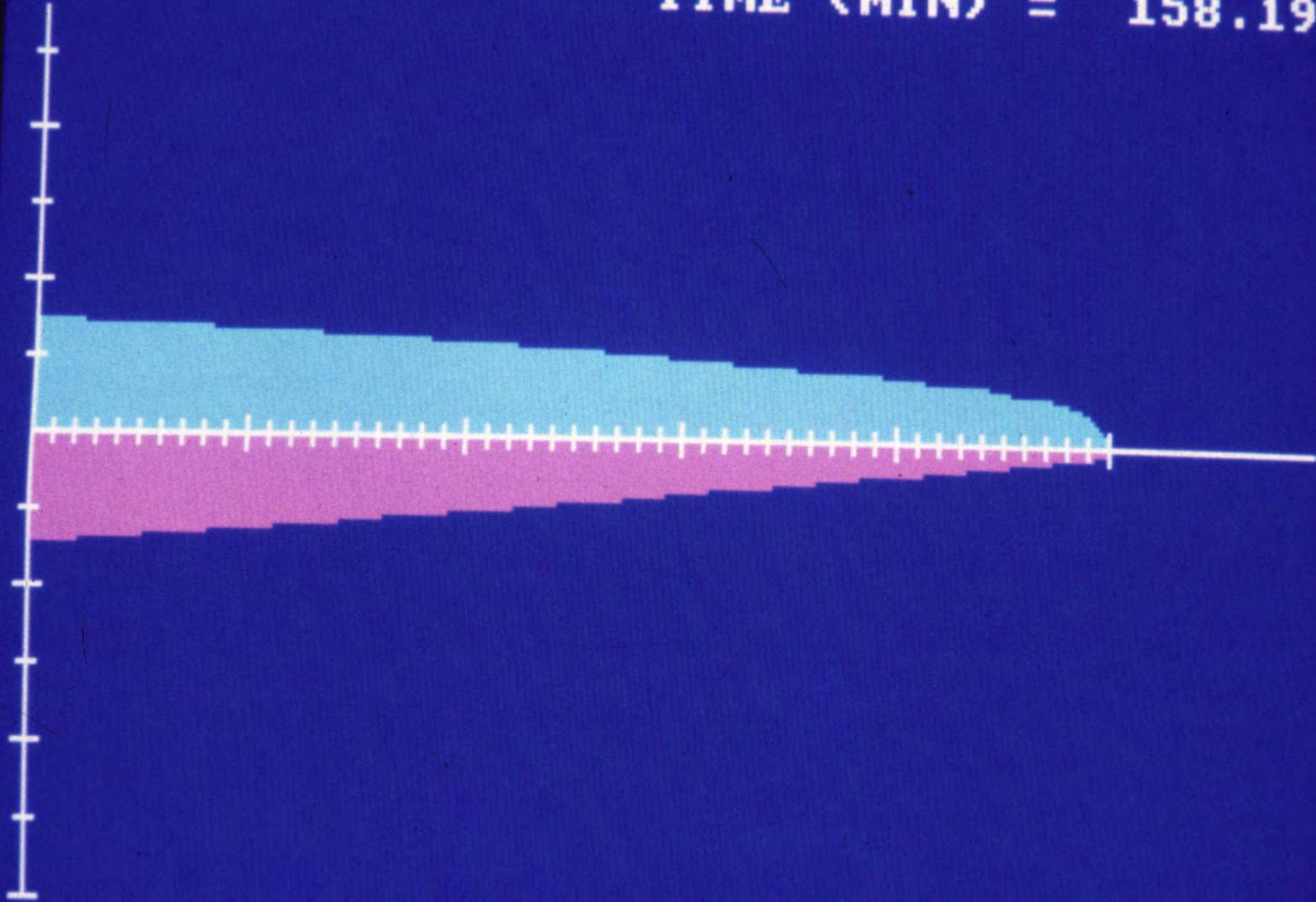
ADVANCE PHASE  
TIME (MIN) = 75.29  
ADV. DIST. (M) = 160.0



