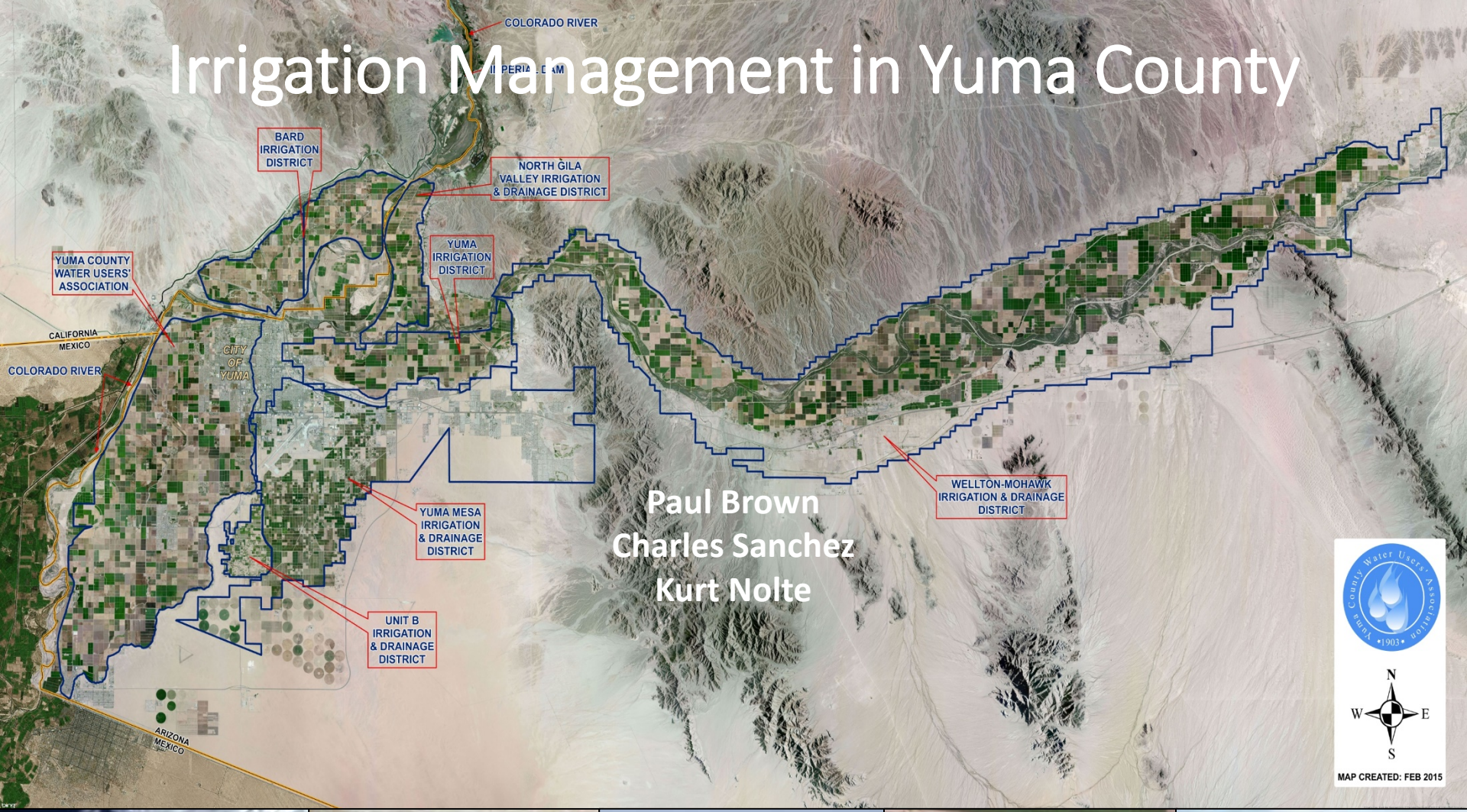
Irrigation Management in Yuma County



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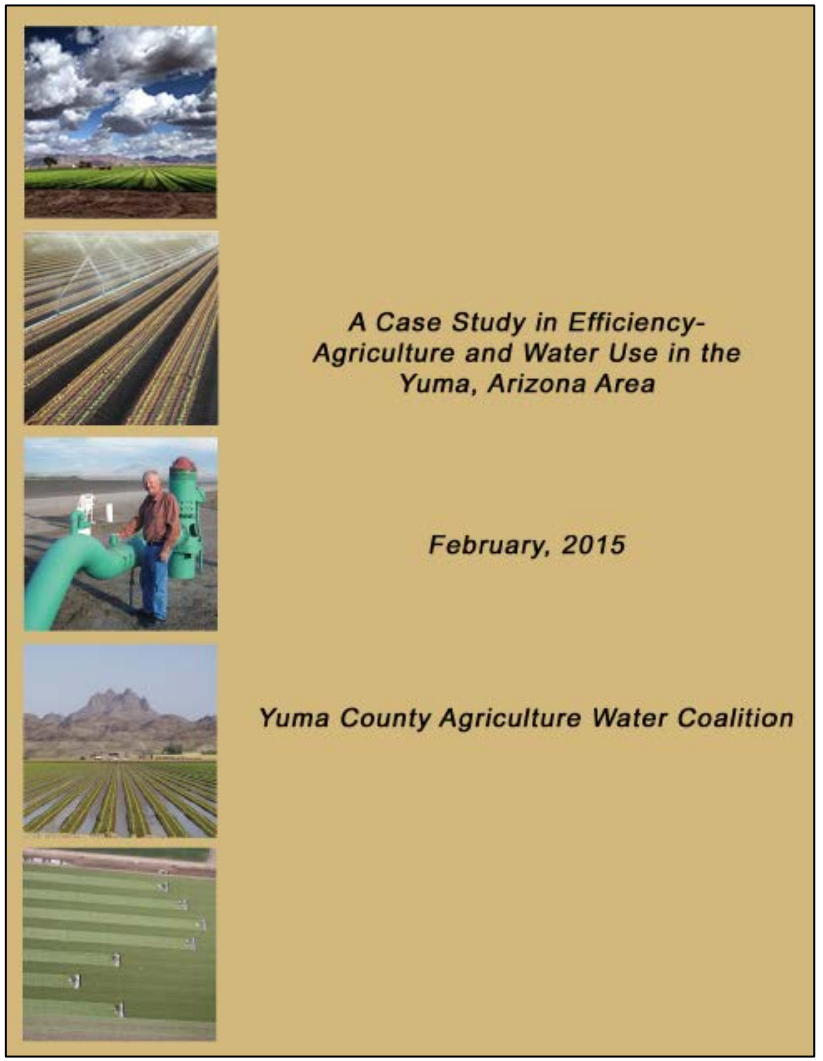
Topics

- **Yuma Agriculture**
  - **Trends/Transformation**
- **Agricultural Water Use**
  - **Trends**
  - **Factors Impacting Use**
- **Irrigation Management**
  - **Infrastructure**
  - **Field Procedures**
  - **Scheduling**
- **Future Research**



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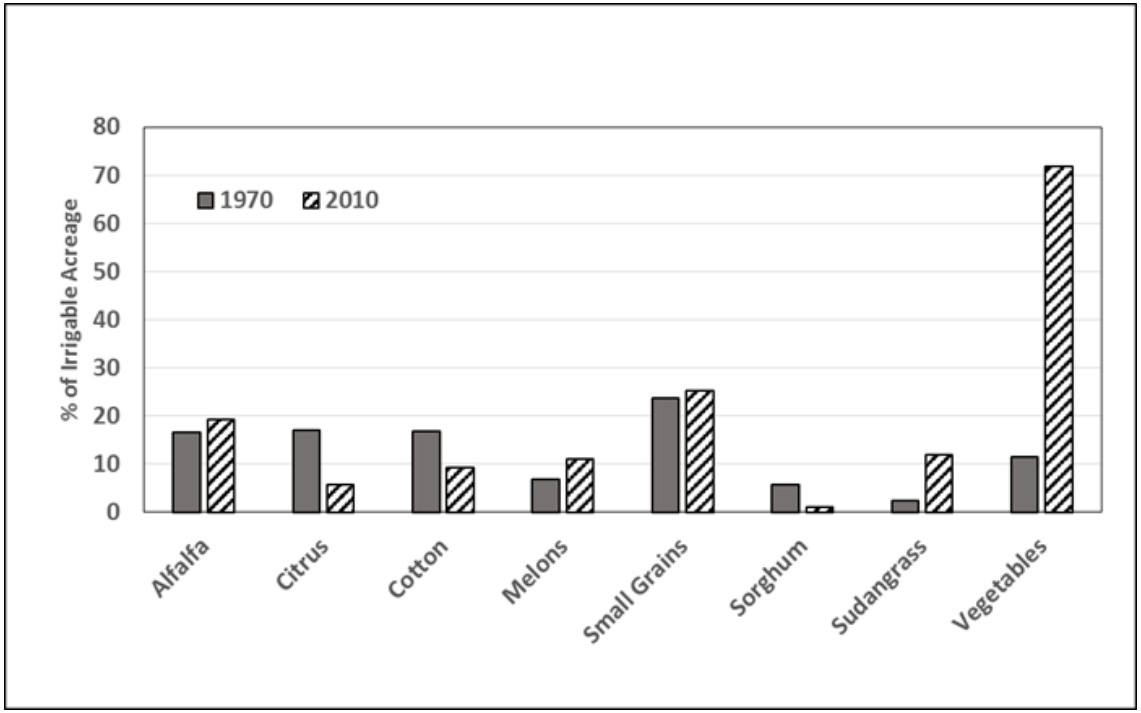
Agricultural Transformation

