Irrigation Strategies for Managing Nitrate Leaching

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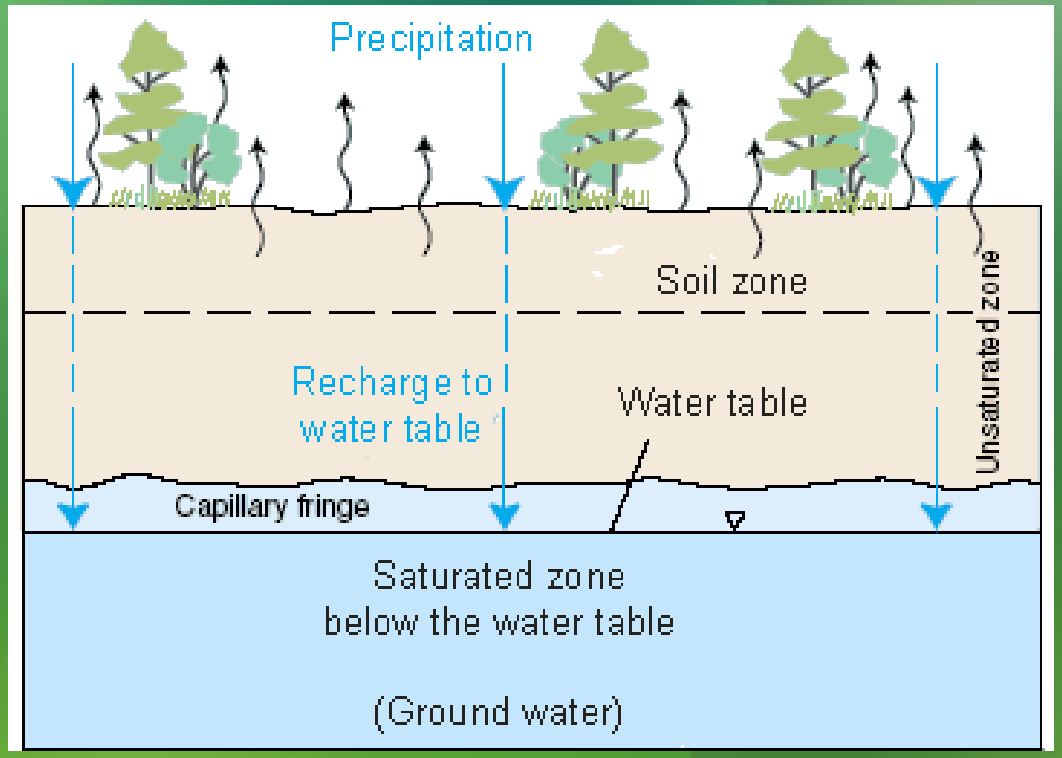
Why is N leaching an issue?

- Nitrate in drinking water causes “blue baby syndrome” (methemoglobinemia)
- Agriculture uses a lot of N fertilizer
- Nitrate moves through soil in water
- Agricultural nitrates end up in drinking water wells



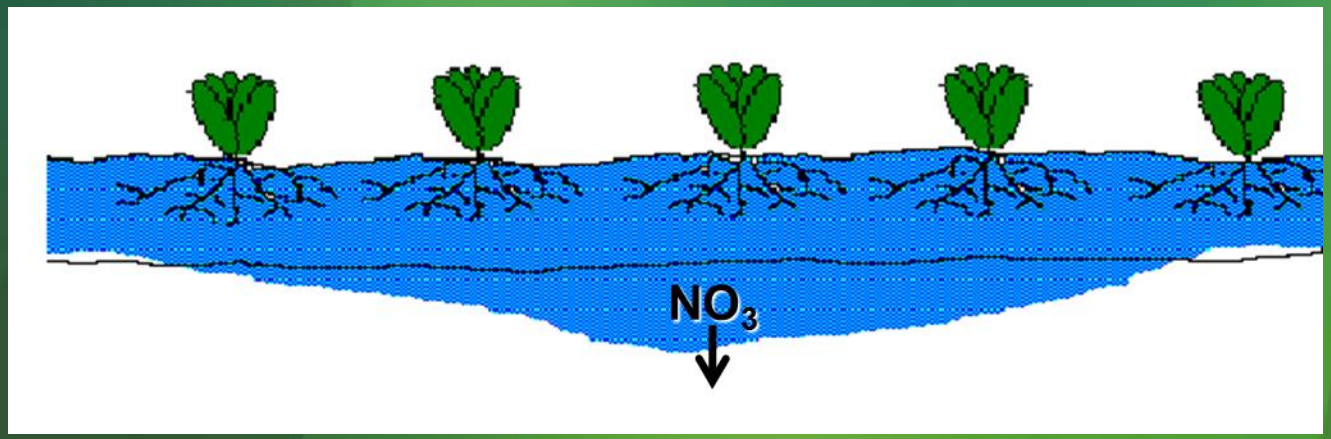
Why does nitrate (NO_3) leach?

