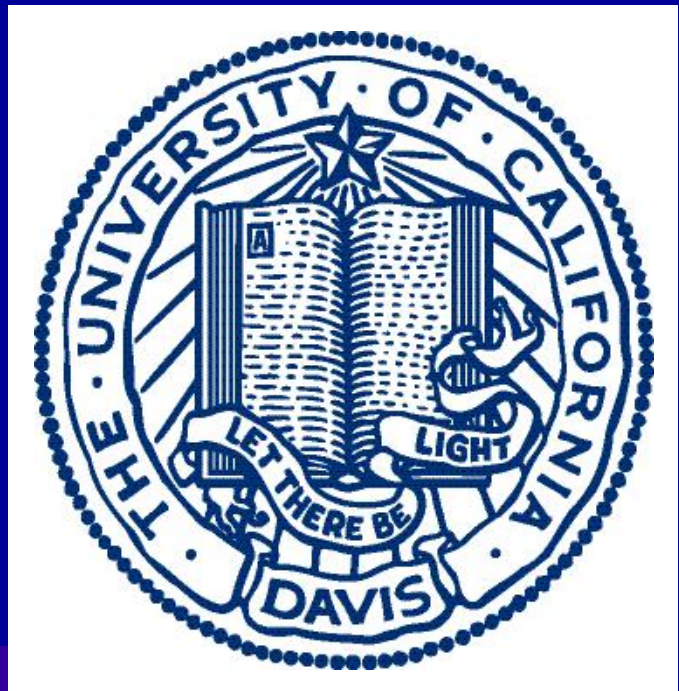
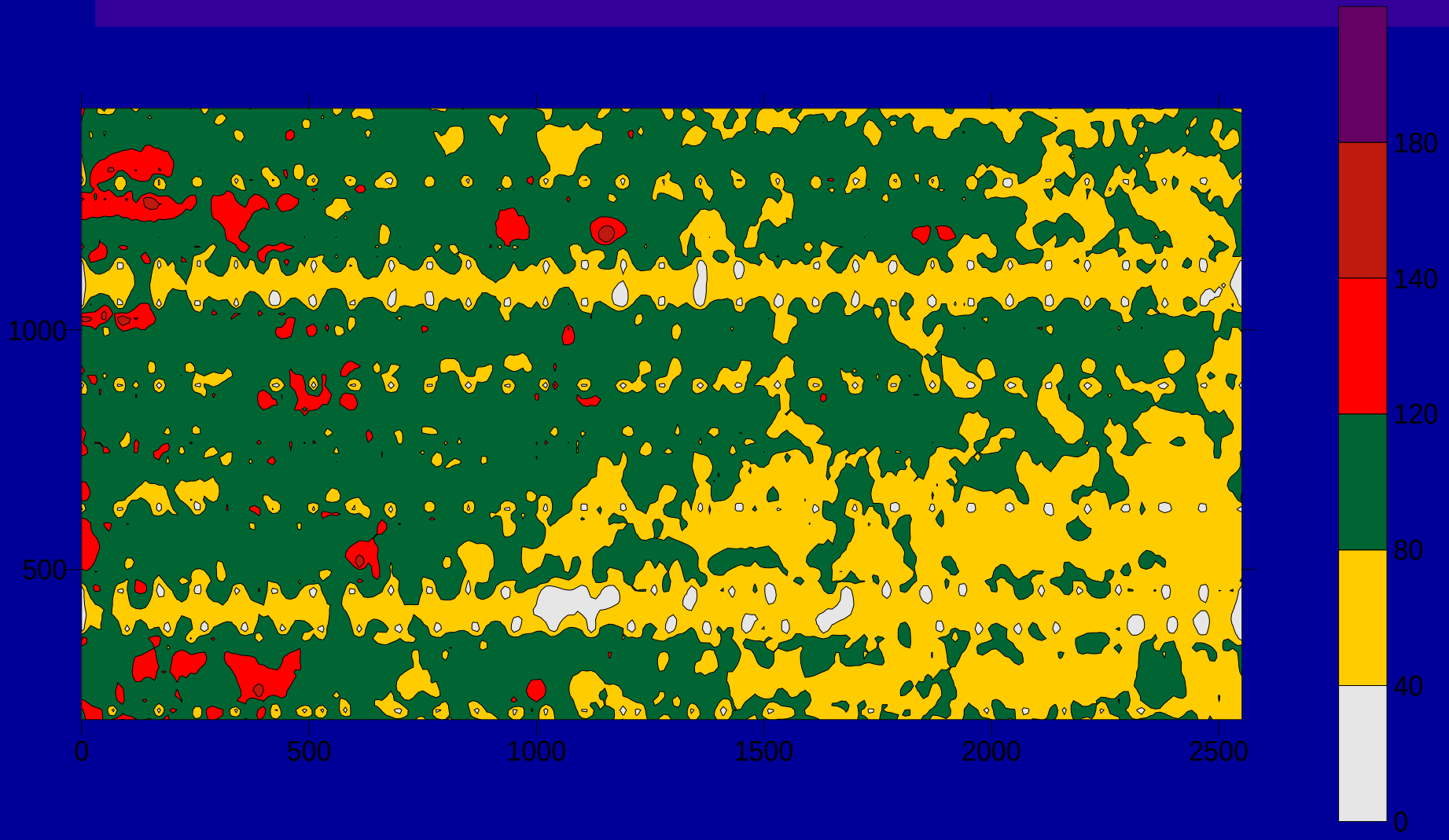
PRECISION AGRICULTURE – Specialty Crops