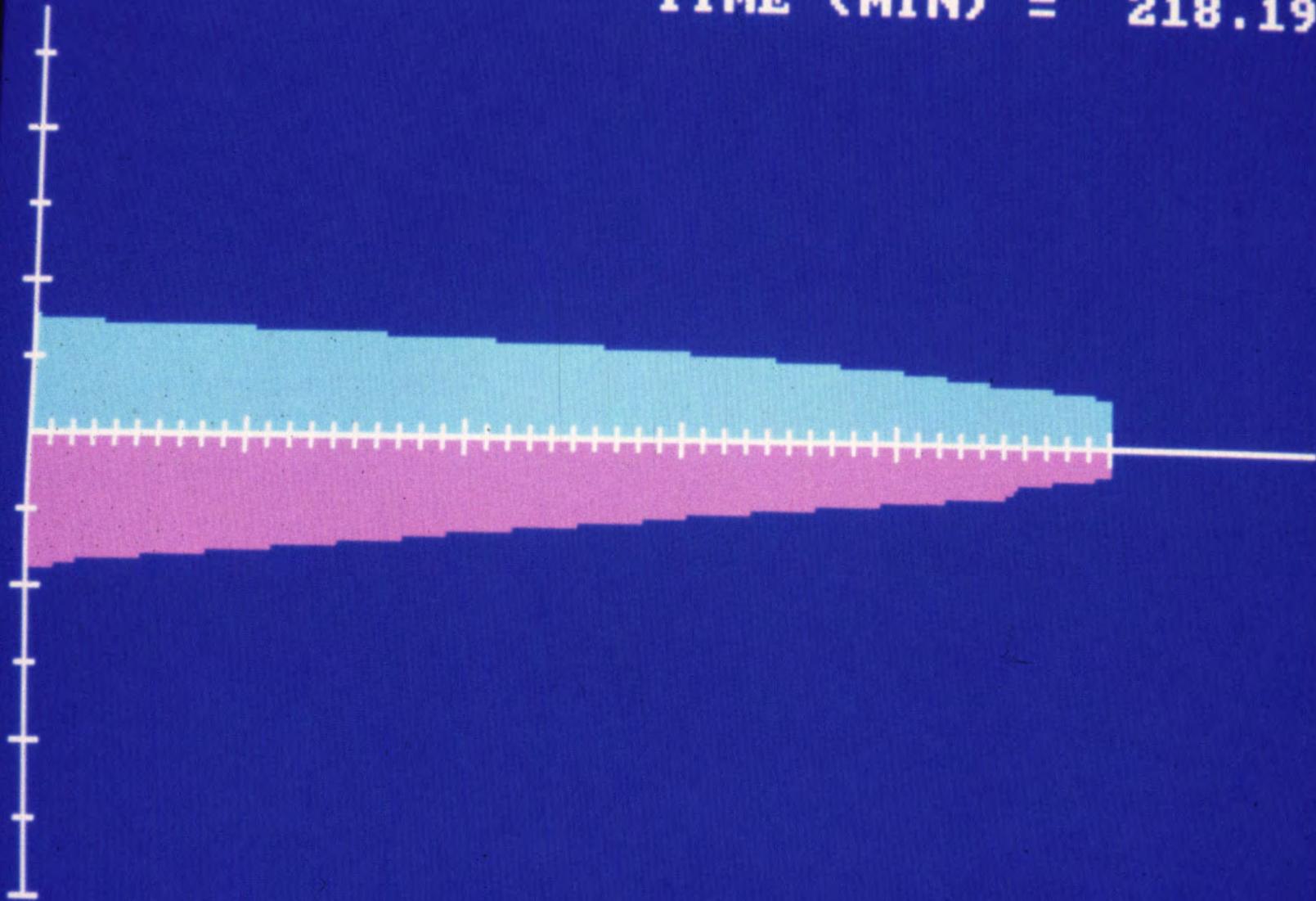
ADVANCE PHASE  
TIME (MIN) = 125.25  
ADV. DIST. (M) = 220.0