- NO_3 is a negatively-charged ion (or “anion”)
  - Does not “stick” to soil (also negatively charged)
  - Goes anywhere water goes
- NO_3 is applied in excess of crop uptake
- Excess irrigation water moves NO_3 past the root zone into water table
- Timing of application does not match crop demand

Nitrate Leaching Principles

For nitrate leaching to occur:

- Nitrate must be present in the soil
- Soil must be permeable to water movement
- Water must be moving through the soil



Strategies to control nitrate leaching

For Nitrate leaching to occur:

- *Nitrate must be present in the soil*

To reduce the nitrate source:

- Use a nitrogen budget
- Add nitrate in irrigation water to your N budget
- Split applications of N
- Don’t apply N when no active roots are present
- Use scavenger crops post-harvest

Strategies to control nitrate leaching

For Nitrate leaching to occur:

- *Soil must be permeable to water movement*
- *Water must be moving through the soil*

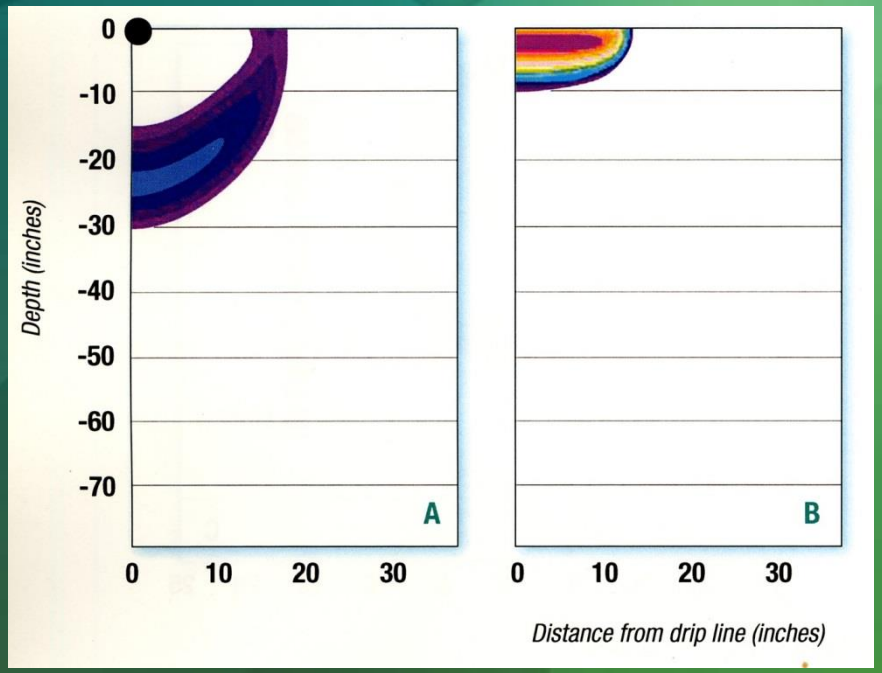
To keep water and nitrate in the root zone:

- Time fertigation events well
- Maximize uniformity and efficiency of your system
- Monitor soil water profile
- Use field-specific data for irrigation decisions

Timing Fertigation events

Surface Drip

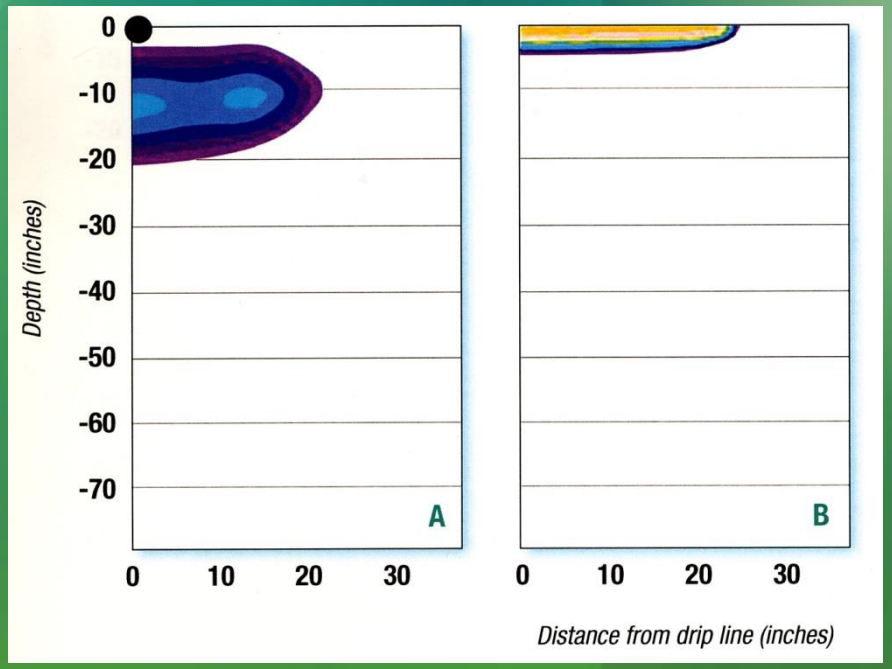
Loam



2 hour injection near start of 27 to 36 hour Irrigation. **N levels elevated at 30 in.**