Shrini K. Upadhyaya, Professor

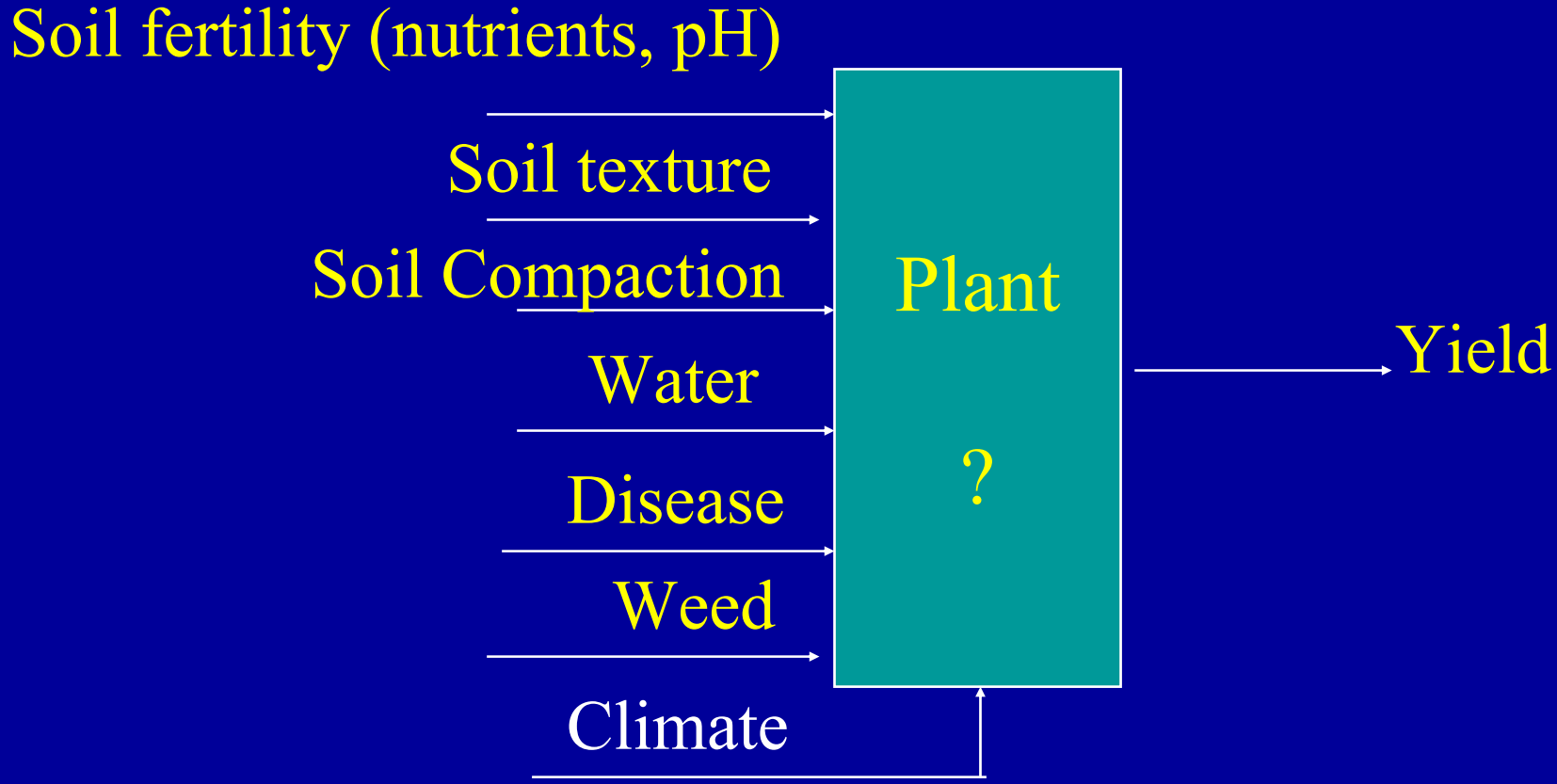
Bio. And Agr. Eng. Dept.



