

Florida Commercial Horticultural Production: Constraints Limiting Water and Nutrient Use Efficiency

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Topics to address

- ID of questions
- General constraints overview
- Discussion of constraints with respect to specific irrigation systems
- Impact of drainage practices on water and nutrient use efficiency


Questions to Address

- What are the constraints that limit efficiency when using the following irrigation methods?
 - Seepage.
 - Drip and micro-sprinkler.
 - Overhead.
- How do drainage practices used by producers affect water and nutrient-use efficiency?

Constraints

- **Any factor within a production system which inhibits, impairs, restricts or reduces the availability of applied water or nutrients can certainly contribute to inefficient use of either input.**

Factors to Consider


- Irrigation system
 - Soil environment
 - Cultural management
 - Method of fertilization
 - Operator management intensity
 - Economics
 - Reluctance to implement
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Irrigation system

- Application efficiencies
- Coverage area
- Evaporation
- Conveyance losses
- Precision of application
- Fertigation potential



Soil characteristics

- Water and nutrient retention characteristics
 - Water and nutrient movement characteristics
 - Presence of (or lack of) water table
 - Drainage characteristics
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Cultural Management

- Bedded vs non-bedded
- Mulched vs non-mulched
- Fertilization procedures
- Transplanting vs direct seeding

Operator Management Efficiency

- Attention to details
- Scheduling
- Maintenance

Seepage Subirrigation

- Uses managed water table level
 - Requires
 - Large quantity water source
 - High natural water table
 - Soil with high water transmissivity characteristics
- Very effective for production goals
- Traditional system for many high value row crops in S. Florida

Constraints to effective water and nutrient use efficiency

- The system itself (high system demands for water not for plant use)
- Traditionally, over-application of nutrients (beyond plant nutrient requirements) is the norm
- The soil (very low water and nutrient holding capacity)
- Management

Drip and Micro-sprinkler Irrigation

- Improved precision for application of water and nutrients
- Irrigation and fertilization in target locations only (root zone)
- Improved flexibility for scheduling
- Limited nutrient leaching vulnerability

Constraints to effective water and nutrient use efficiency

➤ Soil

- Distribution in root zone
- Vulnerability to leaching

➤ Management



Overhead irrigation

- Solid set impact sprinklers
- Traveling systems
 - Guns
 - Lateral move and center pivot
- Irrigates gross area
- Not normally conducive to fertigation

Constraints to effective water and nutrient use efficiency

- System itself (evaporative losses, gross area application...)
- Soil can be a constraint if low in water and nutrient holding capacity
- Weather (possibly)
- Management