- **Declining Production**
  - **Citrus**
  - **Cotton**
  - **Sorghum**
- **Stable Production**
  - **Alfalfa**
  - **Small Grains**
- **Expanded Production**
  - **Vegetables**
    - **Leafy Greens**
    - **Broccoli**
    - **Cauliflower**
  - **Melons**
  - **Sudangrass**



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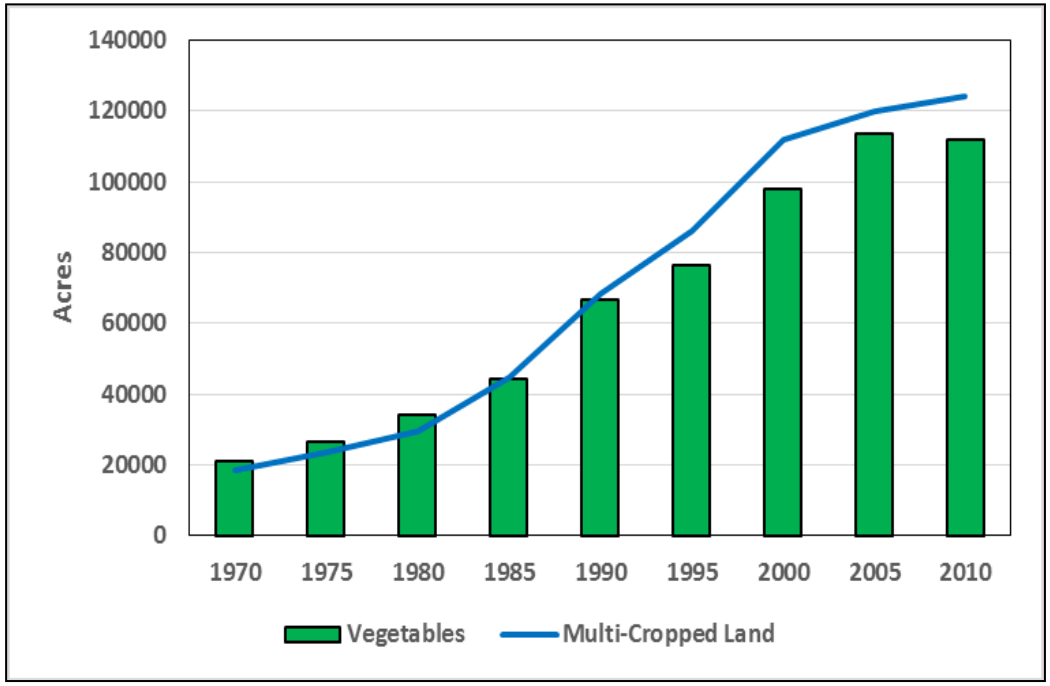
Vegetable Production

- **Vegetables**
  - **6-Fold Increase**
  - **Winter-Centric**
    - **Sep-Mar**
- **Multi-Cropped Land**
  - **6-Fold Increase**
  - **Vegetables Followed By**
    - **Vegetables+**
    - **Wheat**
    - **Melons**
    - **Cotton**
    - **Sudan**



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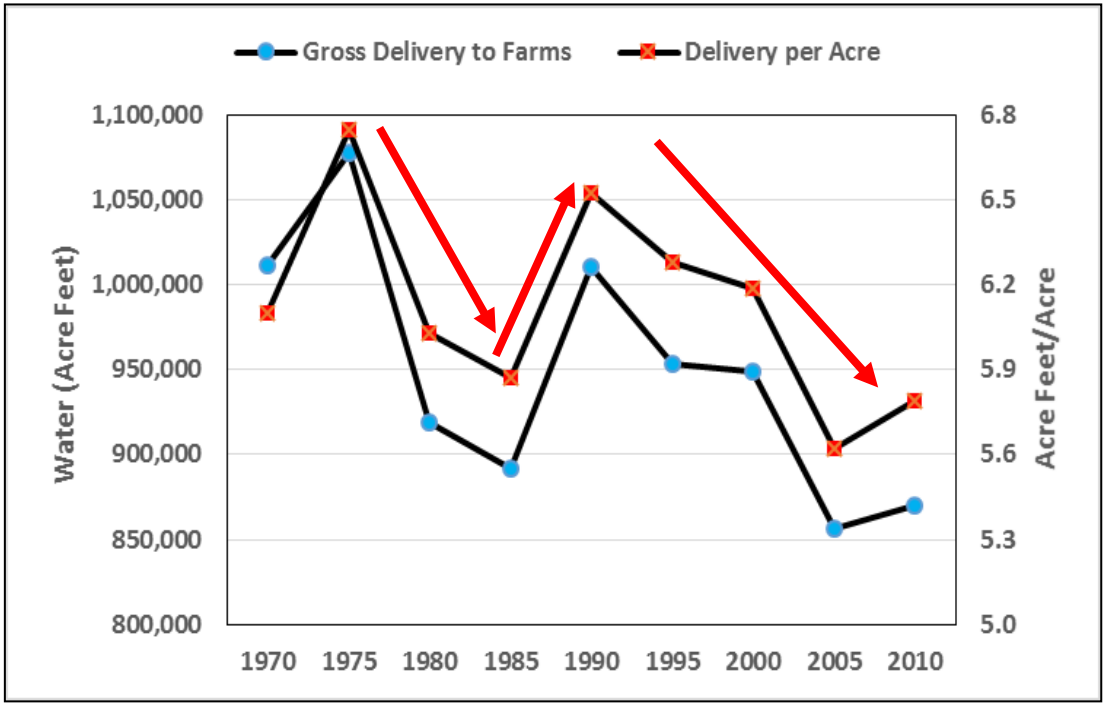
Less Agricultural Water Use

- **Downward Trend**
  - **Total Delivered**
  - **Per Acre**
- **Fluctuations**
  - **Salinity Control Act**
  - **Rise of Vegetables**
  - **Improved Mgmt.**



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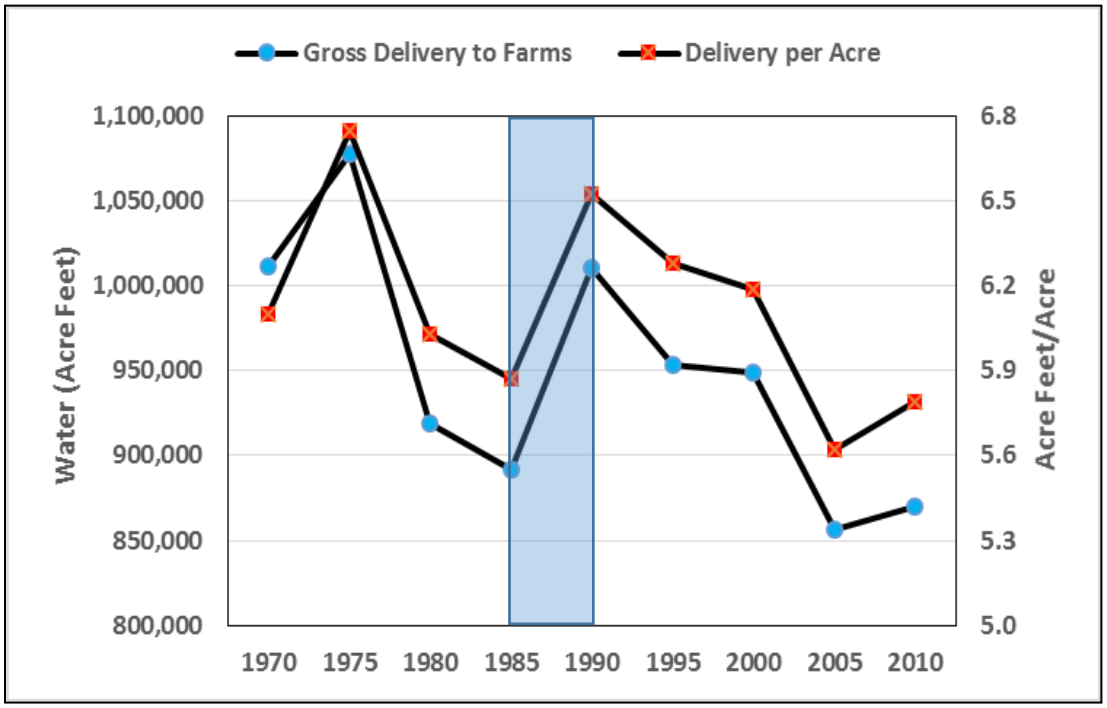
Rise Of Vegetable Production