PISTACHIO YIELD MAP



Why does the yield change within a field or an orchard?



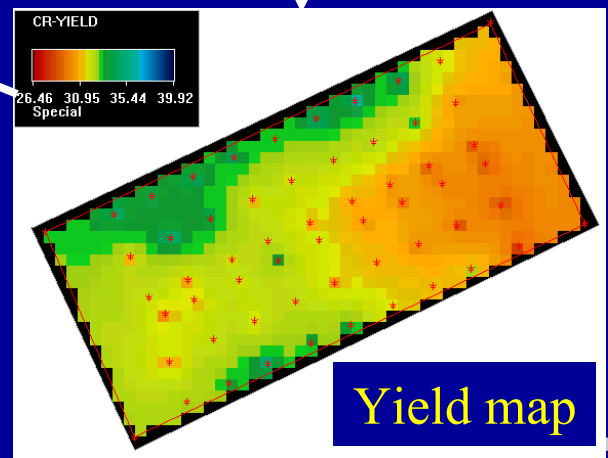

Trimble

GPS


APPLICATION RATES
TARGET
ACTUAL
24.00
24.00
Product
1

GIS


Yield Monitor


CR-YIELD
26.46 30.95 35.44 39.92
Special
Yield map

INPUTS

EC

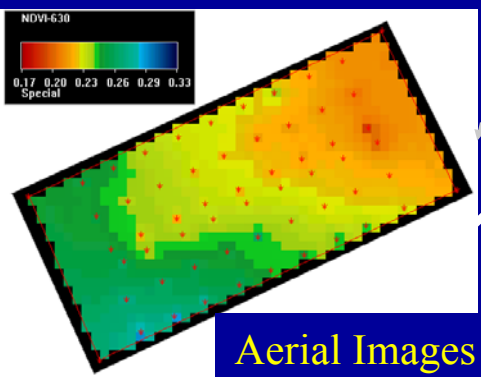
GPS

Fertility and pH

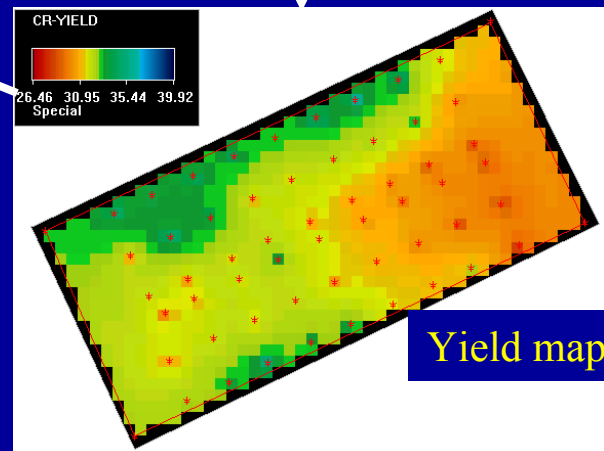
Soil Compaction & MC

GIS

Yield Monitor

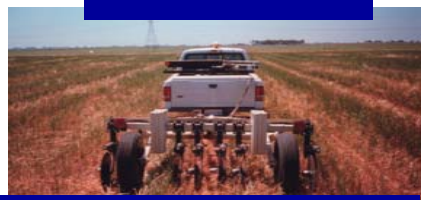