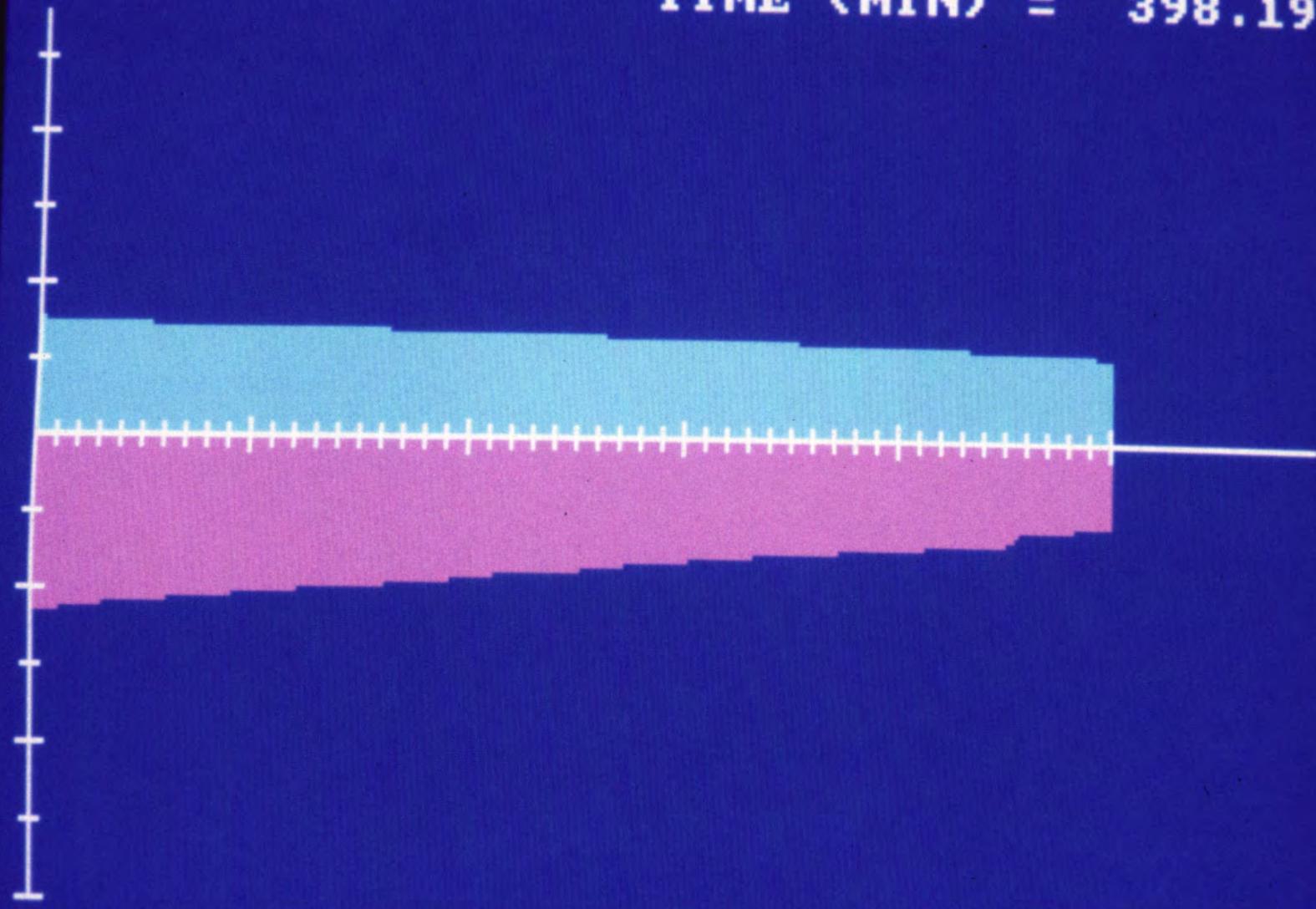
STORAGE PHASE  
TIME (MIN) = 158.19



STORAGE PHASE  
TIME (MIN) = 218.19



STORAGE PHASE  
TIME (MIN) = 398.19



# Surface Irrigation

- **Water losses can be from deep percolation and tailwater runoff.**



# Surface Irrigation

- How do you improve surface irrigation?



# Surface Irrigation

- How do you improve surface irrigation?
  - **Get water across the field more quickly – reduces the non-uniformity.**