2 hour injection near end of 27 to 36 hour Irrigation **N confined to top 10 in.**

Silt Loam



2 hour injection near start of 27 to 36 hour Irrigation **N levels elevated at 20 in**

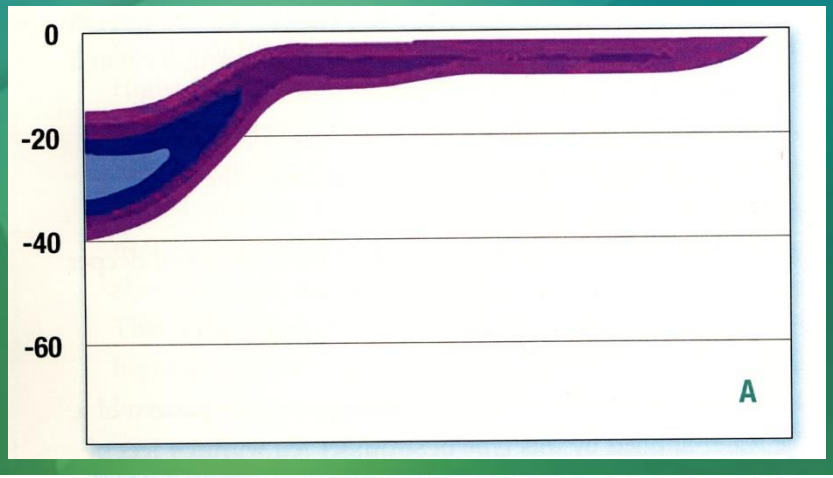
2 hour injection near end of 27 to 36 hour Irrigation **N confined to top 6 in.**

(Blaine Hanson, “Fertigation with Microirrigation”)

Timing Fertigation events

Microsprinklers

Silt Loam



2 hour injection near start of irrigation

2 hour injection near end of Irrigation

(Blaine Hanson, “Fertigation with Microirrigation”)