Aerial Images



Yield map

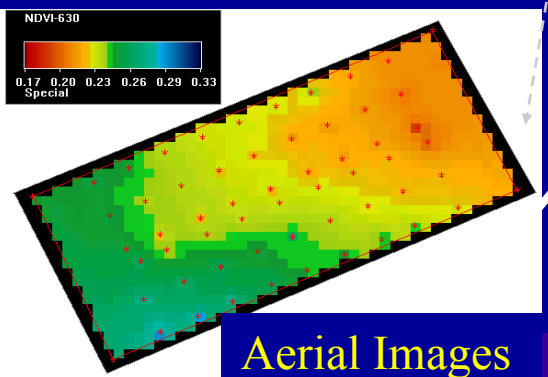
INPUTS



EC

Fertility and pH

Soil Compaction & MC



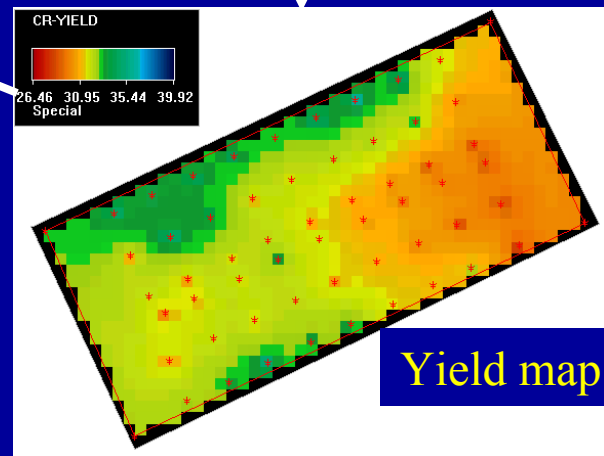
Aerial Images

GPS

GIS

VRA

Yield Monitor



Yield map

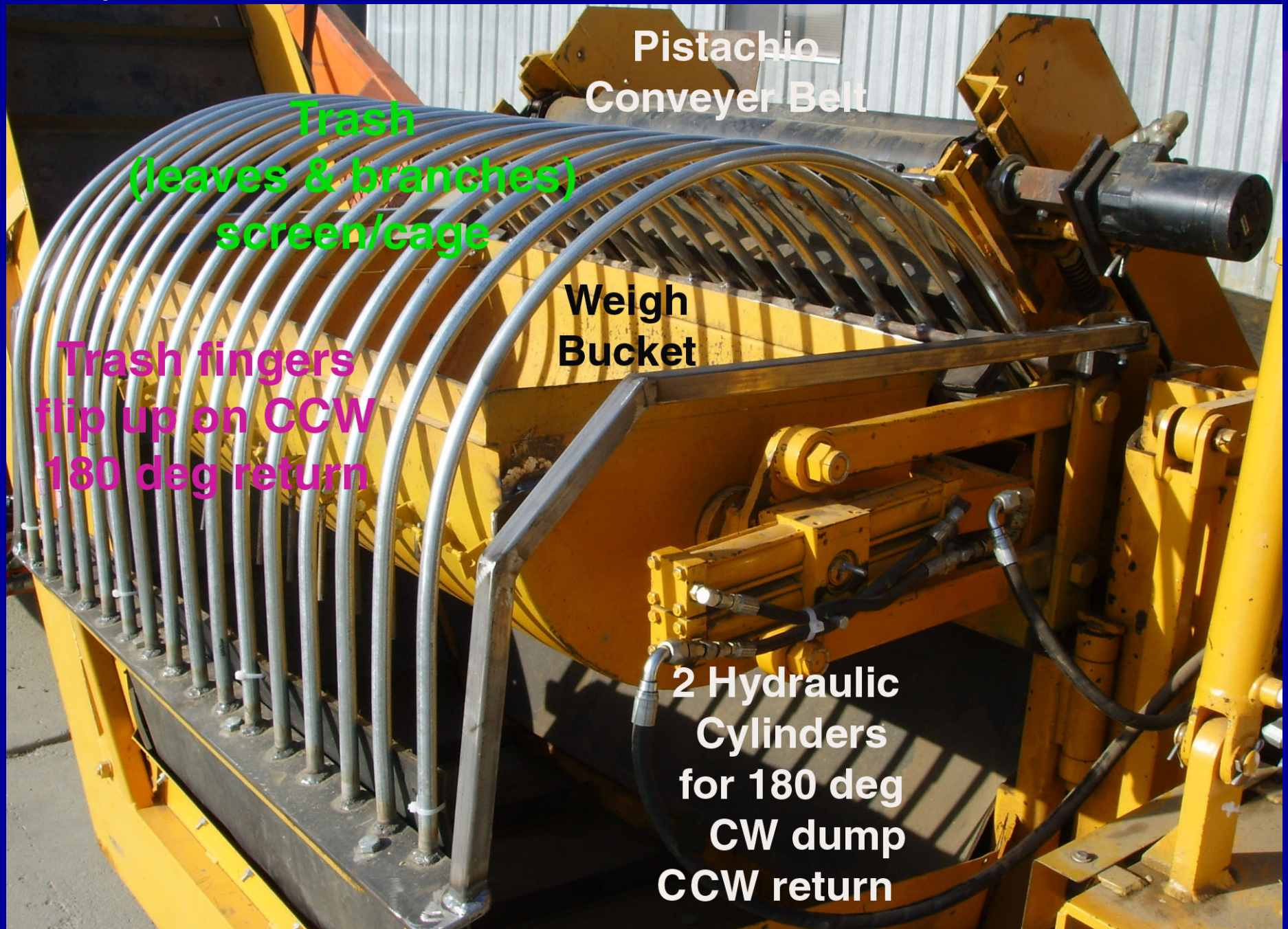
Precision Farming - Definition

⇒It is the technique of applying the right amount of input (fertilizer, pesticide, water etc.) at *the right location at the right time* to enhance production , decrease input, improve quality, and/or protect the environment.

Precision Farming

- ⇒ Location/Positioning (GPS) =>Multi-path problem in Orchard? √
- ⇒ Yield monitors =>? √
- ⇒ Soil Sampling/Analysis **=>?**
  (Sensors for pH, N,P,K etc.)
- ⇒ Remote Sensing **=>?** √
  (Satellite/Aerial/Ground based)
- ⇒ Geographic Information Systems (GIS) =>√
- ⇒ Science of Precision Agriculture
  (Input-Output)**=>?**
- ⇒ Variable Rate Technologies (VRTs) **=>**√