“Subbing Up” Vegetables

Subbing: fields flooded for extended period to ensure uniform germination/stands. Very high water consumption, resulted in higher water tables.

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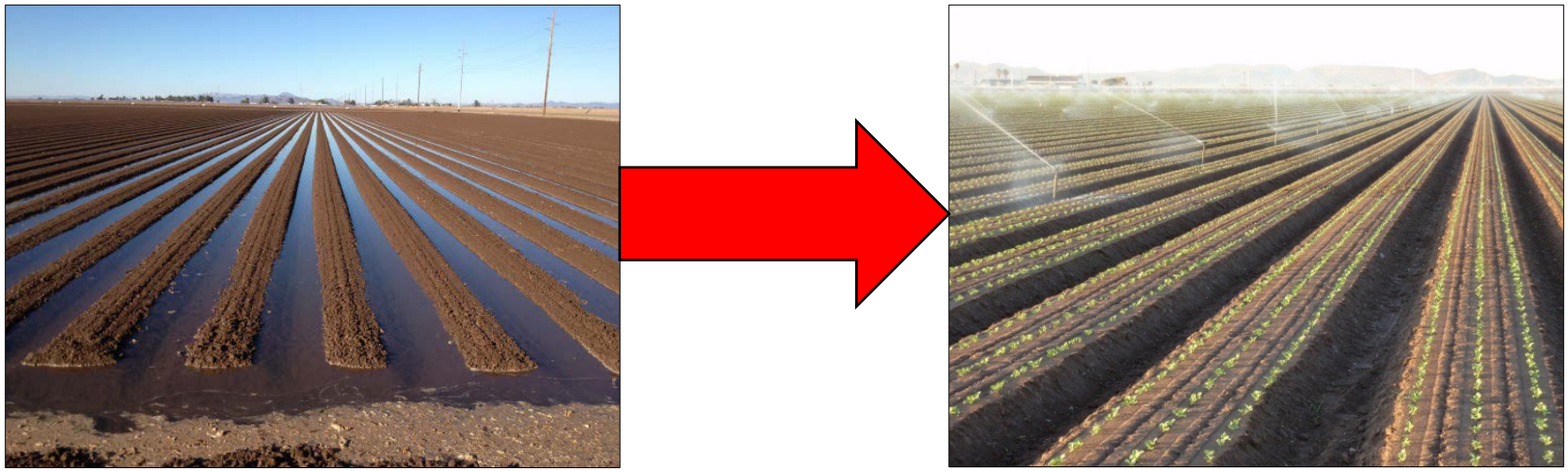
Improved Water/Irrigation Management



Sprinklers have replaced subbing as a means of establishing vegetable crops. Water used to establish vegetable crops has decreased by 50-75%.

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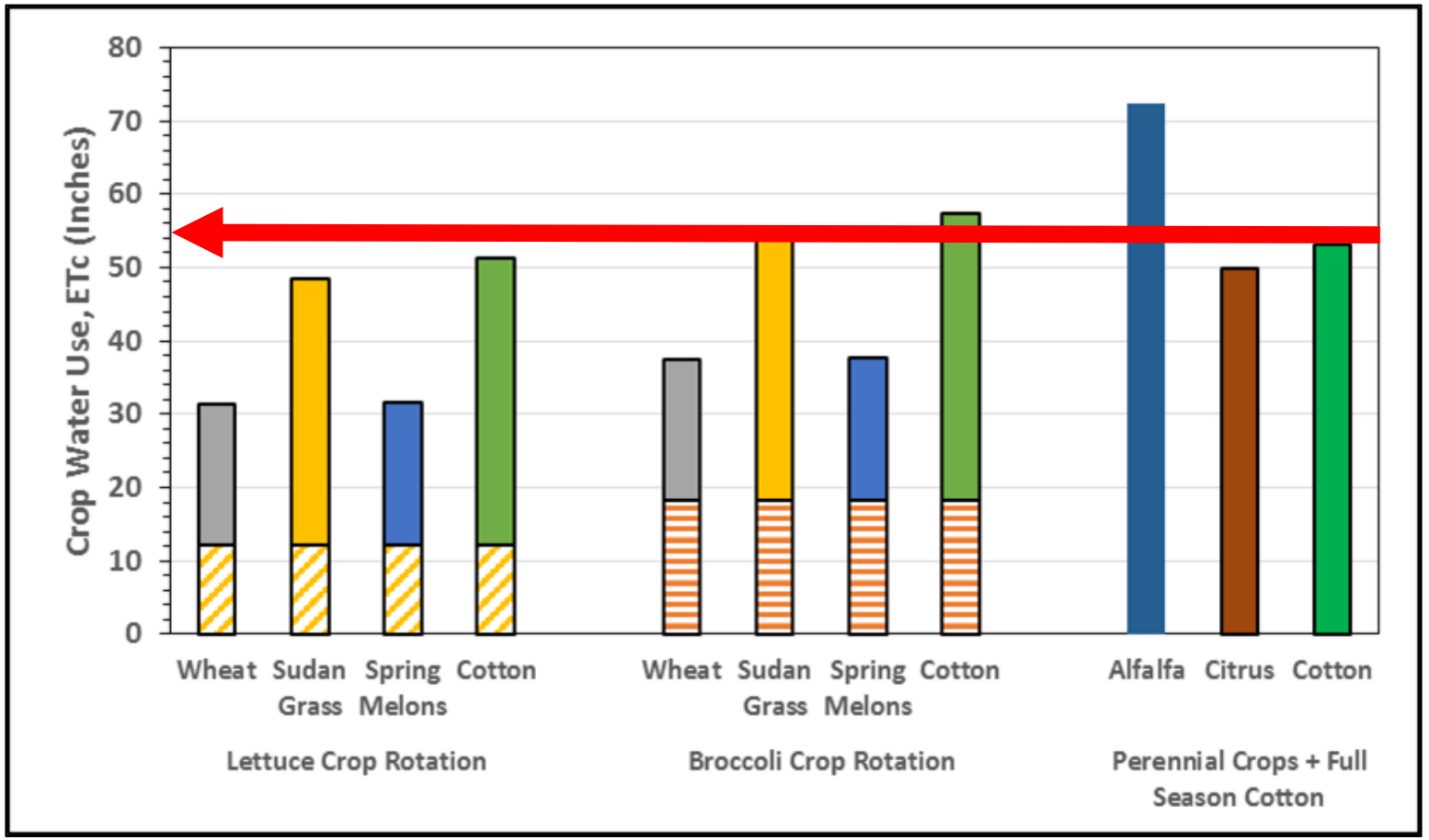
Multi-Crop Production Systems

