

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.



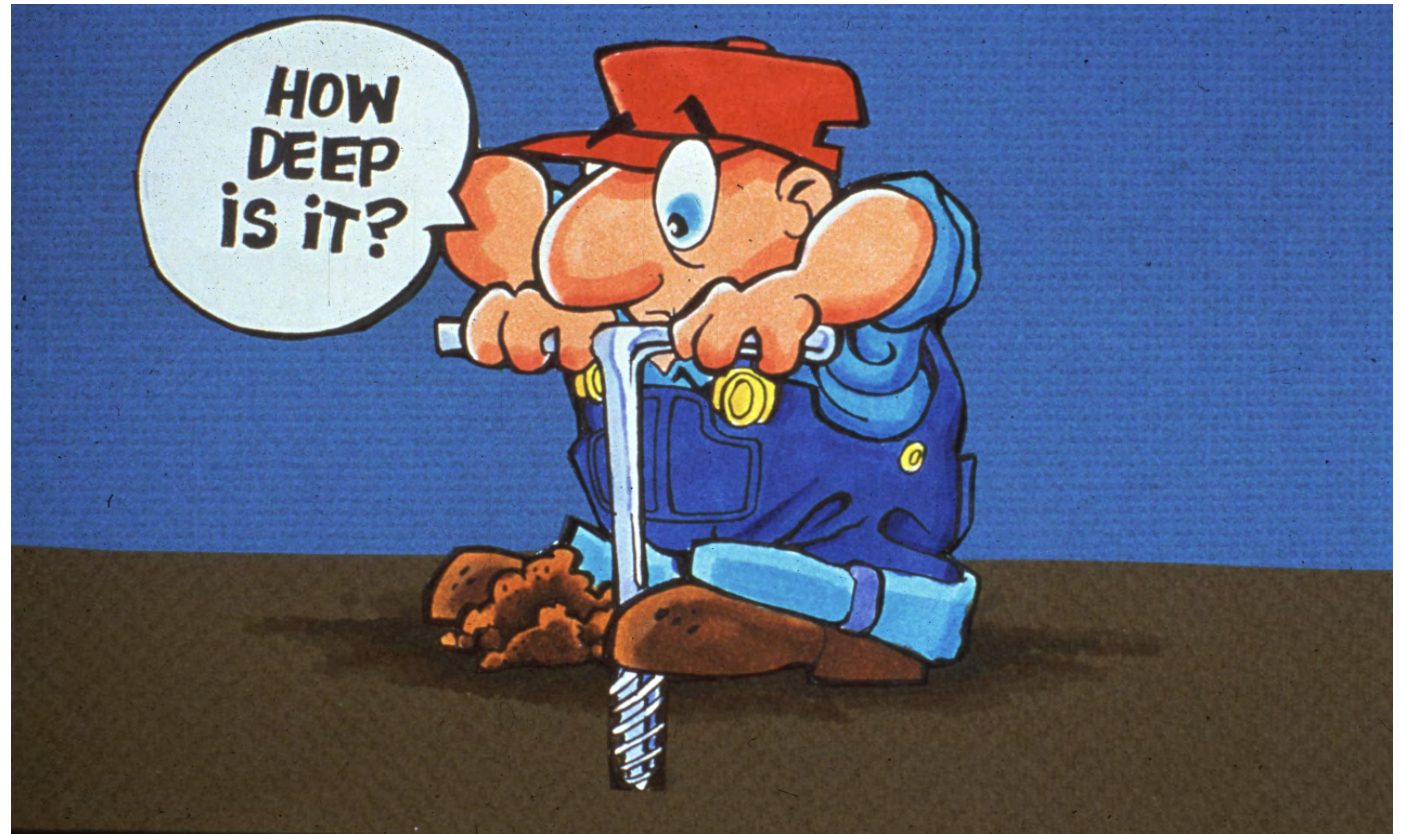
How Do We Become Efficient Irrigators?

- 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.**

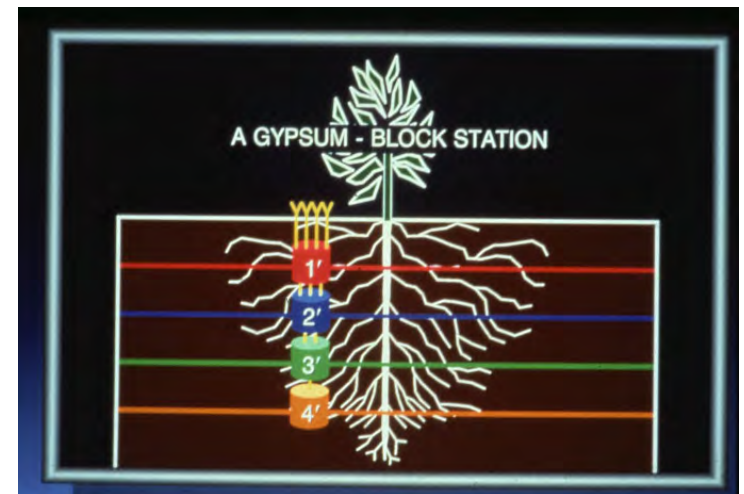


Irrigation Scheduling

■ Approaches:

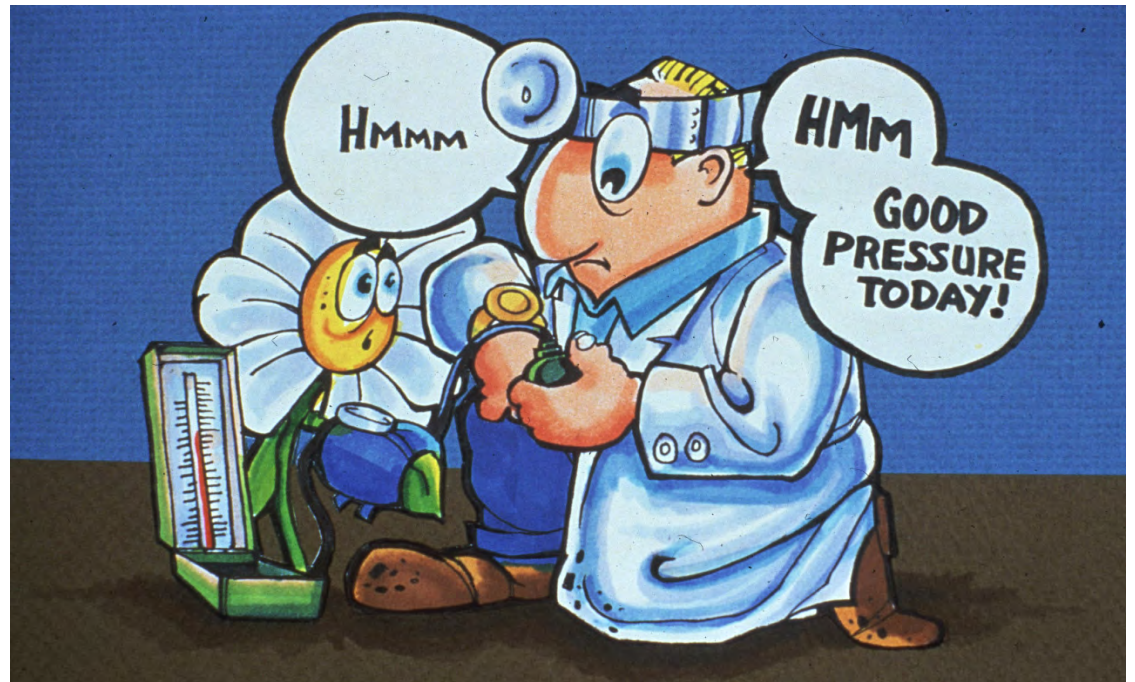
■ Monitor the soil

- 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

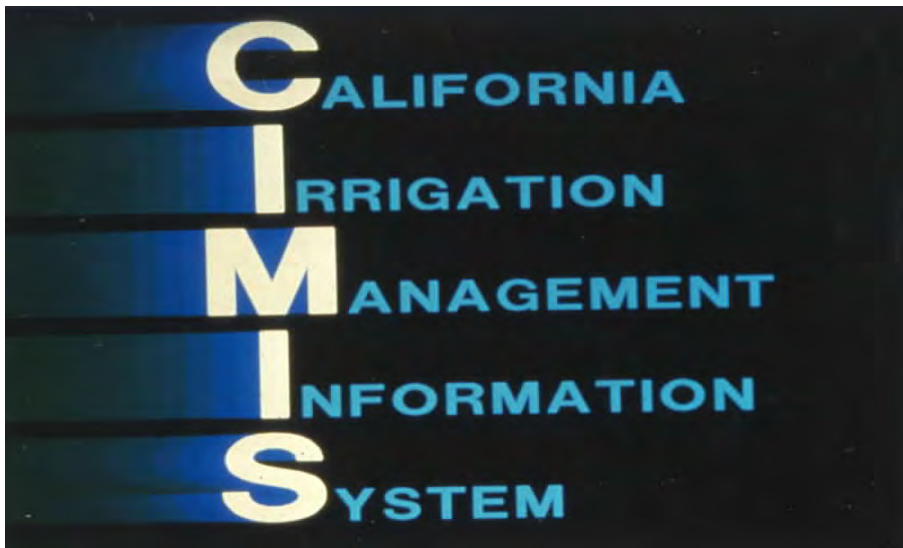
- Approaches:
 - Monitor the soil
 - Monitor the plant
 - **Monitor the weather**
 - Monitor the weather and use it to estimate crop ET.



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.**



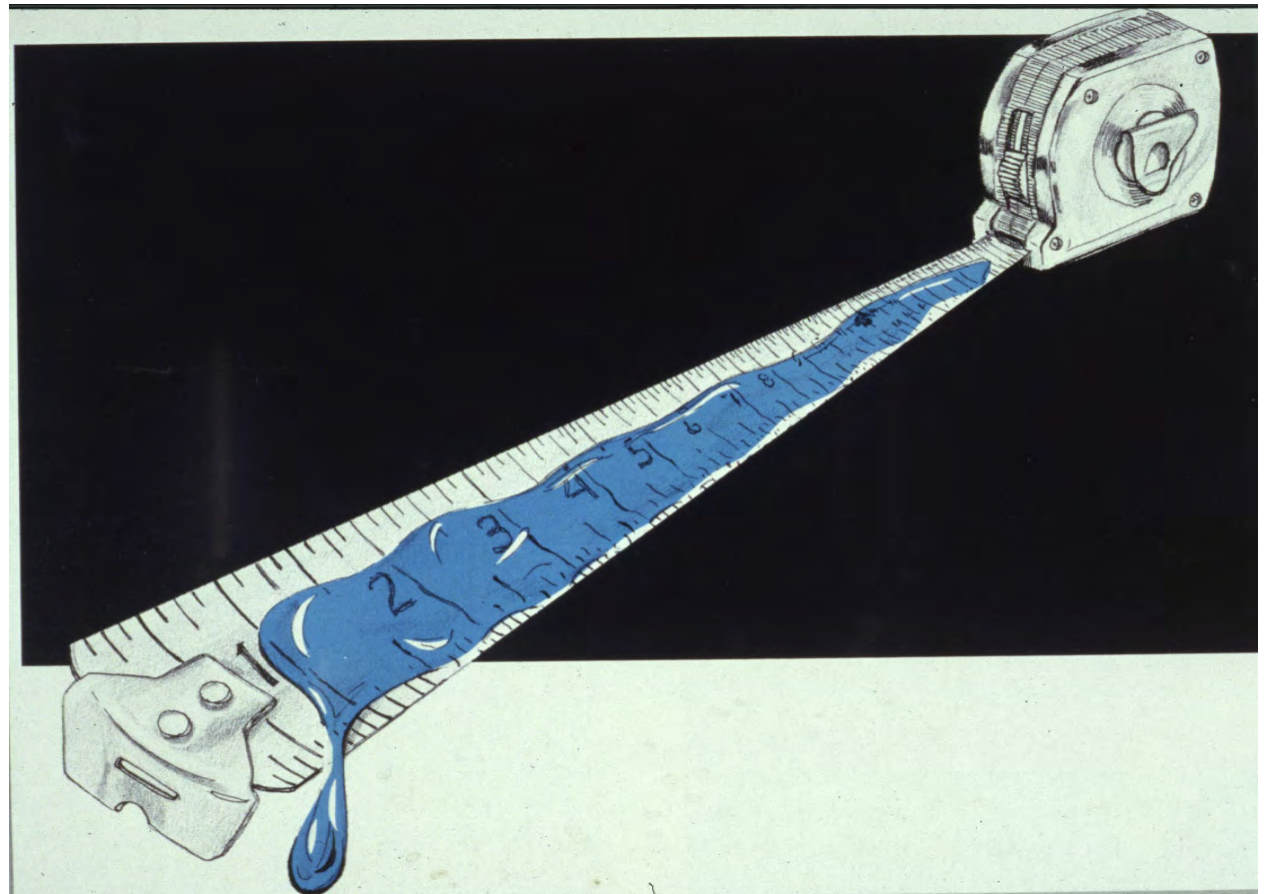
How Do We Become Efficient Irrigators?

- 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.