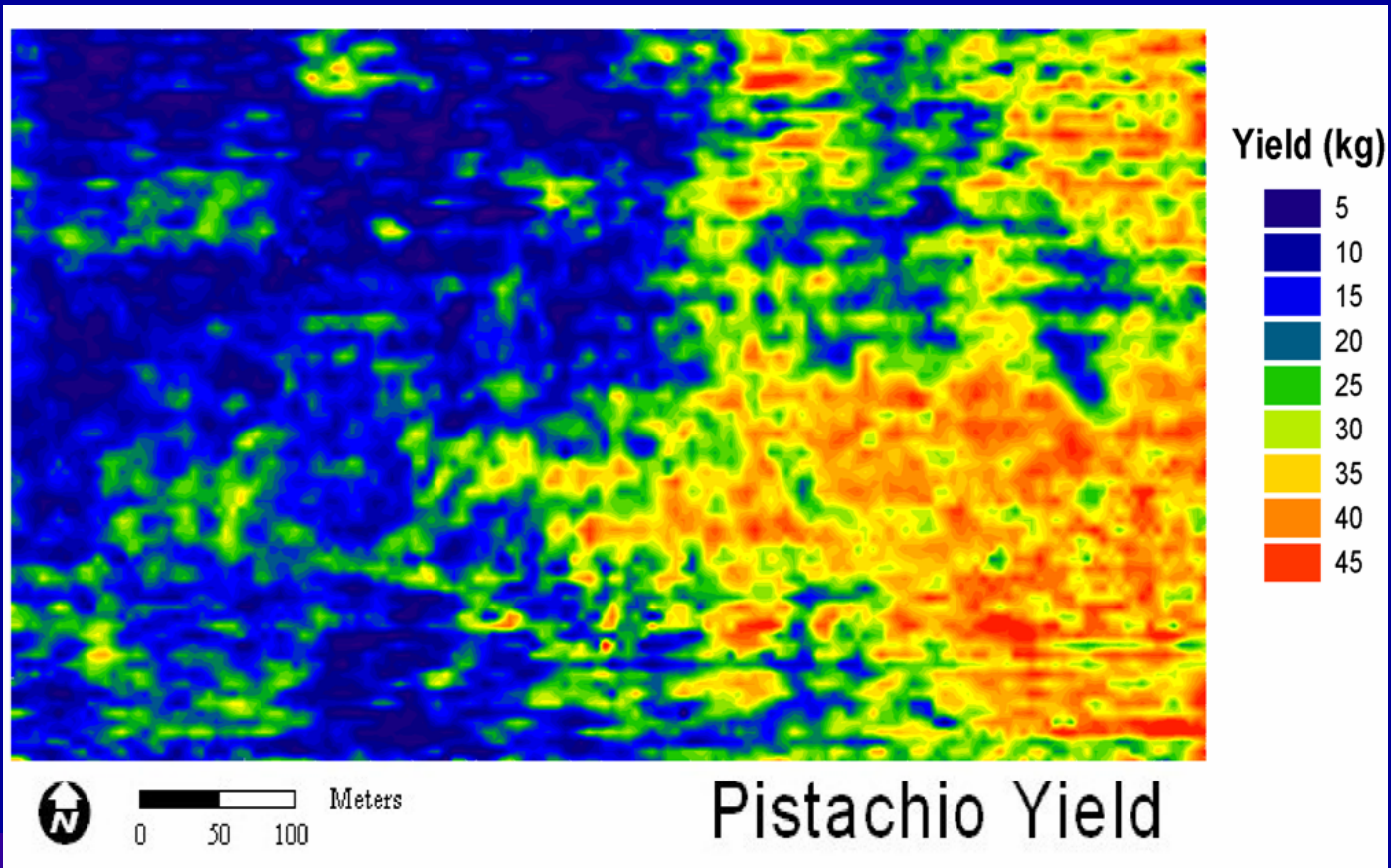
Prof. Uriel Rosa, Shrini Upadhyaya and Patrick Brown


Pistachio
Conveyer Belt
Trash
(leaves & branches)
screen/cage
Weigh
Bucket
Trash fingers
flip up on CCW
180 deg return
2 Hydraulic
Cylinders
for 180 deg
CW dump
CCW return