Often Use Less Water



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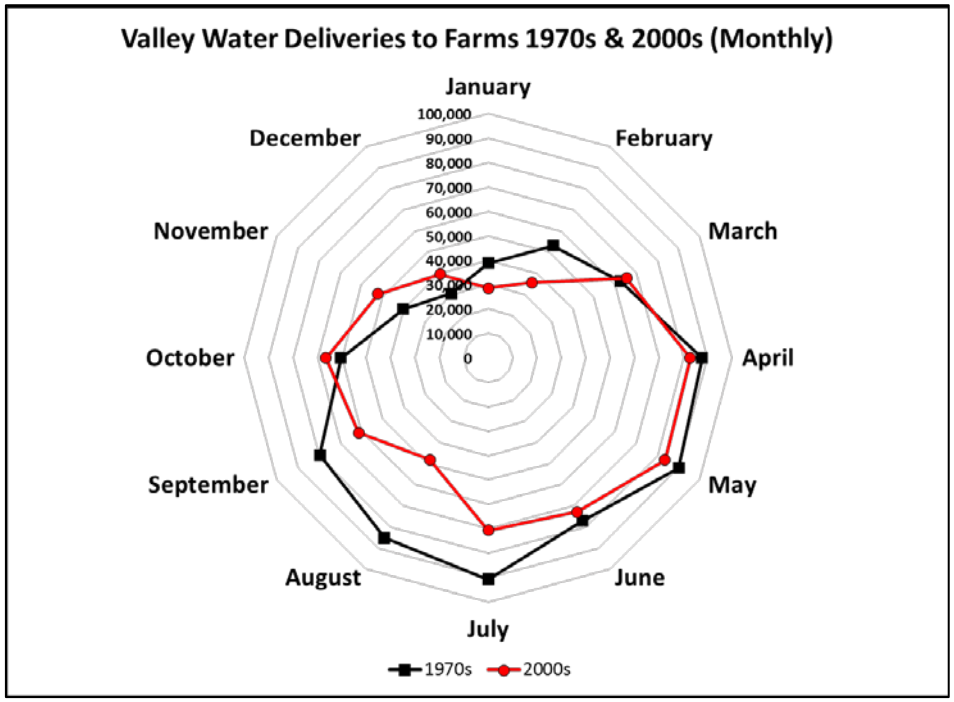
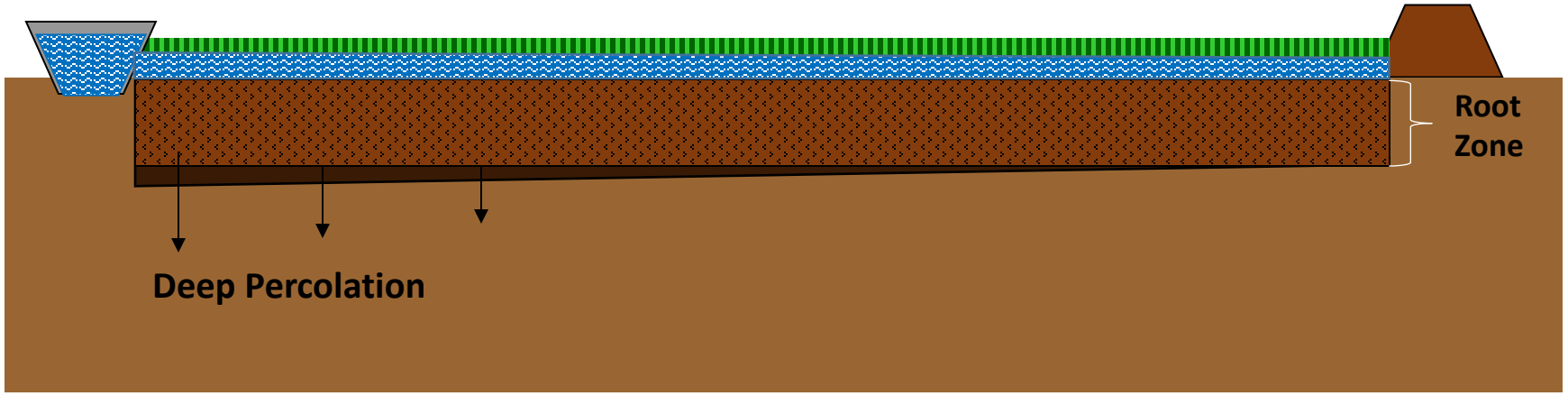
Change in Seasonal Water Use

- **Lower Summer Use**
  - **Less Cotton & Alfalfa**
  - **Wheat Matures in Spring**
  - **Summer Crops**
    - **Early Termination**
    - **Vegetable Field Prep**
- **Higher Fall Use**
  - **Vegetable Establishment**
  - **Vegetable Irrigation**
- **Lower Use: Jan/Feb**
  - **Less Pre-Irrigation**



Level Furrow/Basin Irrigation



High flows, rapid advance of water limits deep percolation

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Level Basin Irrigation

Infrastructure, Equipment, Management

Laser Leveling (Annual)

High Flow Turnouts

Lined Canals

Press Wheels (Bolas)

Shortened Irrigation Runs

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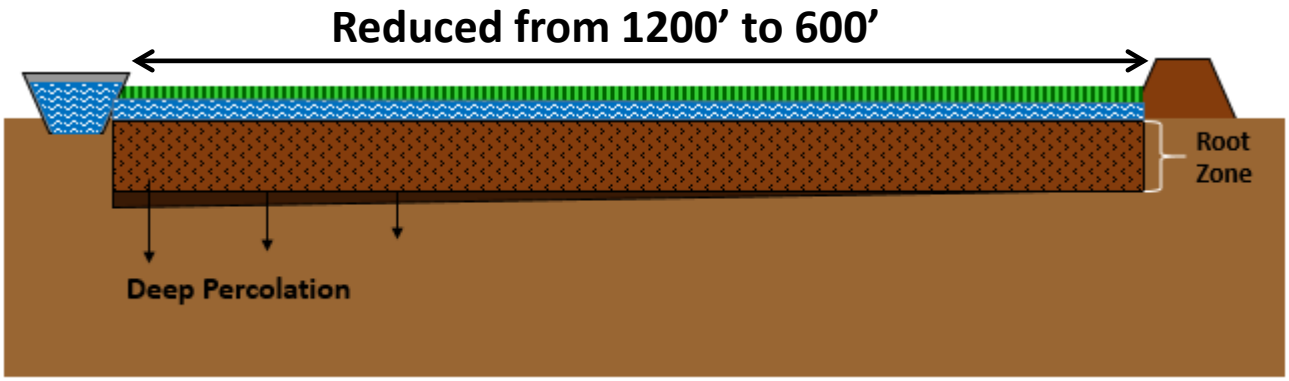

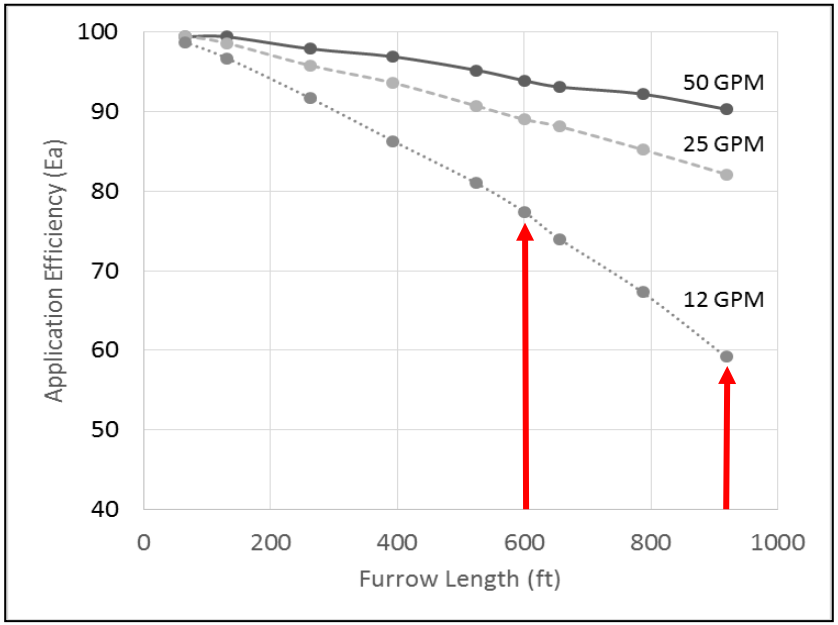

Adapted from Sanchez et al. 2008

Shortened irrigation runs when combined with high flow improve efficiency.