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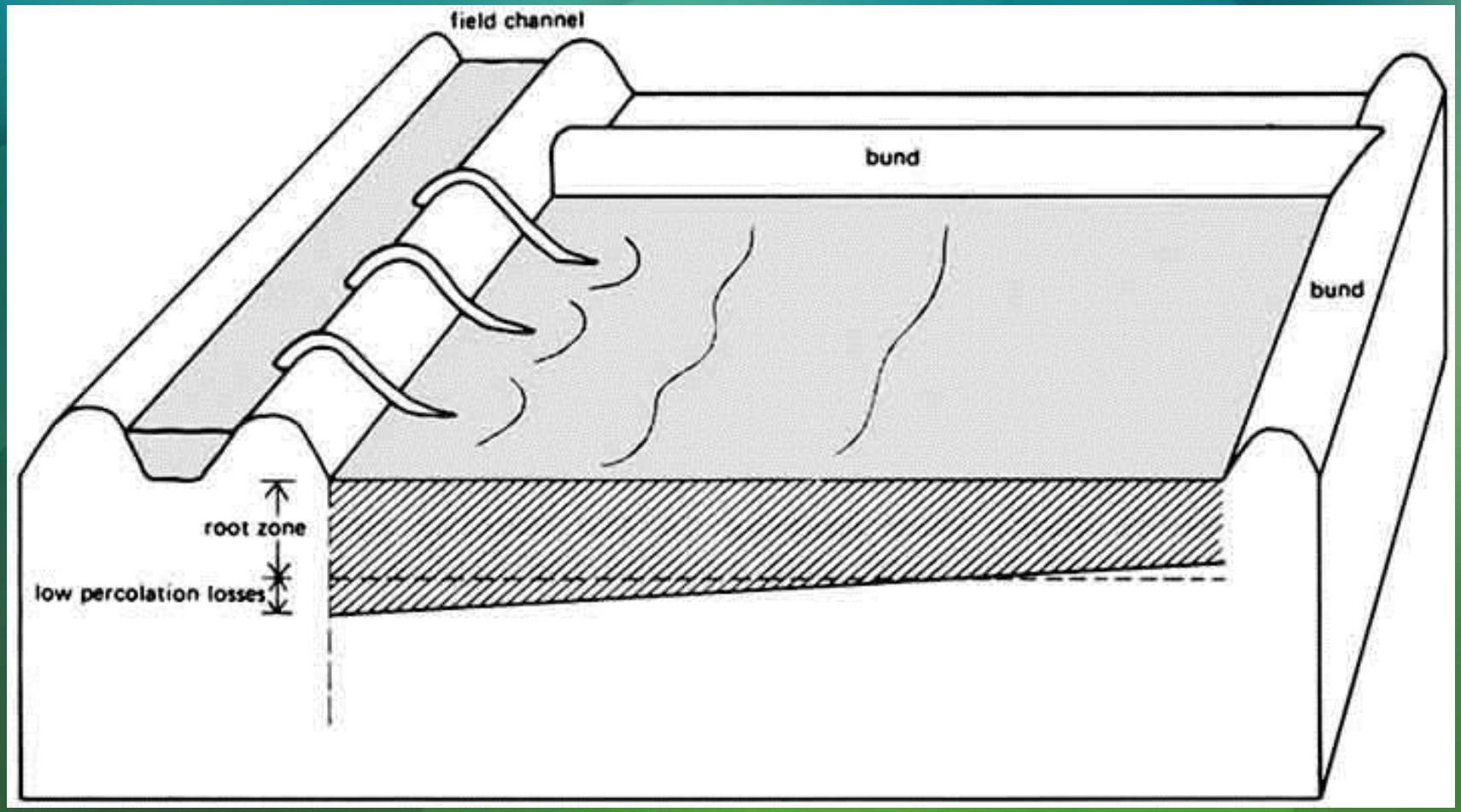