Question #2

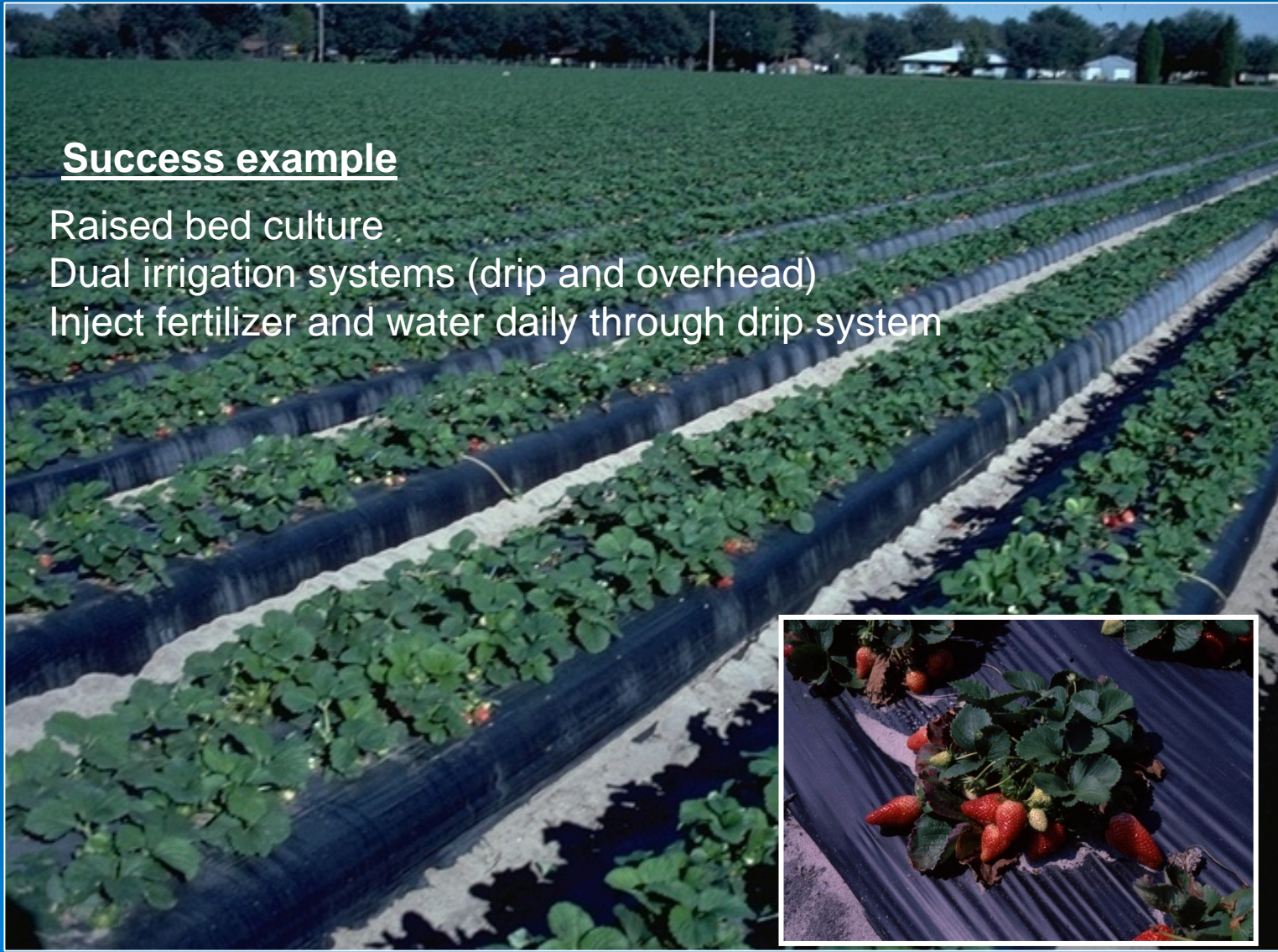
- How do drainage practices used by producers affect water and nutrient-use efficiency?
- Factors to consider
 - Drainage system design
 - Minimize loss/maximize retention (w/o endangering the crop)
 - Capture and reuse

Success example

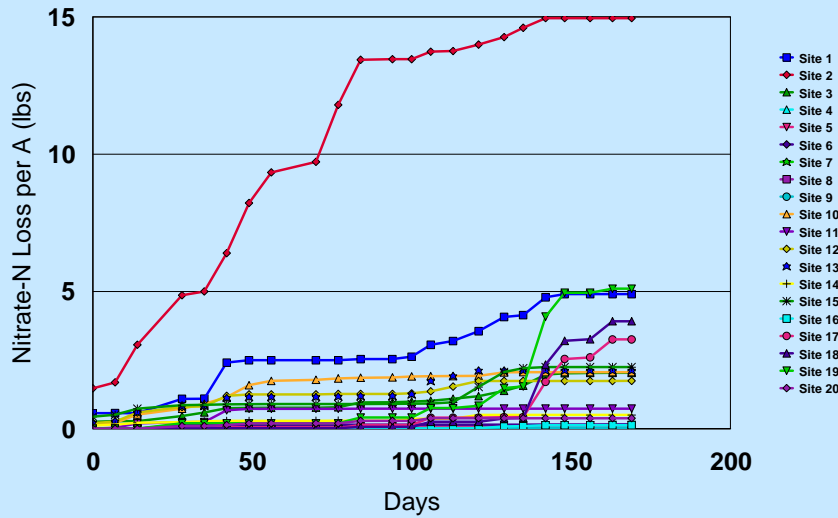
Raised bed culture

Dual irrigation systems (drip and overhead)