# Surface Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
  - **Shorten the field length.**

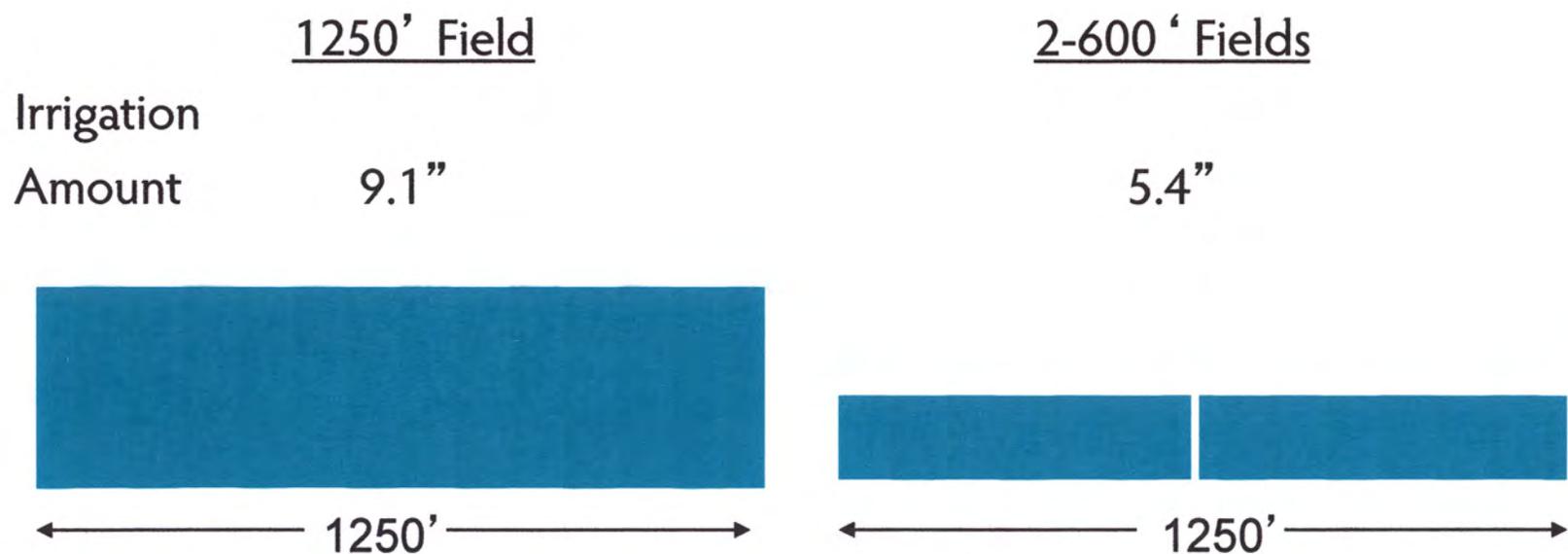


# Improving Furrow Irrigation Performance

- **Reduce field length.**

- Often the most effective option
- Also often the least popular option
- For more info:

[http://cetulare.ucanr.edu/newsletters/Field\\_Crop\\_Notes48141.pdf](http://cetulare.ucanr.edu/newsletters/Field_Crop_Notes48141.pdf)



# Surface Irrigation

- **How do you improve surface irrigation?**
  - Get water across the field more quickly.
    - Shorten the field length.
    - **Increase the field slope.**



# Improving surface irrigation performance

- Increase the field slope.

|                    | <u>0.001 slope</u> | <u>0.002 slope</u> |
|--------------------|--------------------|--------------------|
| Irrigation Applied | 5.1"               | 4.8"               |



# Improving border check irrigation performance

- Reduce field length.
- Increase the field slope.
- **Increase the flow per foot of border check.**

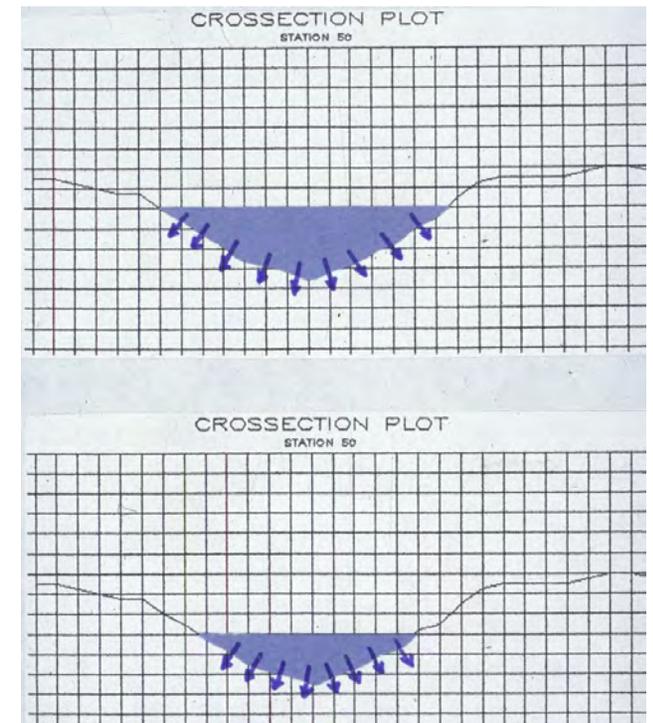
Case study: Usually run 2 valves per check. Make checks half as wide and run 1 valve at a time. More flow per foot of check width.

|                           | <u>Wide check (200')</u> | <u>Narrow check (100')</u> |
|---------------------------|--------------------------|----------------------------|
| <b>Irrigation Applied</b> | <b>5.1"</b>              | <b>4.3"</b>                |



# Improving border check irrigation performance

- Reduce field length.
- Increase the field slope.
- Increase the flow per foot of border check.
  - Doesn't work for furrow irrigation.