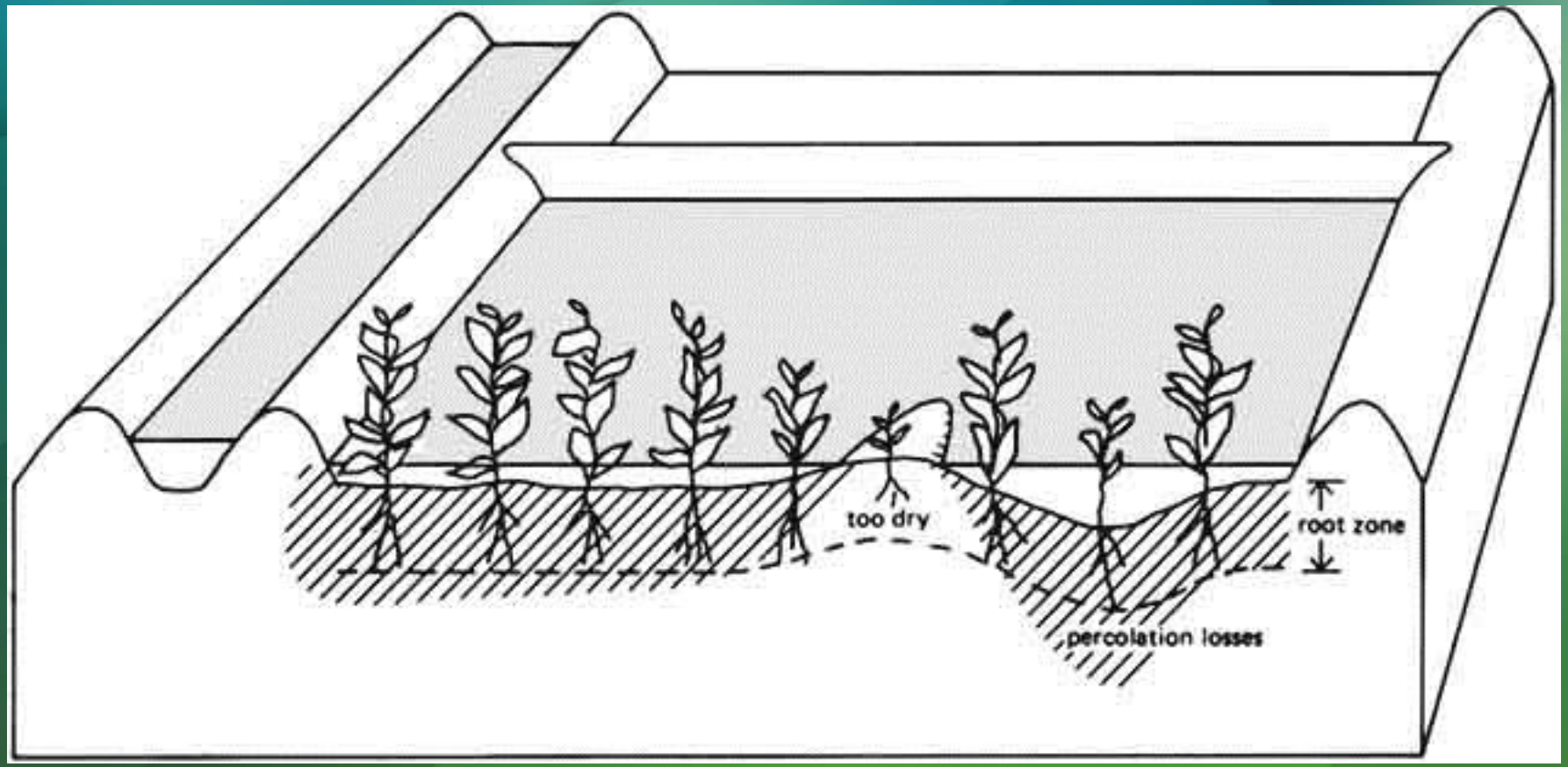
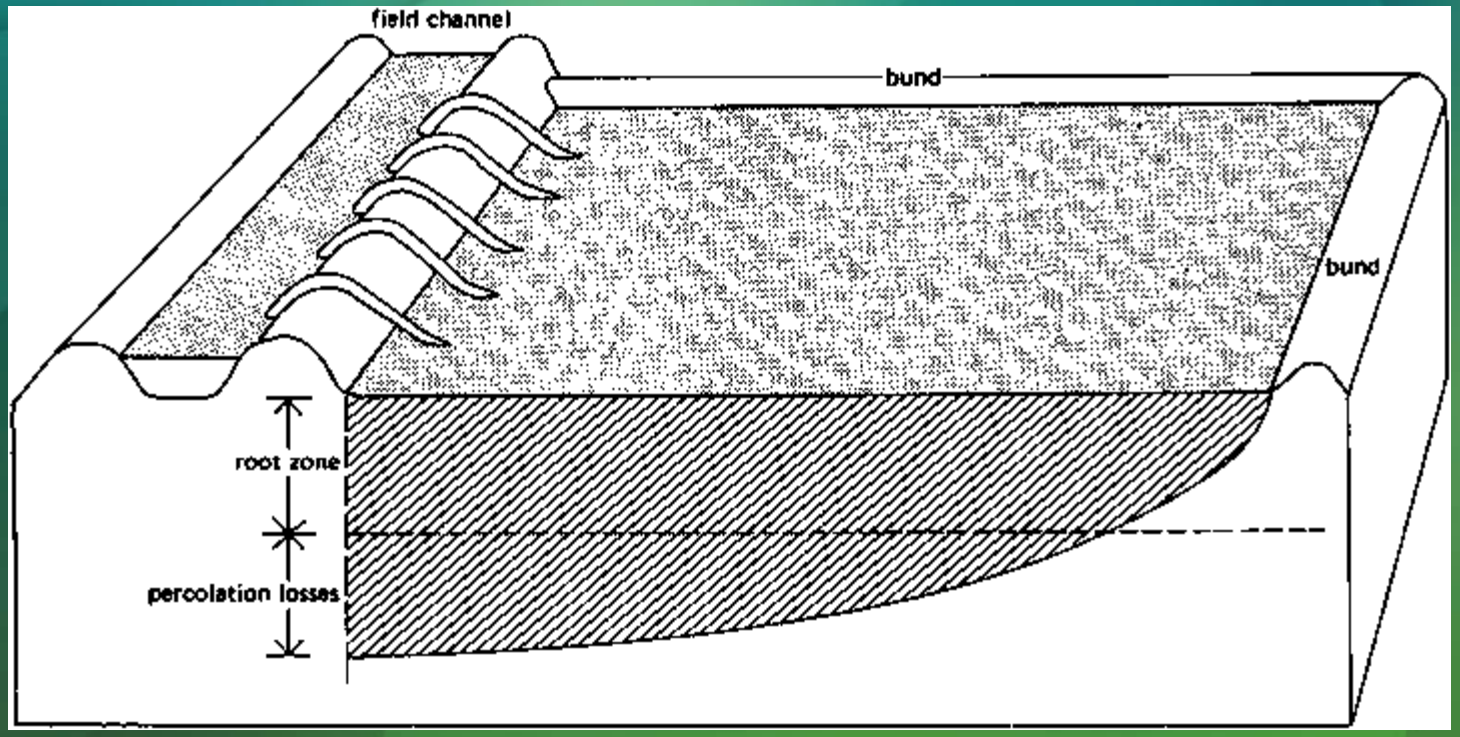
Ideal flood irrigation profile