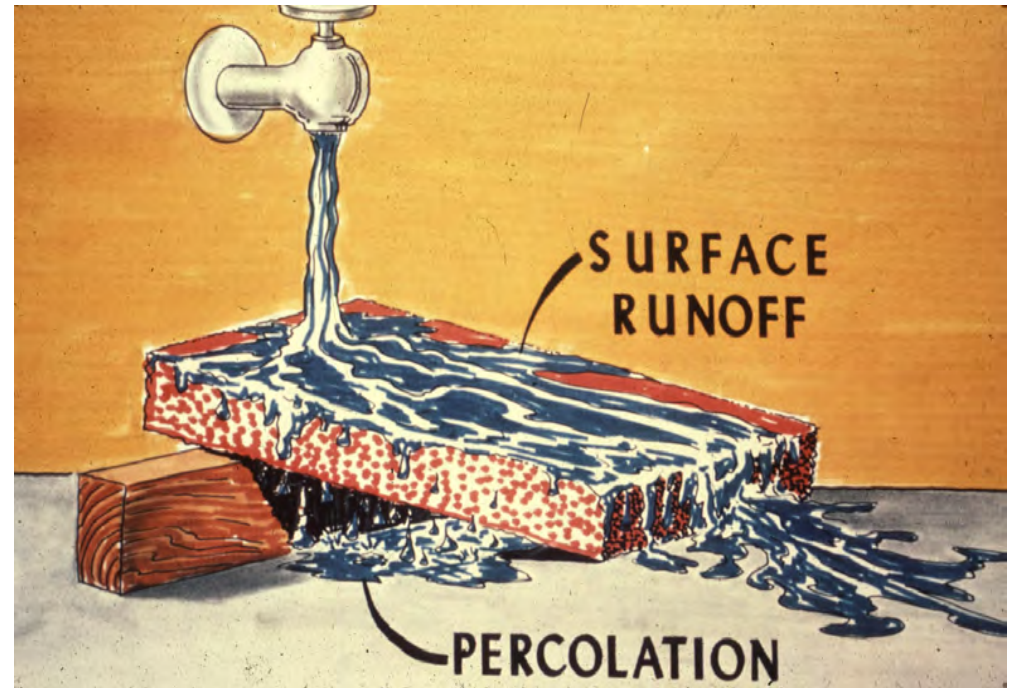
Surface Irrigation Systems:

- What is a “good irrigation system”?



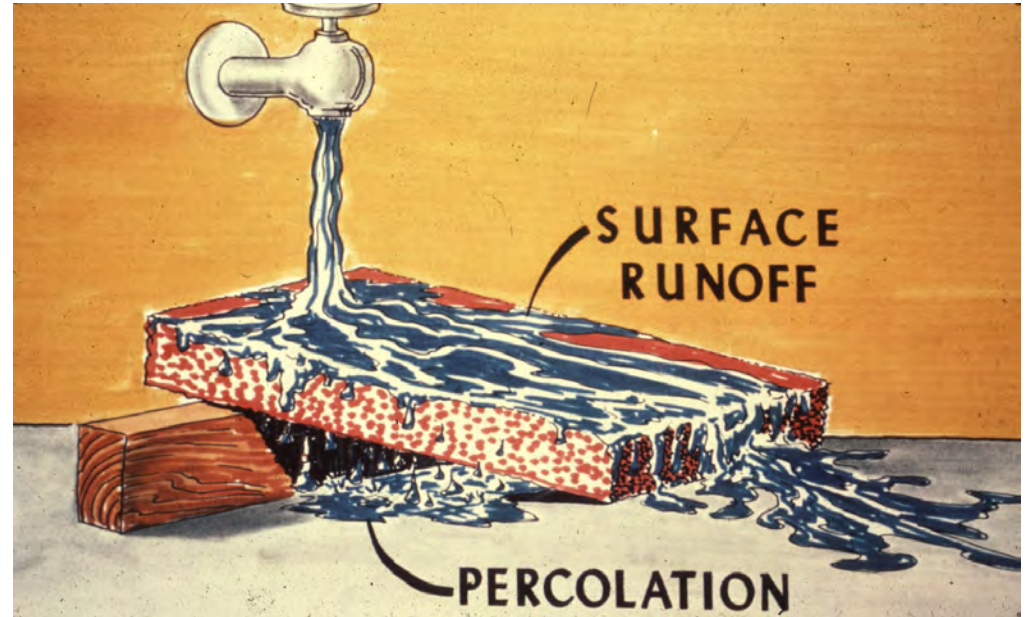
Surface Irrigation Systems:

- 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

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

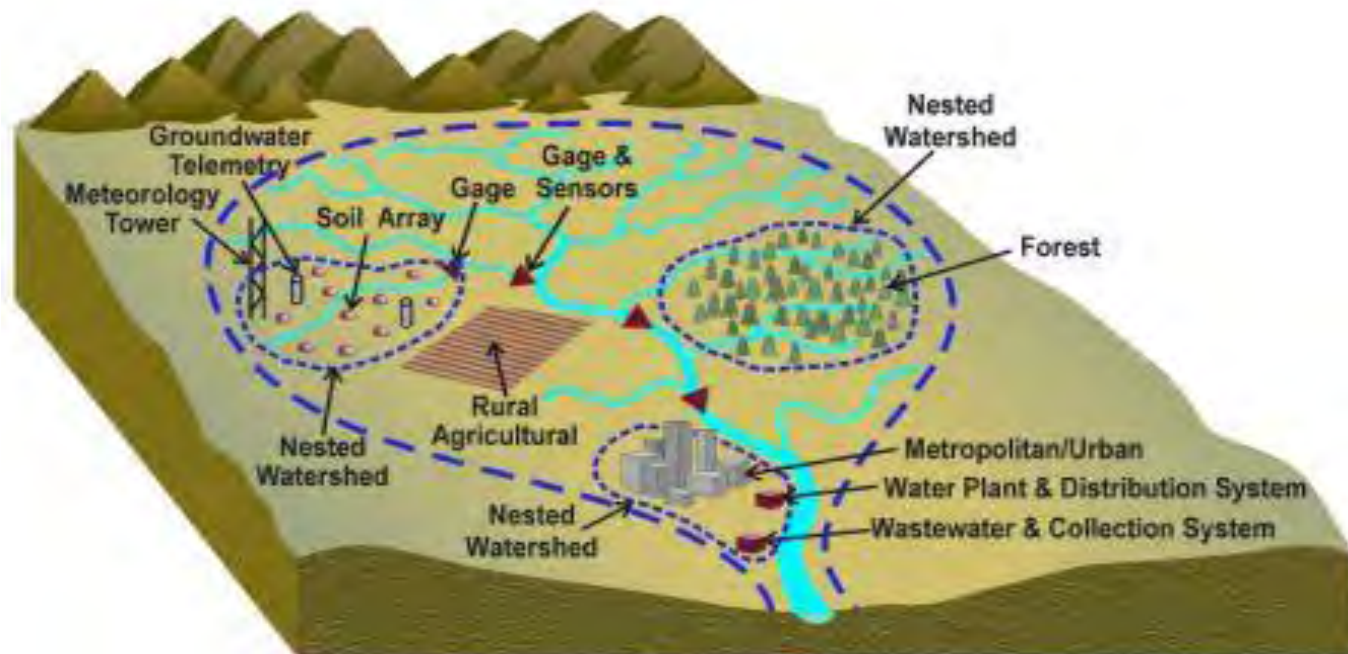


Irrigation Efficiency

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

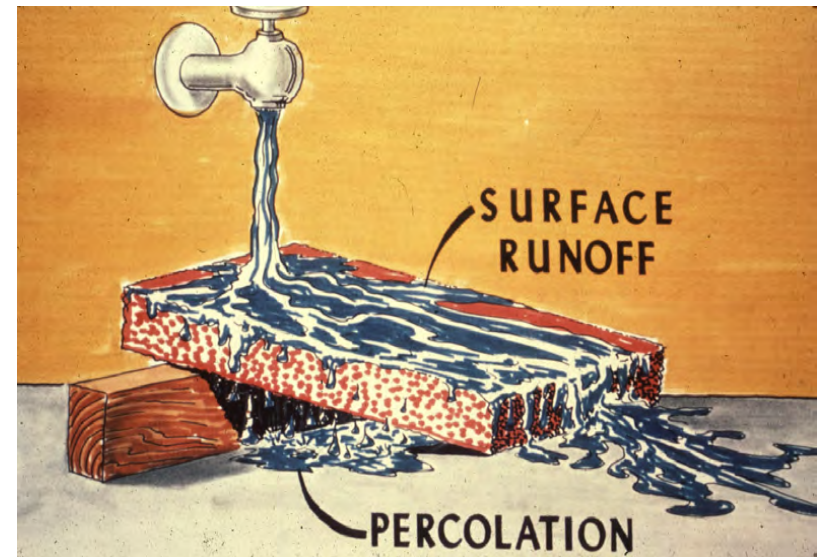
Field scale – vs – Watershed or basin scale

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.