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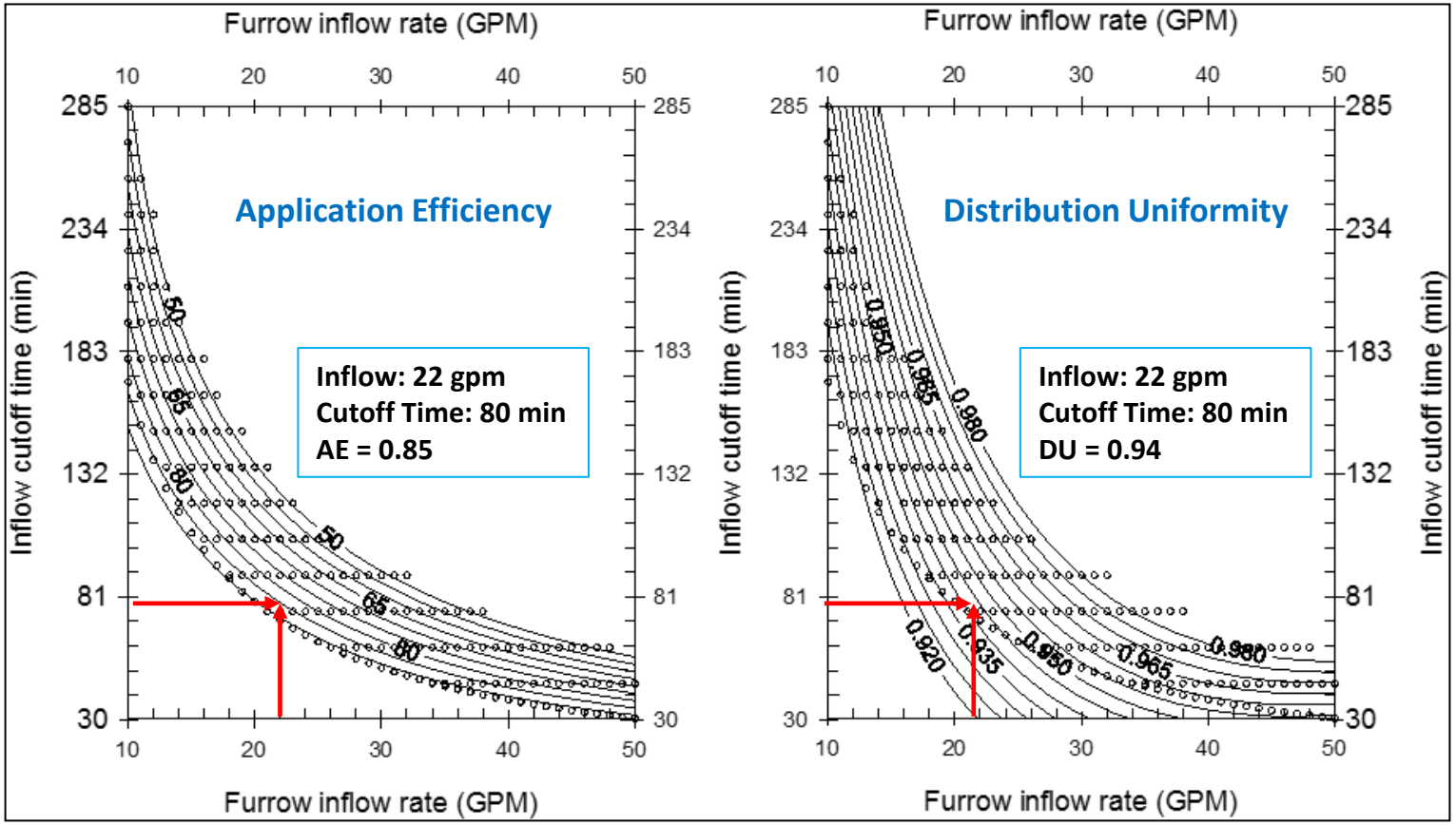
Irrigation System Management



Sanchez et al. (2008) have developed procedures to optimize irrigation system management in both Valley and Mesa soils. High application efficiencies & uniformity can be achieved using proper inflow rates and cutoff times.

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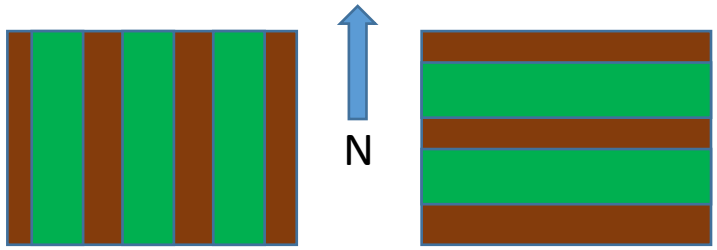
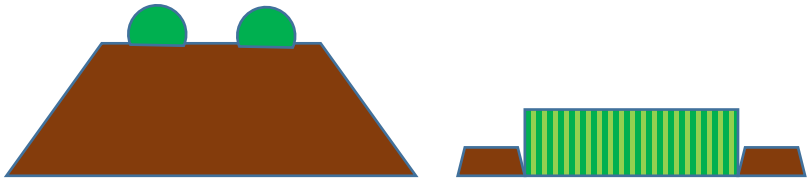
Drip Irrigation

Not Widely Used

- **Advantages**
  - **Uniform Water Application**
  - **Reduced Water Use**
  - **Improved Crop Performance**
- **Disadvantages**
  - **Cost**
  - **Field Flexibility**
  - **Salinity**
  - **Non-Uniform Germination**
  - **Capacity Limitations**



Vegetables: North-South **Melons: East-West**



Variable Bed Width

Two Row Veg: 42”
Cauliflower: 38”
Romaine Let: 34”
Spring Mix: 84”

Level Basins

Wheat
Alfalfa
Sudan

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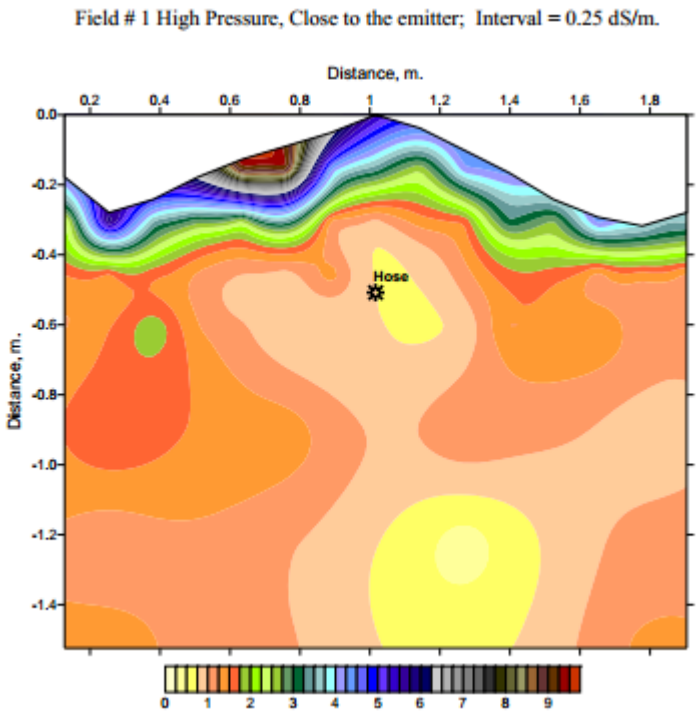
Drip Irrigation
Salinity Concerns



Source: Burt et al., 2003

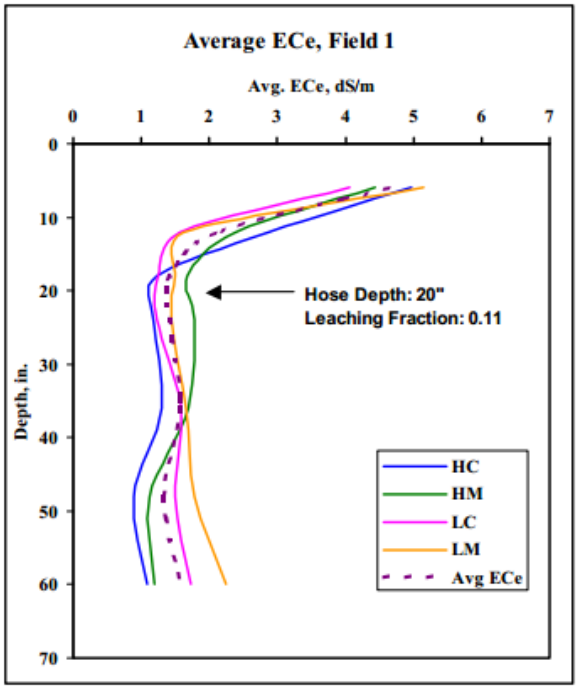


Figure 7. Change of ECe (dS/m) as a function of depth in inches in Field 1.