Poor uniformity



Deep percolation in surface irrigation



Keys to efficiency: surface irrigation

- Improve Distribution Uniformity (DU)
- Move water across field quickly
- Run length: not too long
- Field slope
- On-flow rates
- Soil intake rate (Furrows)

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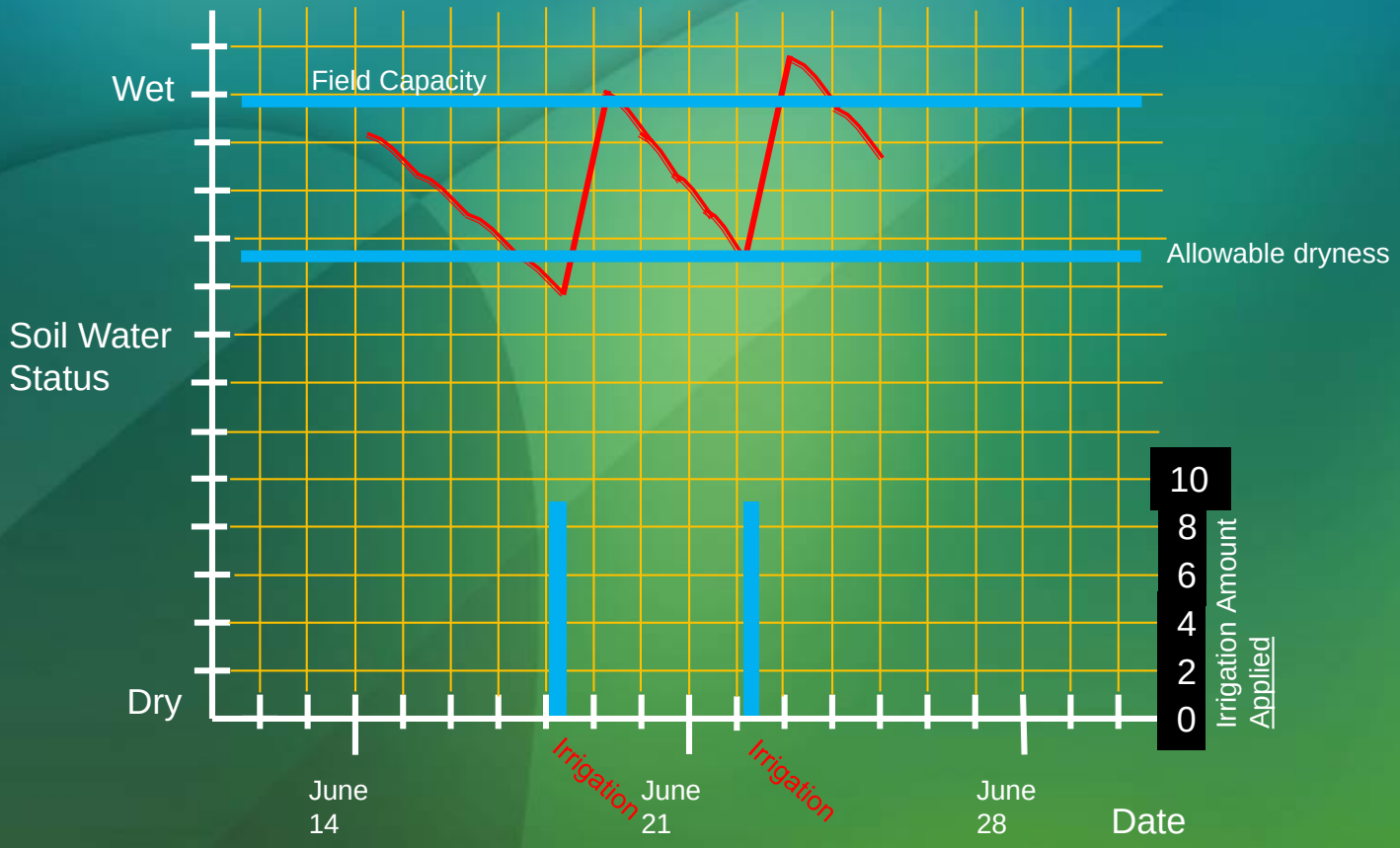
Soil Water Status vs. Time



Key Elements:

- Allowable dryness line
- Field Capacity line
- Soil Water Status line
- Irrigation events

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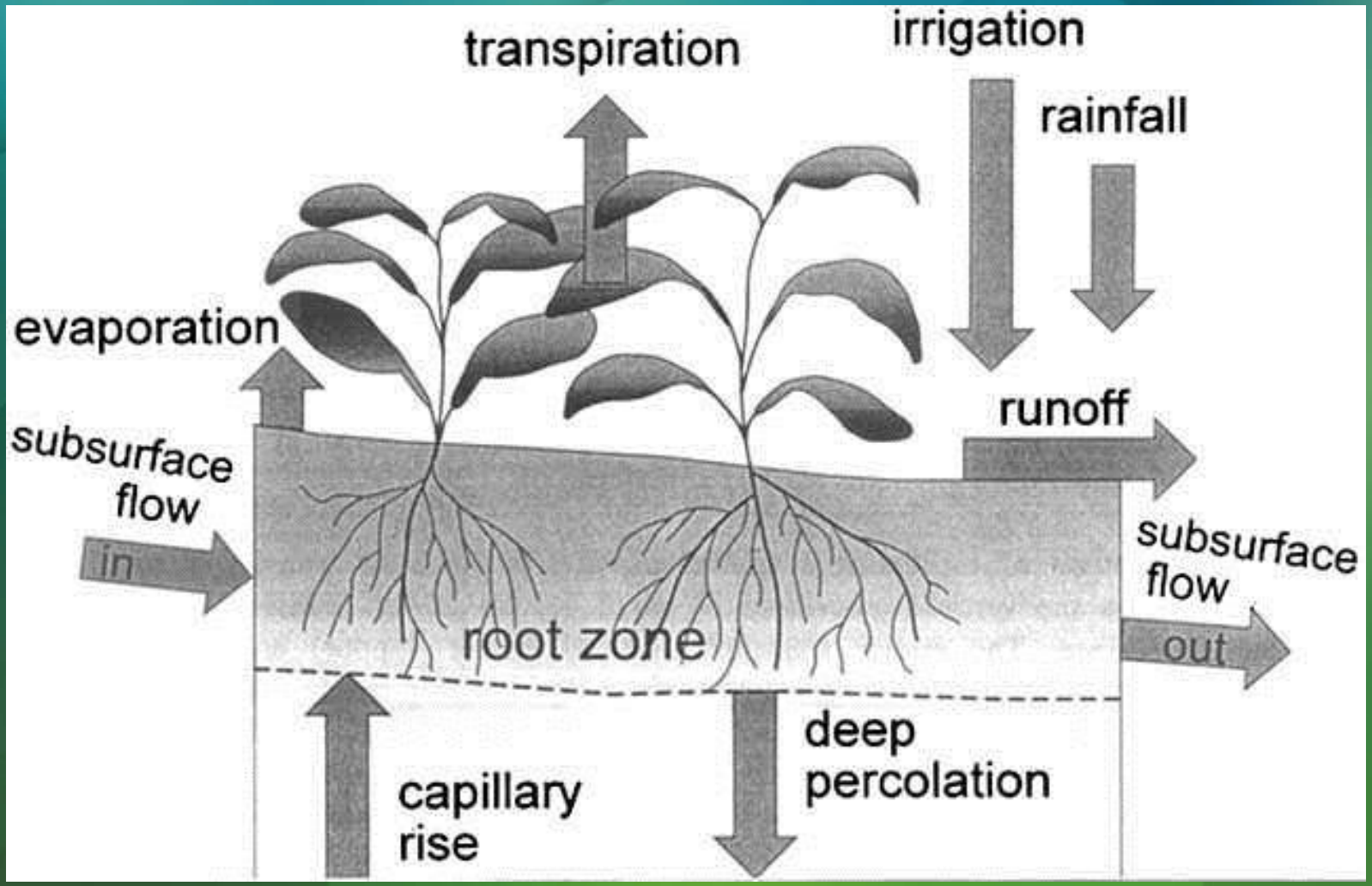
How much and when?