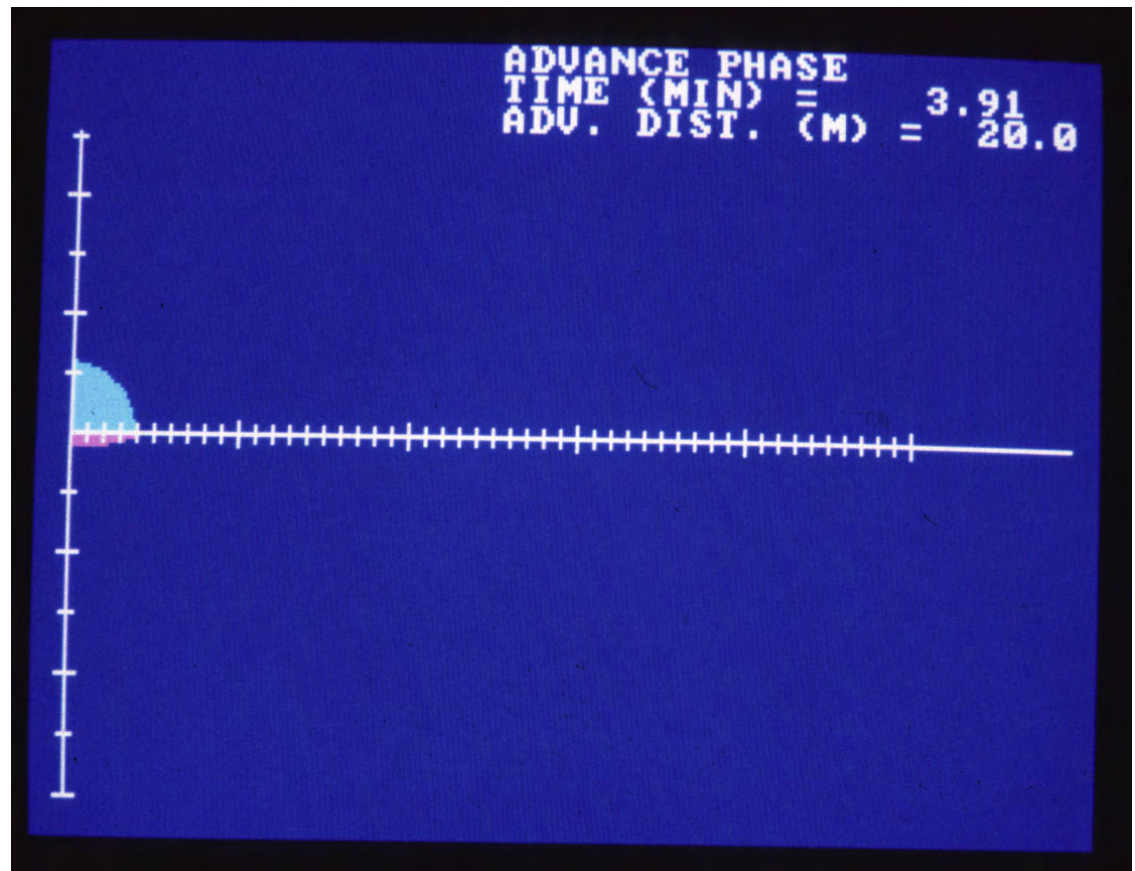


Irrigation Uniformity

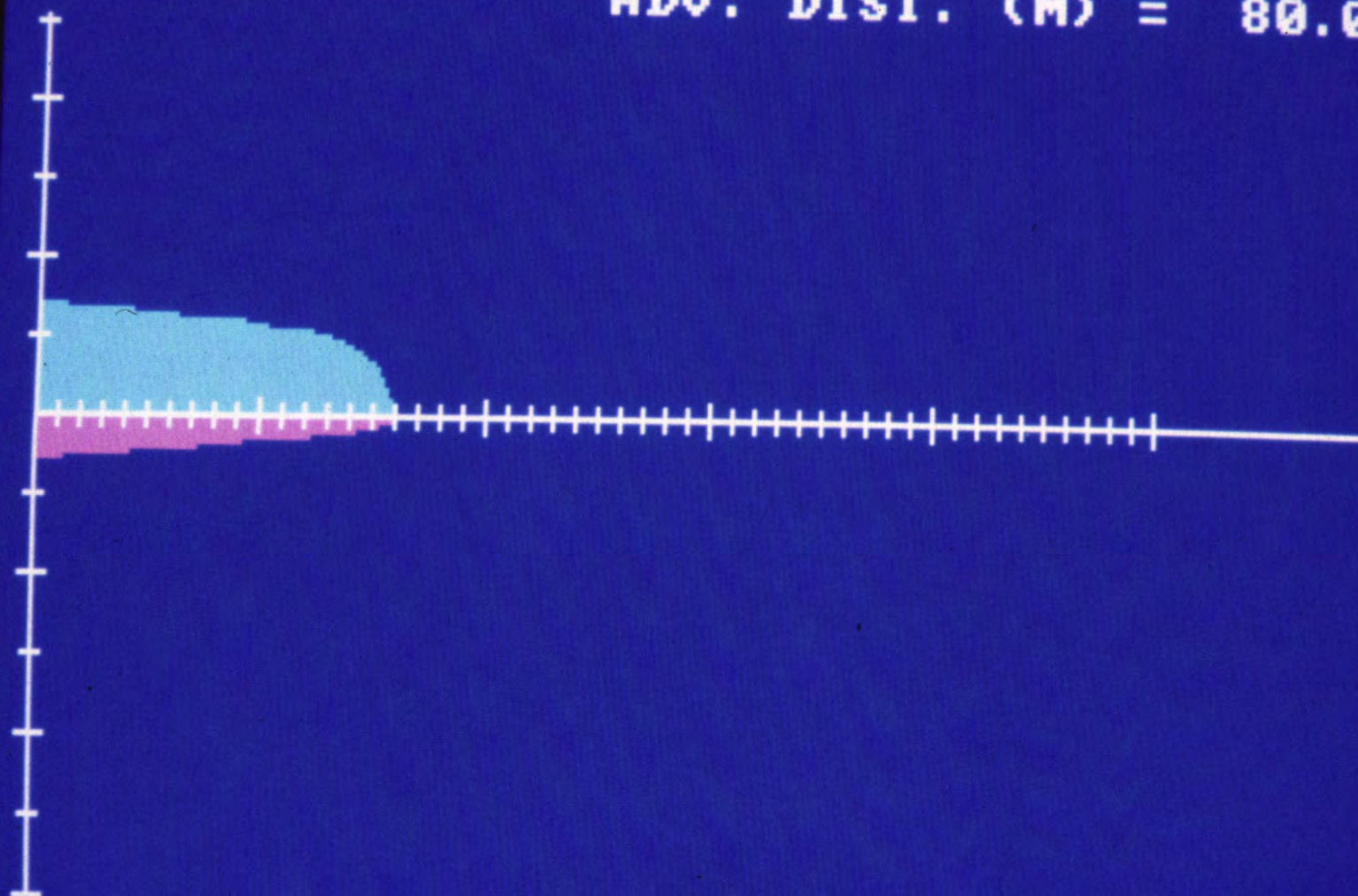
- **Measure of how evenly water is applied to the field.**