Source: Burt et al., 2003

Salt accumulates above the drip tape and must be flushed out with leaching. Surface or sprinkler irrigation must be used to leach salts from surface soil.

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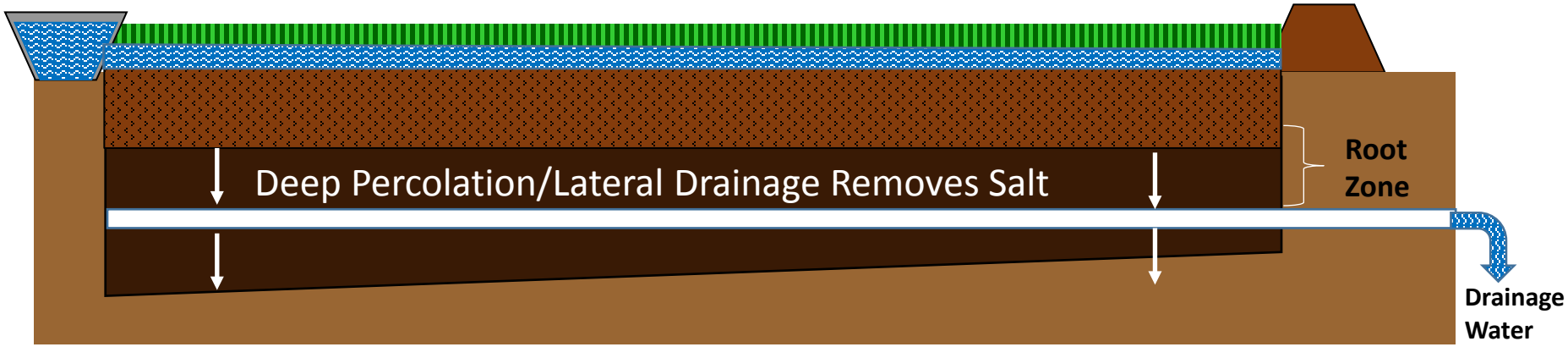
Salinity Management

Leaching is a Requirement!

Irrigation Adds Salt



-- Leaching requirement: w uired to flush salts and maintain proper salinity level in the

-- Varies with salinity of irri ty tolerance of crop.

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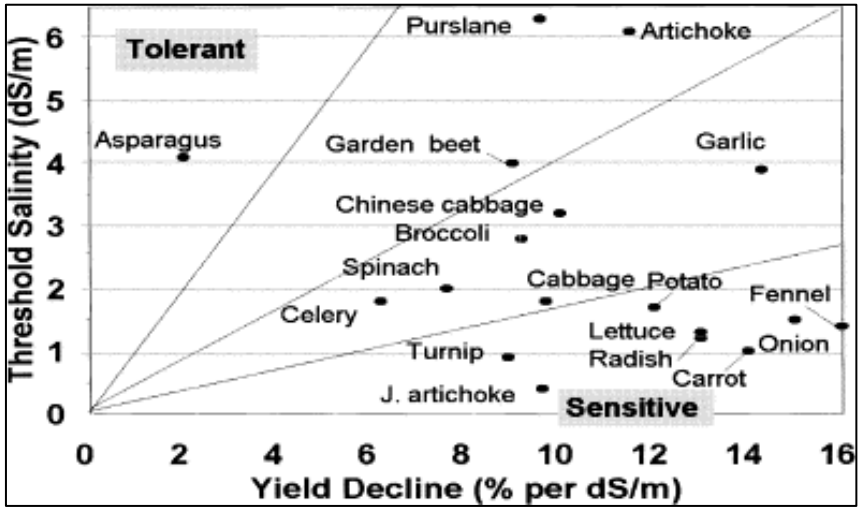
Vegetable Crops

Intolerant of High Salt Levels



Source: Ayers & Wescott, 1994

Late Summer Leaching Prior To Planting Vegetables

Leaching fractions of ~15% are required to maintain optimal salinity levels for vegetables.

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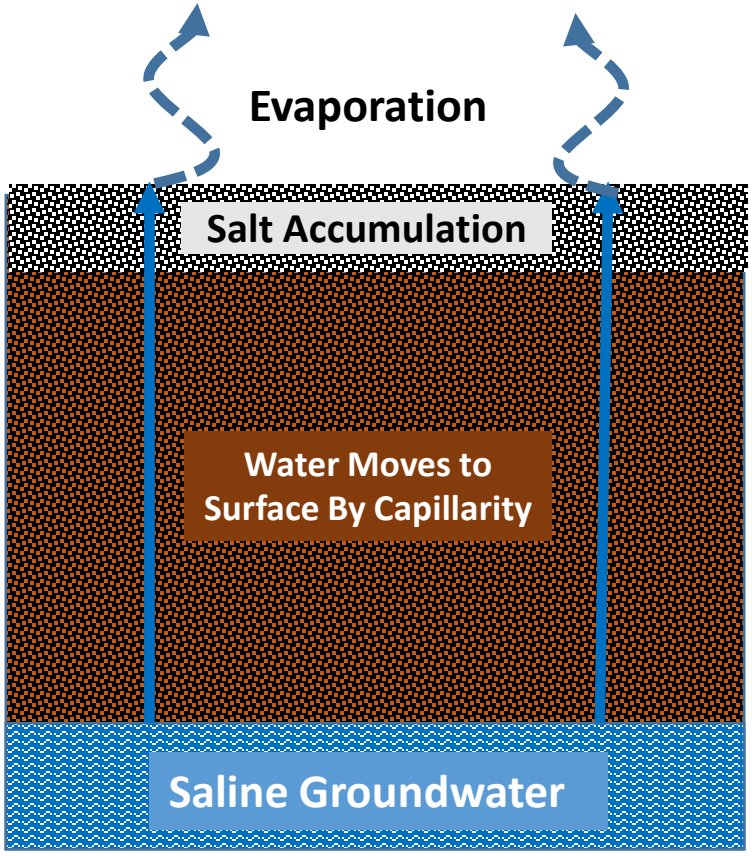
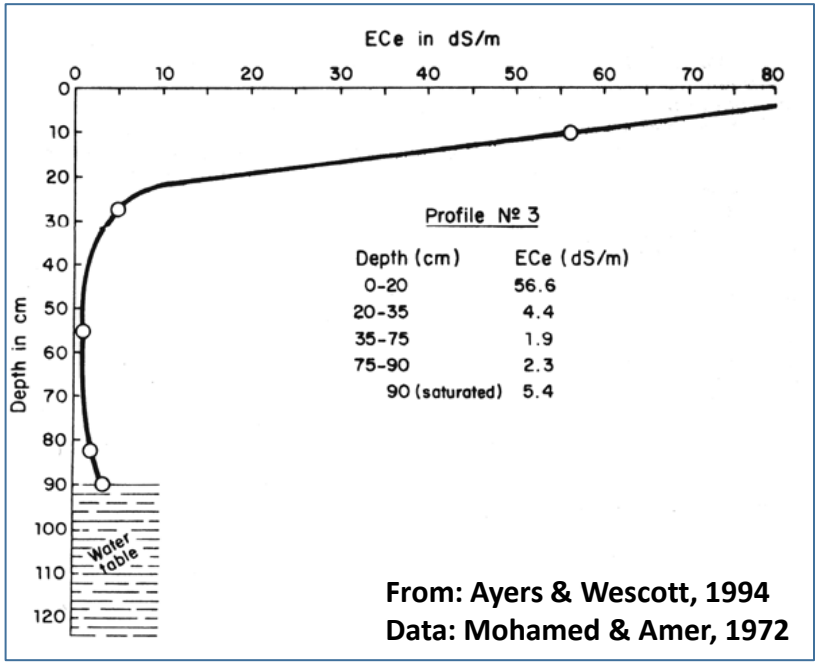
Fallowing & Salinity