Concepts of irrigation management

How much water should I apply?

- Water in the soil
- Crop water demand (Evapotranspiration)
- Water available (well capacity, irrigation district)
- Irrigation system application rates
- Efficiency of system

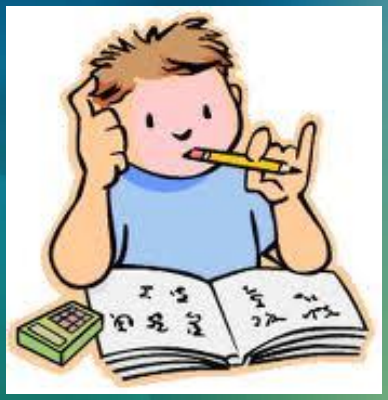
When should I apply water?

- Time since last irrigation
- Soil moisture status
- Crop water use since last irrigation (Evapotranspiration)
- Length of time necessary to irrigate

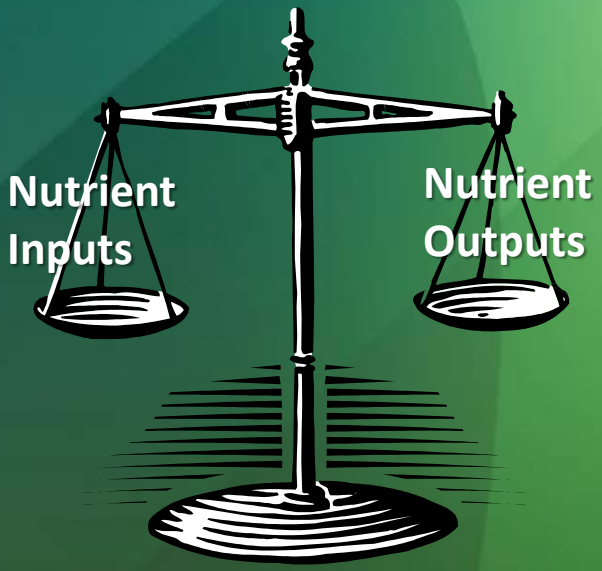
Data and Record Keeping

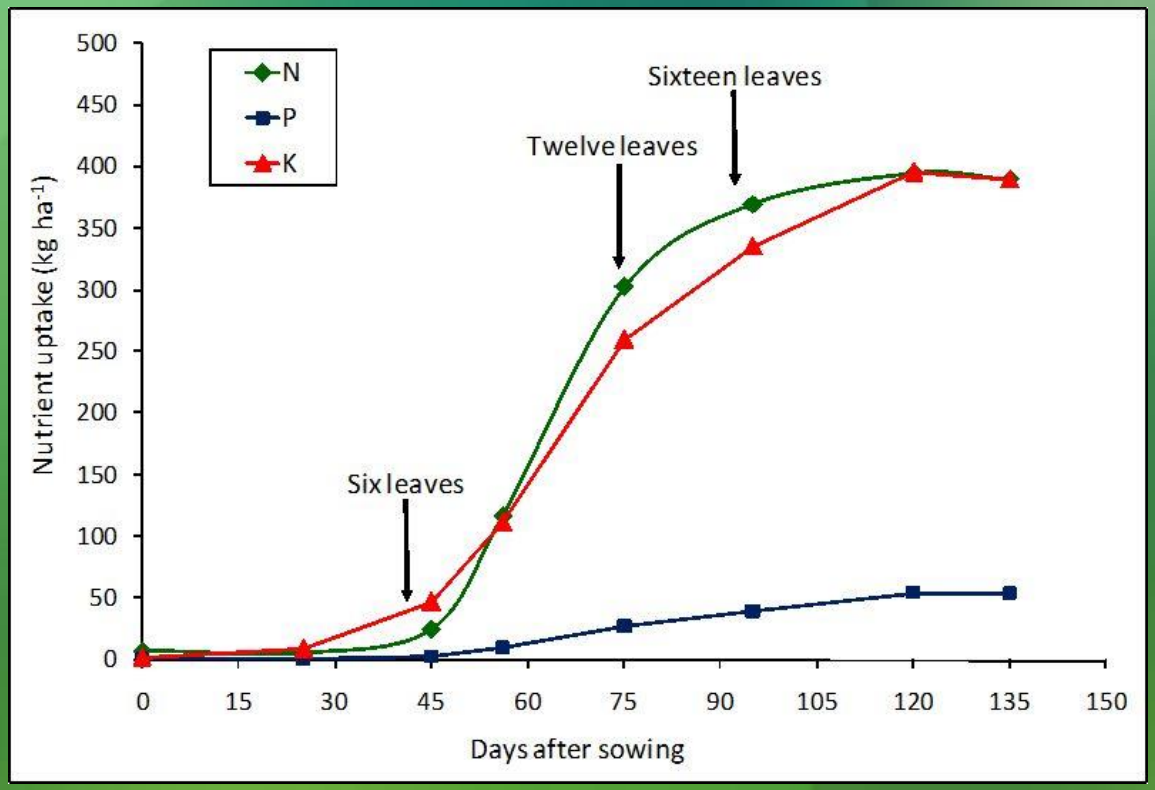
- N budget:
  - Soil test data- Residual N in soil
  - Fertilizer applications
  - Organic material applications
  - Irrigation water nitrate
  - Yield
- Amount of water applied
- Crop ET