Irrigation Uniformity

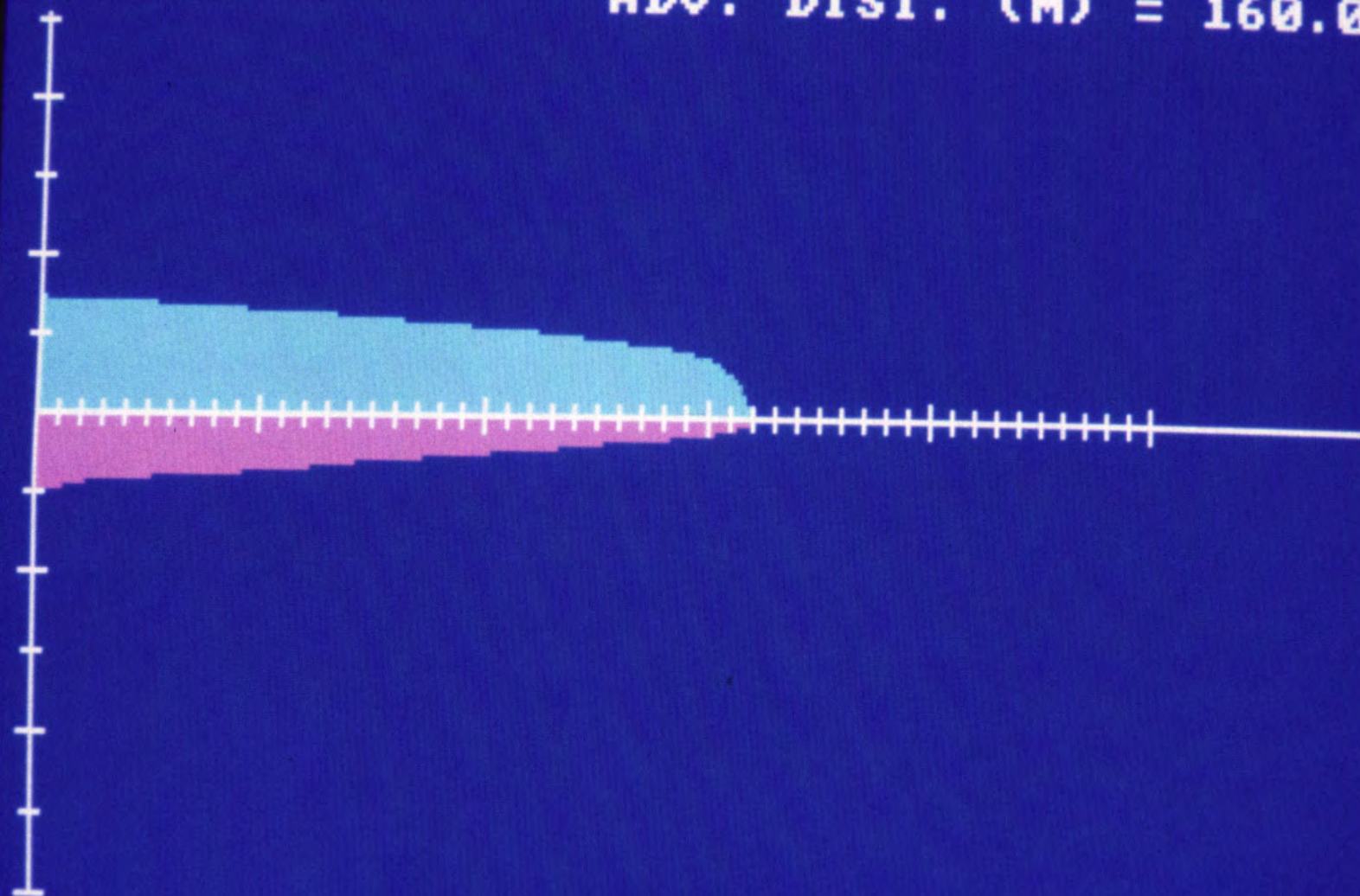
- What's happening when we irrigate?