From: Ayers & Wescott, 1994
Data: Mohamed & Amer, 1972

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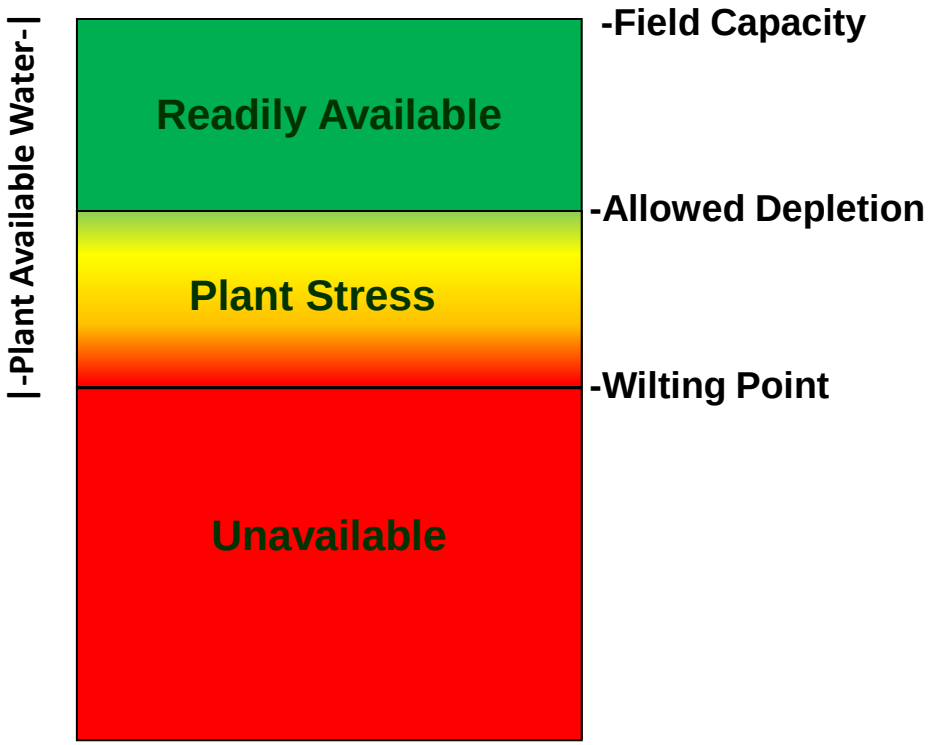
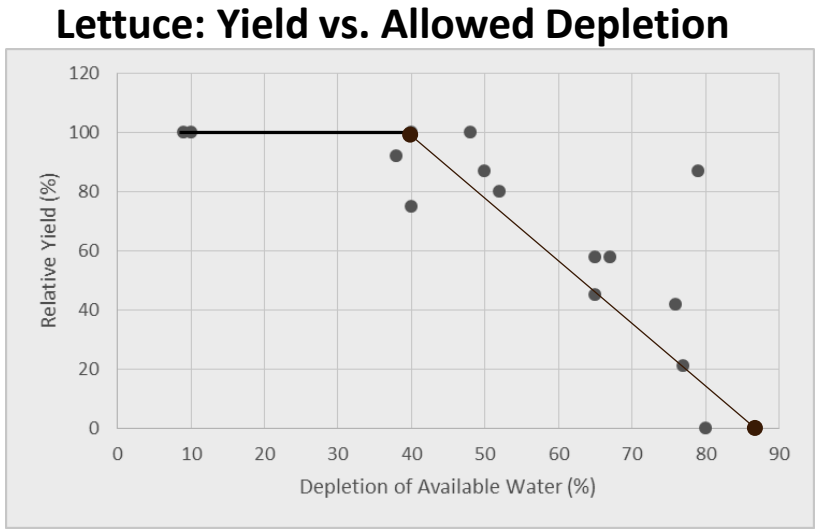
Irrigation Scheduling

Understanding Soil Water Reservoir





We Manage ~ 25% of Soil Water Through Irrigation

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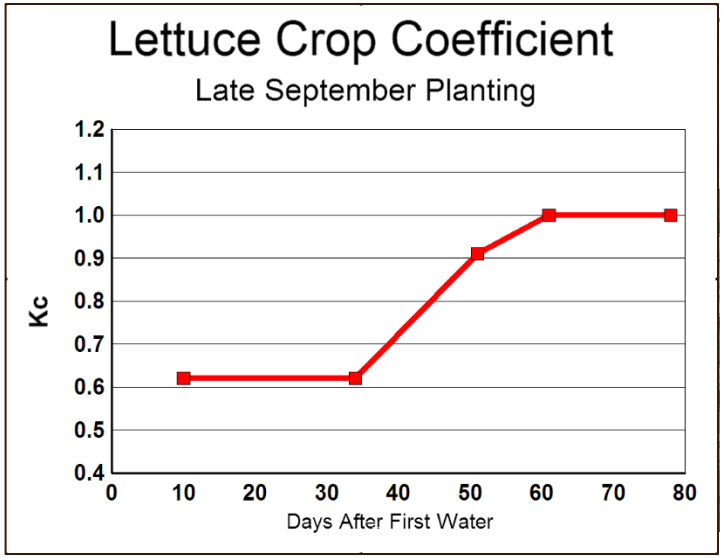
Estimating Crop Water Use

Weather Data

Crop Coefficients



Crop Water Use

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District Wide Irrigation Efficiency

Wellton-Mohawk Irrigation & Drainage District

- **Procedure 1**
  - **Crop Water Use**
    - **Crop ET * Acreage**
  - **Compared to Water Diverted to Farms**
- **Procedure 2**
  - **Salinity of Water Diverted to District (Ciw)**
  - **Salinity of Water Diverted to Drainage Canal (Cdw)**

LF = Ciw/Cdw
Efficiency = 100*(1-LF)

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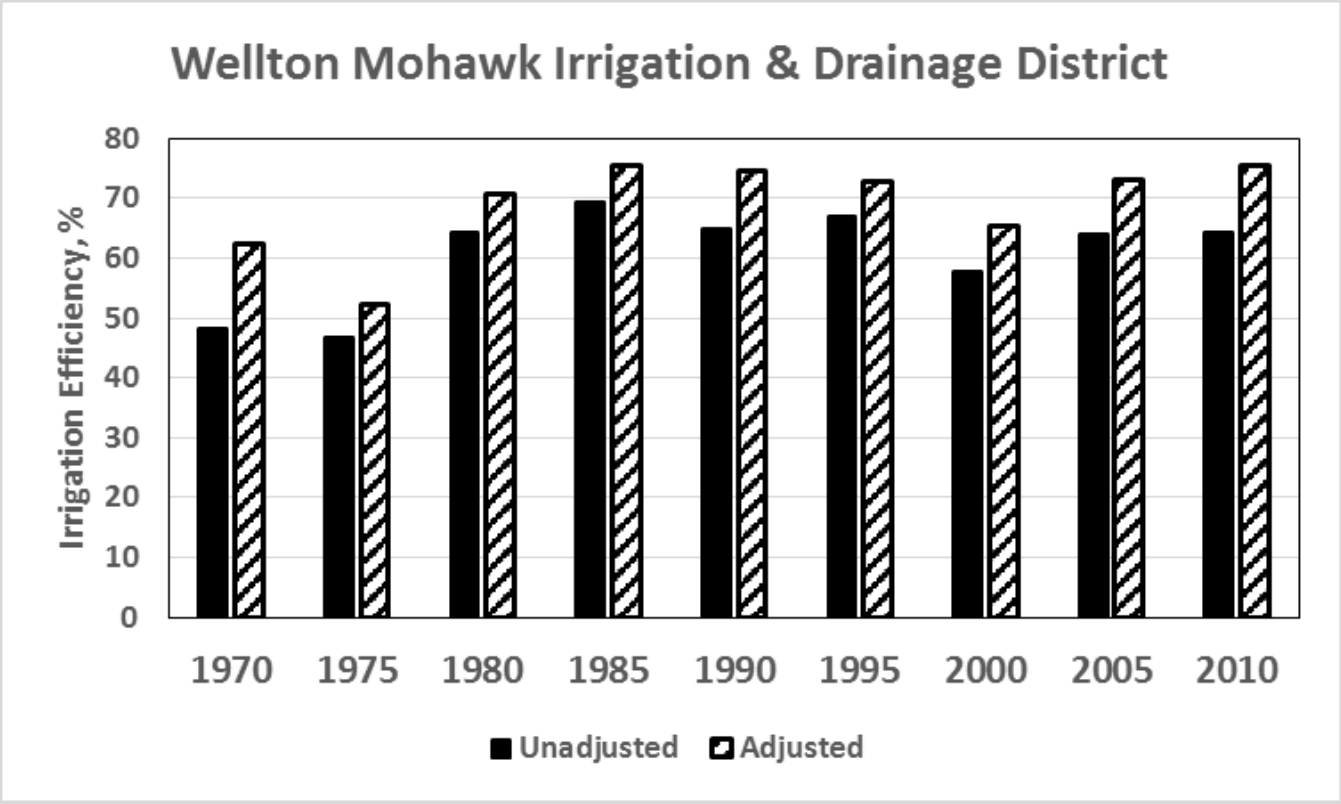
On-Farm Irrigation Efficiency