NRCS assistance available



- Nutrient Management practice
  - Includes N, P, K





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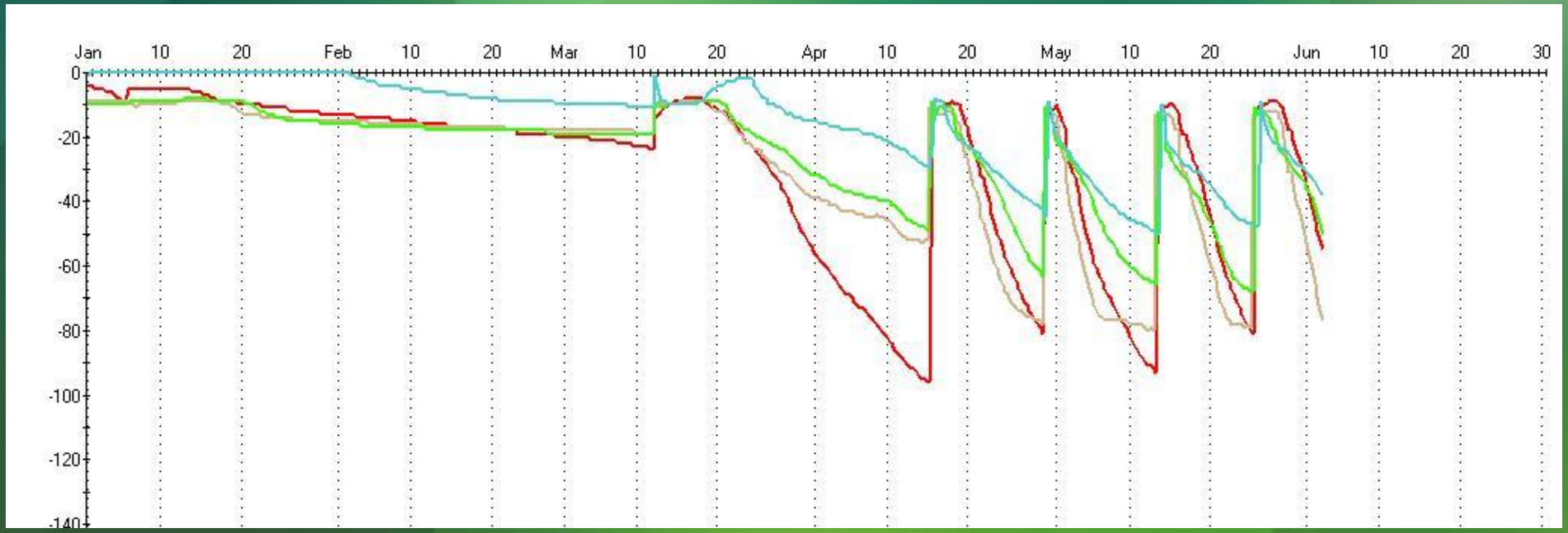

NRCS assistance available

- Nutrient Management practice-
  - Similar, but includes NPK
- Irrigation water management practice
- Technical assistance
  - Soil maps, advice on soil sampling
  - Resource assessment
  - Record-keeping tools
  - Resources, questions

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- Technical assistance
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  - Resources, questions
- Financial assistance: Environmental Quality Incentives Program (EQIP)
  - Competitive process

Resources in Solano County

- Irrigation system evaluations
  - Available throughout the county
  - Solano Irrigation District
  - Paul Lum, Ag Water Efficiency Specialist
- Irrigation water management help
  - NRCS

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