# Furrow Irrigation

- **How do you improve surface irrigation?**
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
    - **Torpedoes**



# Furrow Irrigation

- **How do you improve surface irrigation?**
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
  - **Torpedoes.**



Field Trial of Torpedoes – Early Season Irrigation

|                    | <u>Not Torpedoed</u> | <u>Torpedoed</u> |
|--------------------|----------------------|------------------|
| Irrigation Applied | 12.9"                | 9.4"             |

**About a 25% decrease in applied water.**

# Surface Irrigation

- **How do you improve surface irrigation?**
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
    - Torpedoes.
  - **Irrigate alternate furrows.**

**Studies have shown about a 25% reduction in applied water.**

**May need to irrigate more often since applying less per irrigation.**



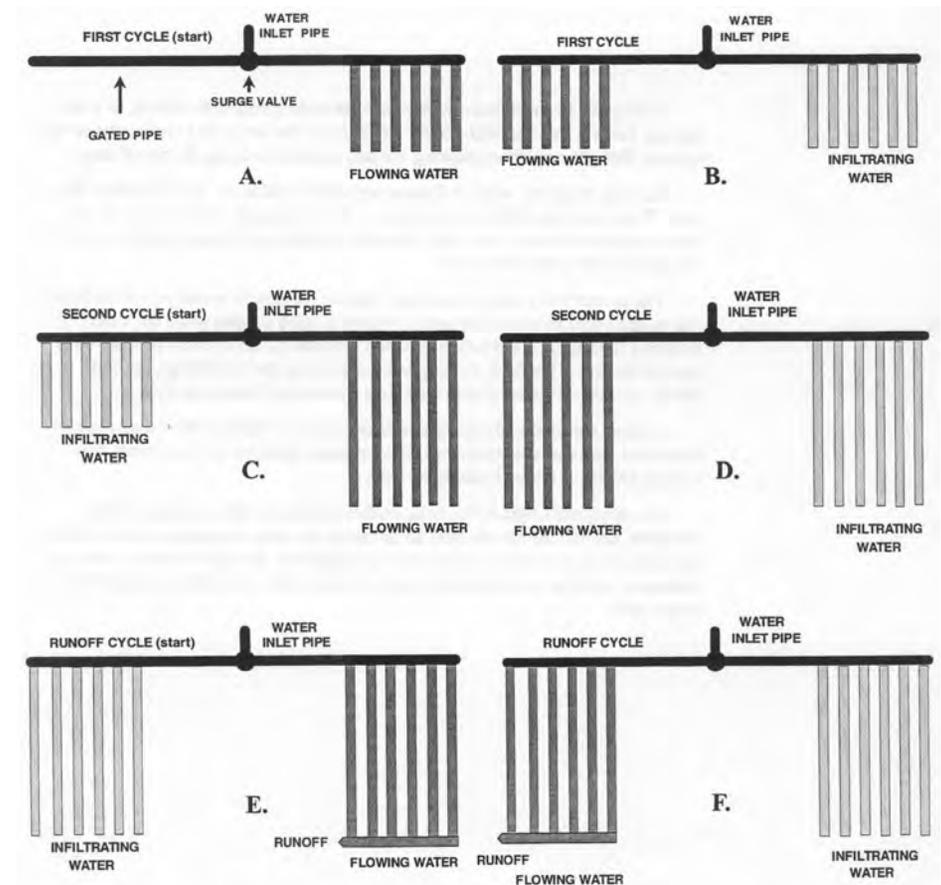
# Surface Irrigation

- **How do you improve surface irrigation?**
  - Get water across the field more efficiently.
    - Shorten the field length.
    - Increase the field slope.
    - Torpedoes.
    - Irrigate alternate furrows.
  - **Switch from borders to furrows.**
    - Remember, you are applying less water per irrigation so may need to irrigate more often.



# Furrow Irrigation

- How do you improve surface irrigation?
  - Get water across the field more quickly.
    - Shorten the field length.
    - Increase the field slope.
    - Torpedoes.
    - Alternate furrows.
  - **Surge Irrigation.**



# Surface Irrigation

- How do you improve surface irrigation?
  - Reuse tailwater runoff.
    - Tailwater return systems.



# Surface Irrigation

- How do you improve surface irrigation?
  - Reuse tailwater runoff.
    - Tailwater return systems.

**For more info.: Reducing Runoff from Irrigated Lands: Tailwater Return Systems**  
**<http://anrcatalog.ucdavis.edu/Details.aspx?itemNo=8225>**



# Improving Surface Irrigation

- **What happens if none of the previous alternatives work, or you don't want to try them?**

# Improving Surface Irrigation

- What happens if none of the previous alternatives work, or you don't want to try them?
  - **Switch to a pressurized irrigation system – sprinklers or drip (usually subsurface drip).**



# Questions???

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**Presentations available at: <http://ucanr.edu/schwankl>**