From Crop Water Use Estimates



Without acreage adjustment: 60-70%

With acreage adjustments: 70-76%

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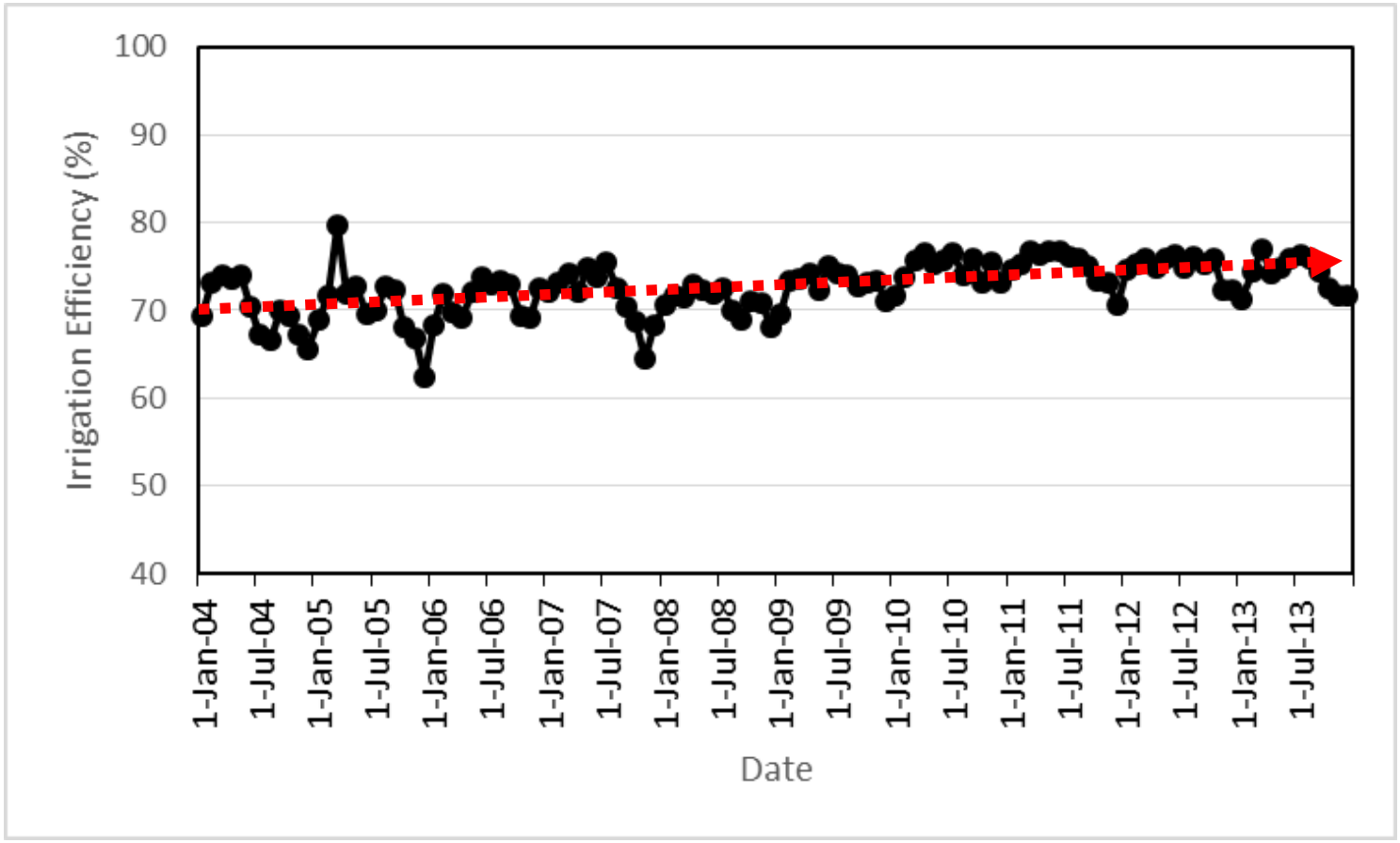
District Irrigation Efficiency

Using Salt Balance Procedures



-Irrigation efficiencies averaging close to 75%, upward trend
-Seasonal minimum during vegetable establishment
-Peak efficiencies in summer (deeper rooted crops)

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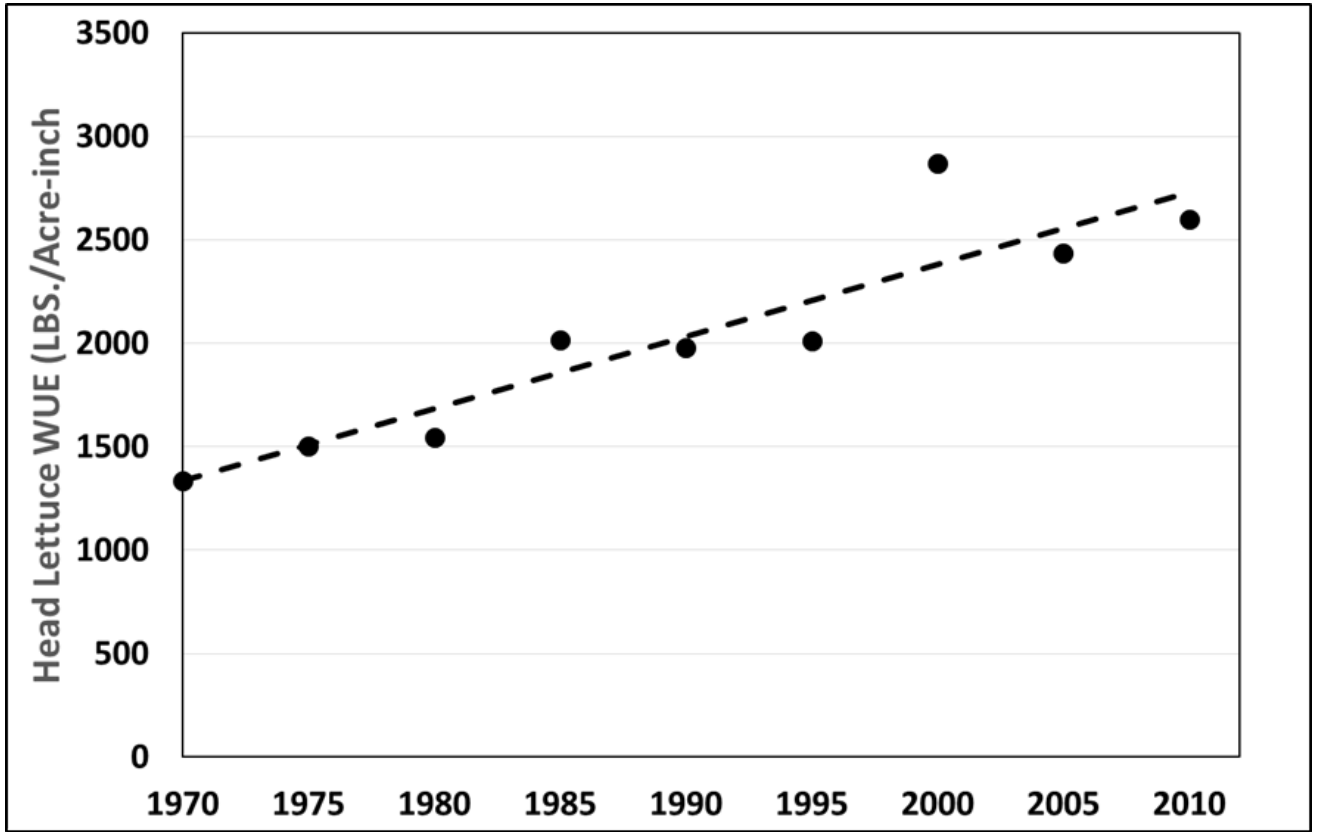
Improving Water Use Efficiency

Growers Implementing New Production Technologies



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Research Needs

- **Reexamine Crop Water**
  - **Much of Data Now Very Old!**
  - **New Vegetable Crops**
- **Salinity Issues**
  - **Effectiveness of Current Leaching Procedures**
  - **Fallow/Salinity Assessment**
- **Sprinkler Management**
  - **Microclimate, Salinity & Establishment**
- **Scientific Irrigation Scheduling**
  - **Weather/ET Systems**
  - **Soil Moisture Monitoring**