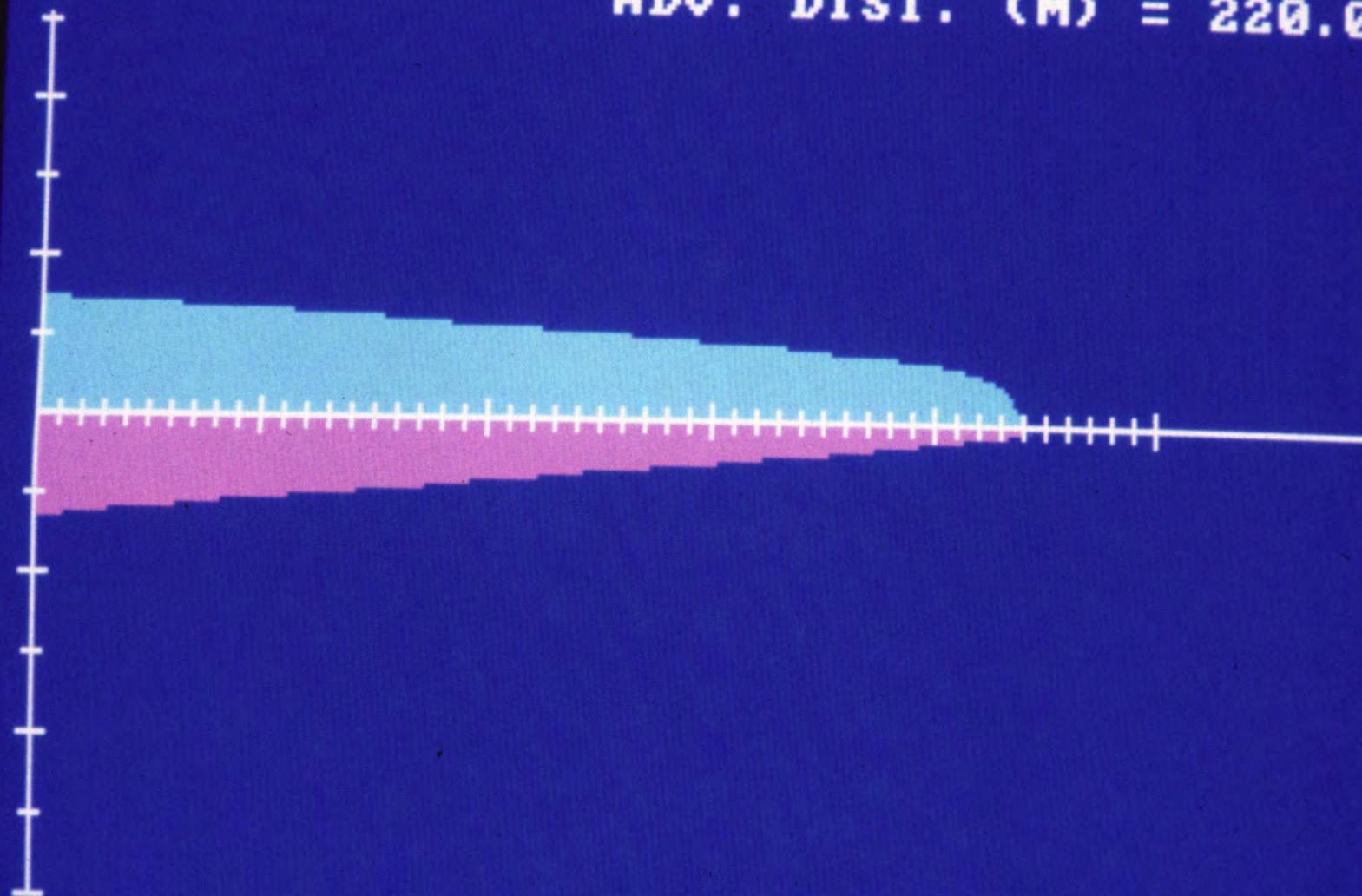
ADVANCE PHASE
TIME (MIN) = 27.79
ADV. DIST. (M) = 80.0



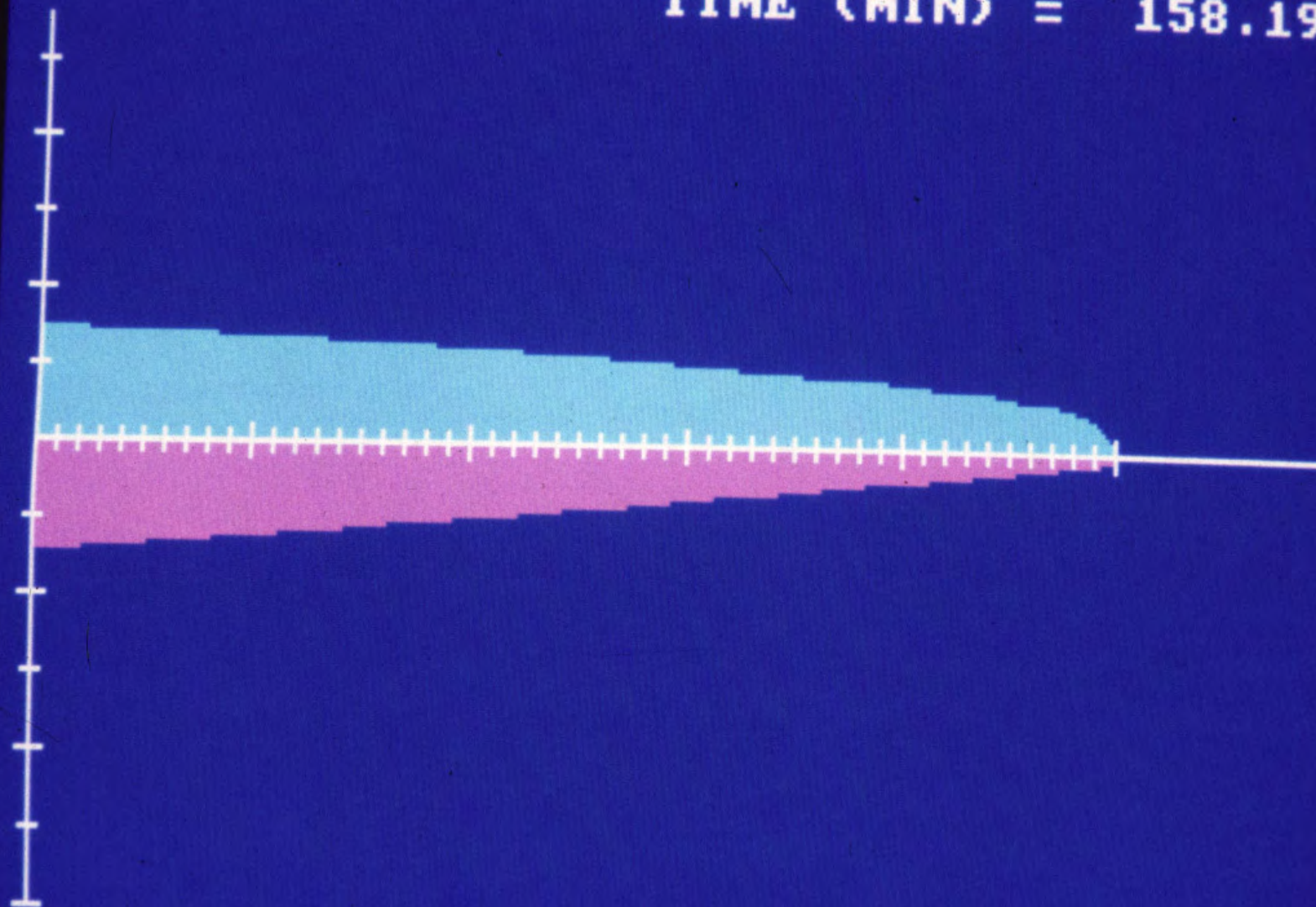
ADVANCE PHASE
TIME (MIN) = 75.29
ADV. DIST. (M) = 160.0