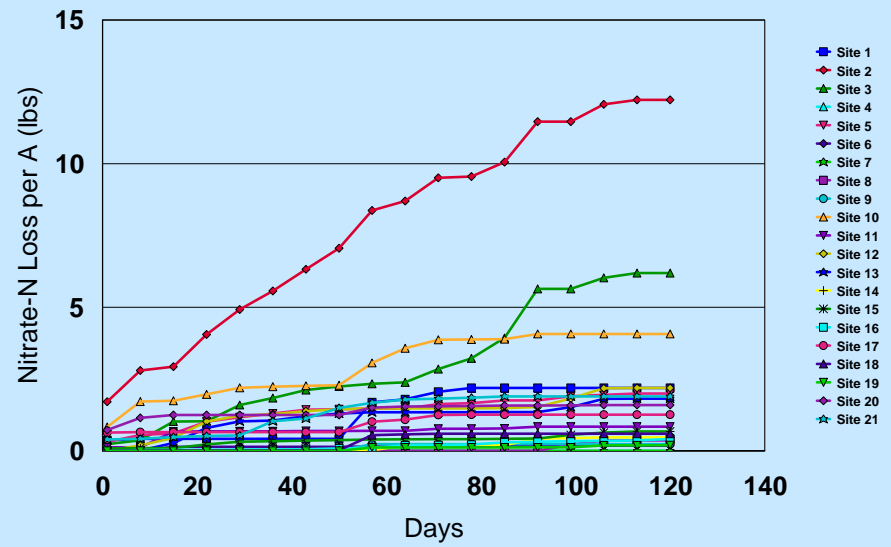
Inject fertilizer and water daily through drip system



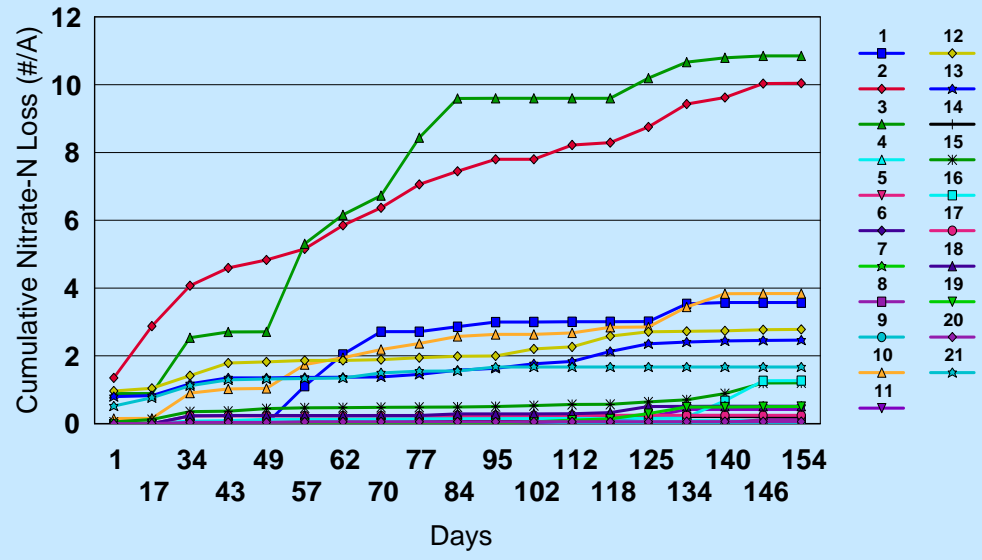
All Sites (2004-2005)



All Sites (2005-2006)




All Sites (2006-2007)



Remaining Questions

- Vision: what does the industry need to do better?
- Where should the future research efforts be focused?
- What are the critical issues on the horizon that may affect the industry?

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- Where should the future research efforts be focused?
 - Development and evaluation of new technologies
 - Continued field validation of BMP recommendations
 - Increased effort on impacts of land use changes on water quality
 - Improve effectiveness in communicating BMP advantages