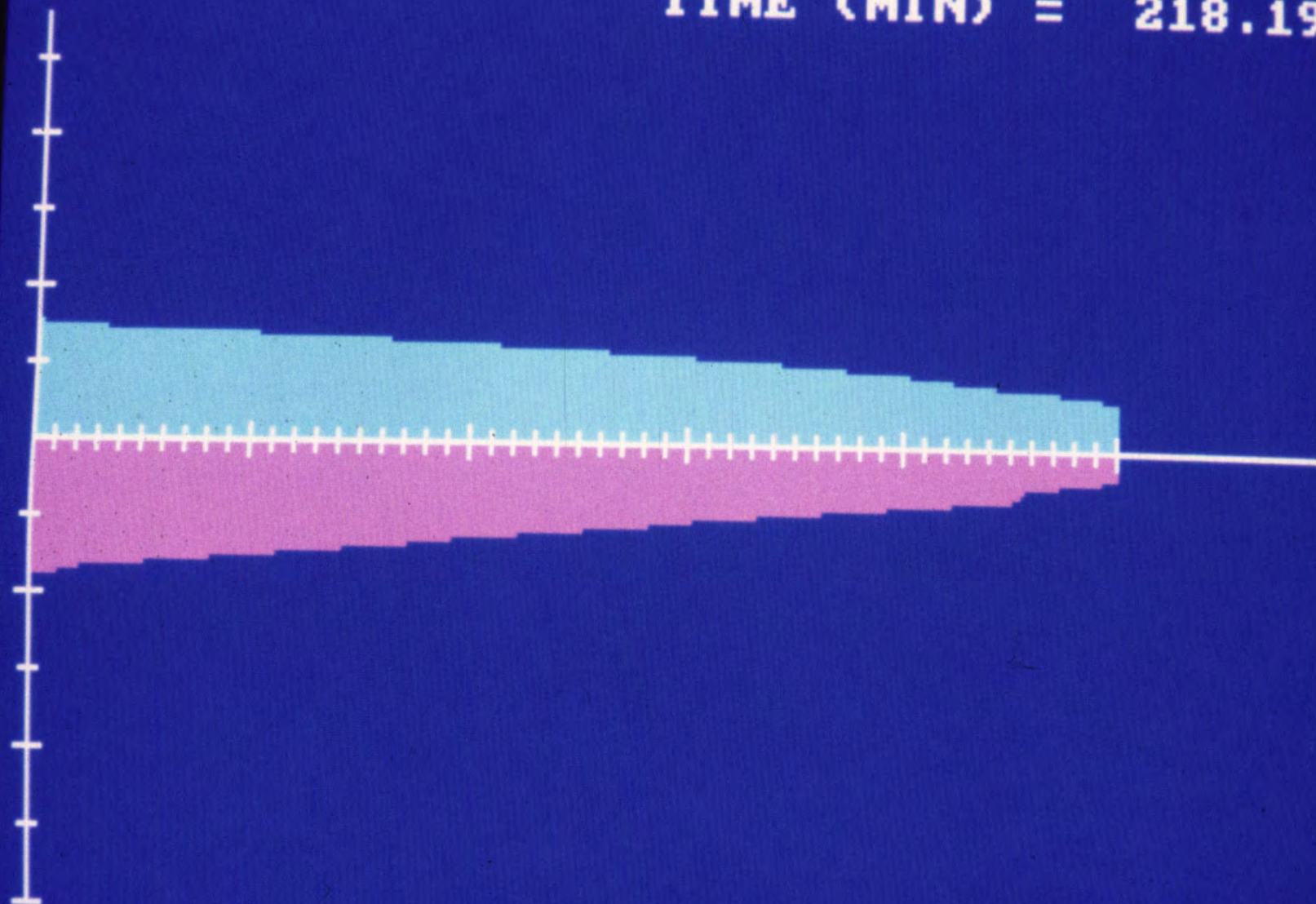
ADVANCE PHASE
TIME (MIN) = 125.25
ADV. DIST. (M) = 220.0



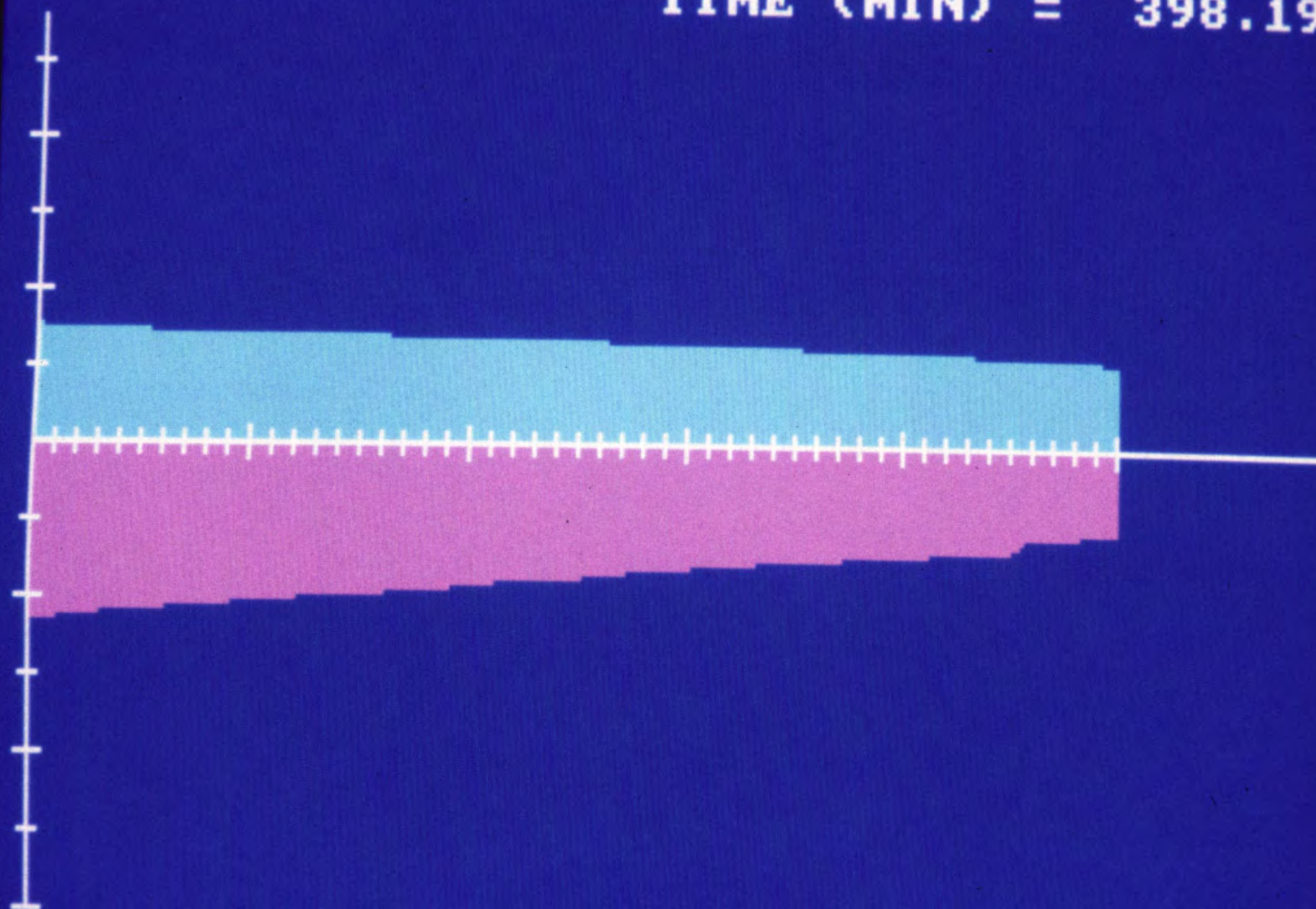
STORAGE PHASE
TIME (MIN) = 158.19



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.**

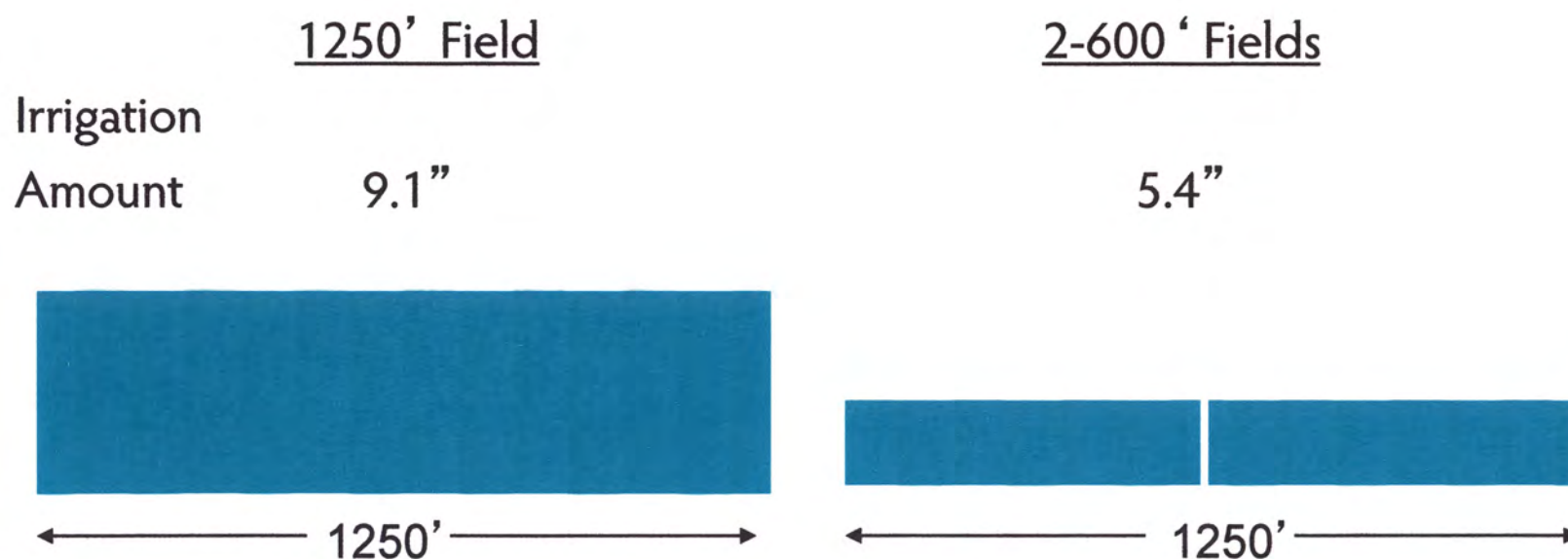


Improving Furrow Irrigation Performance

- **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



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.**

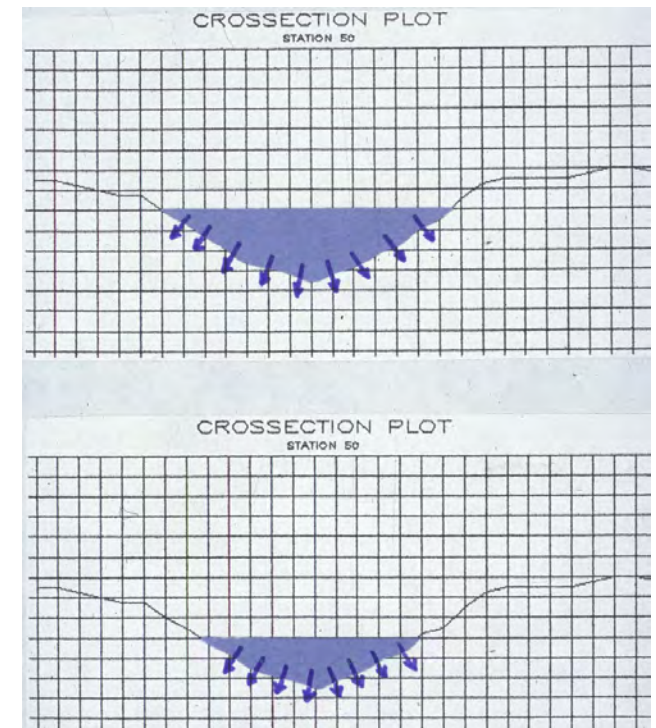
Case study: Usually run 2 valves per check. Make checks half as wide and run 1 valve at a time. More flow per foot of check width.

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



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.



Photo by Khalid Bali

Furrow Irrigation

- How do you improve surface irrigation?

- Get water across the field more quickly.

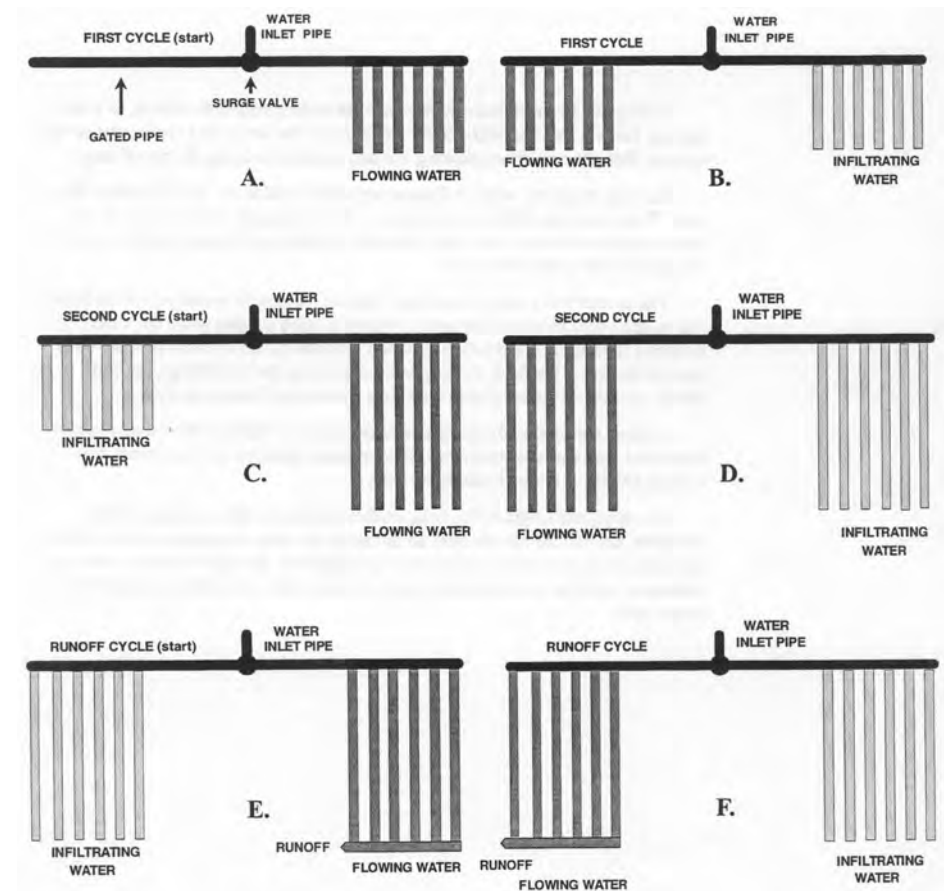
- Shorten the field length.

- 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>