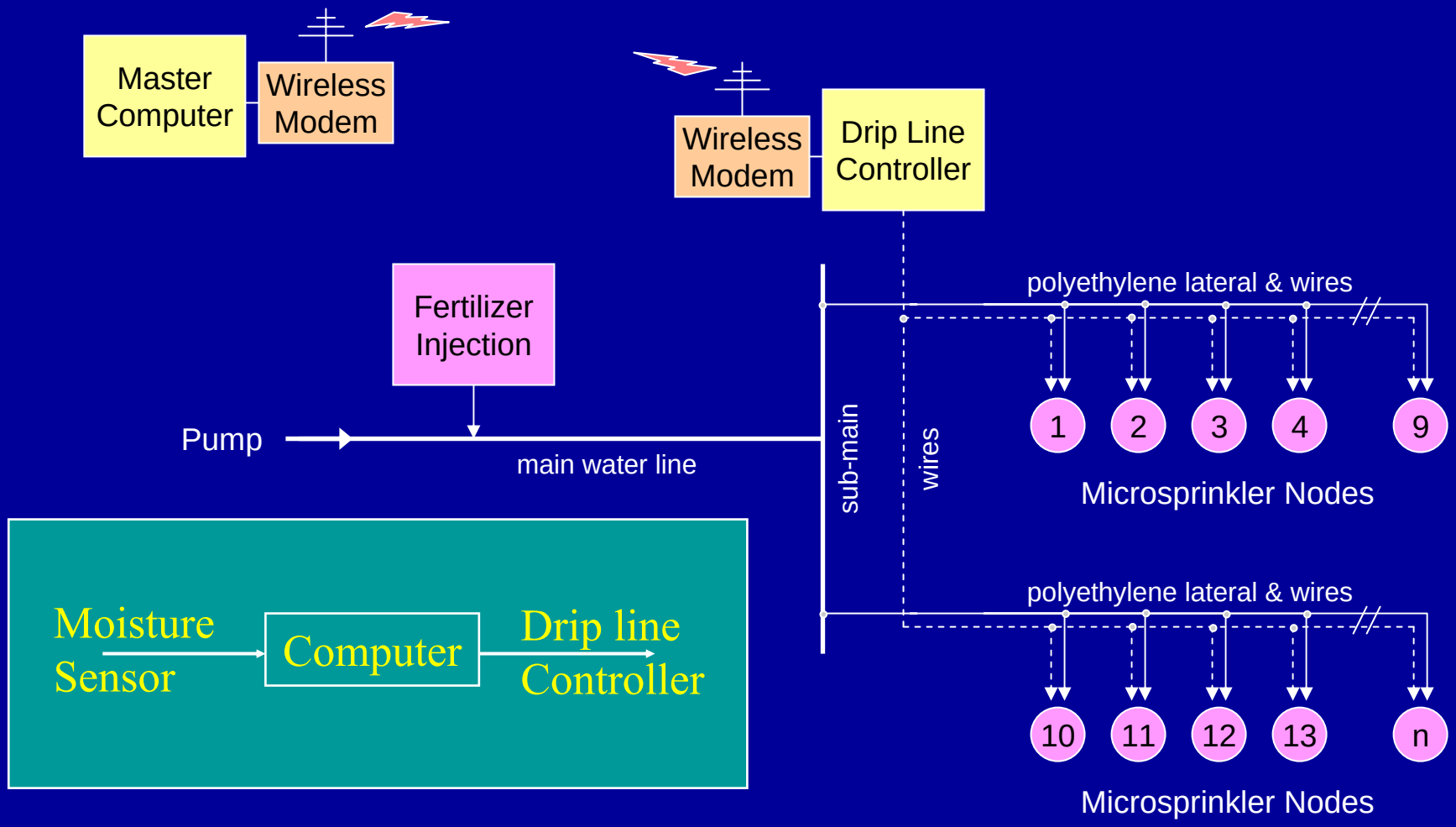
Prof. Mike Delwiche, Bob Coates and Patrick Brown

Management of water and fertilizer

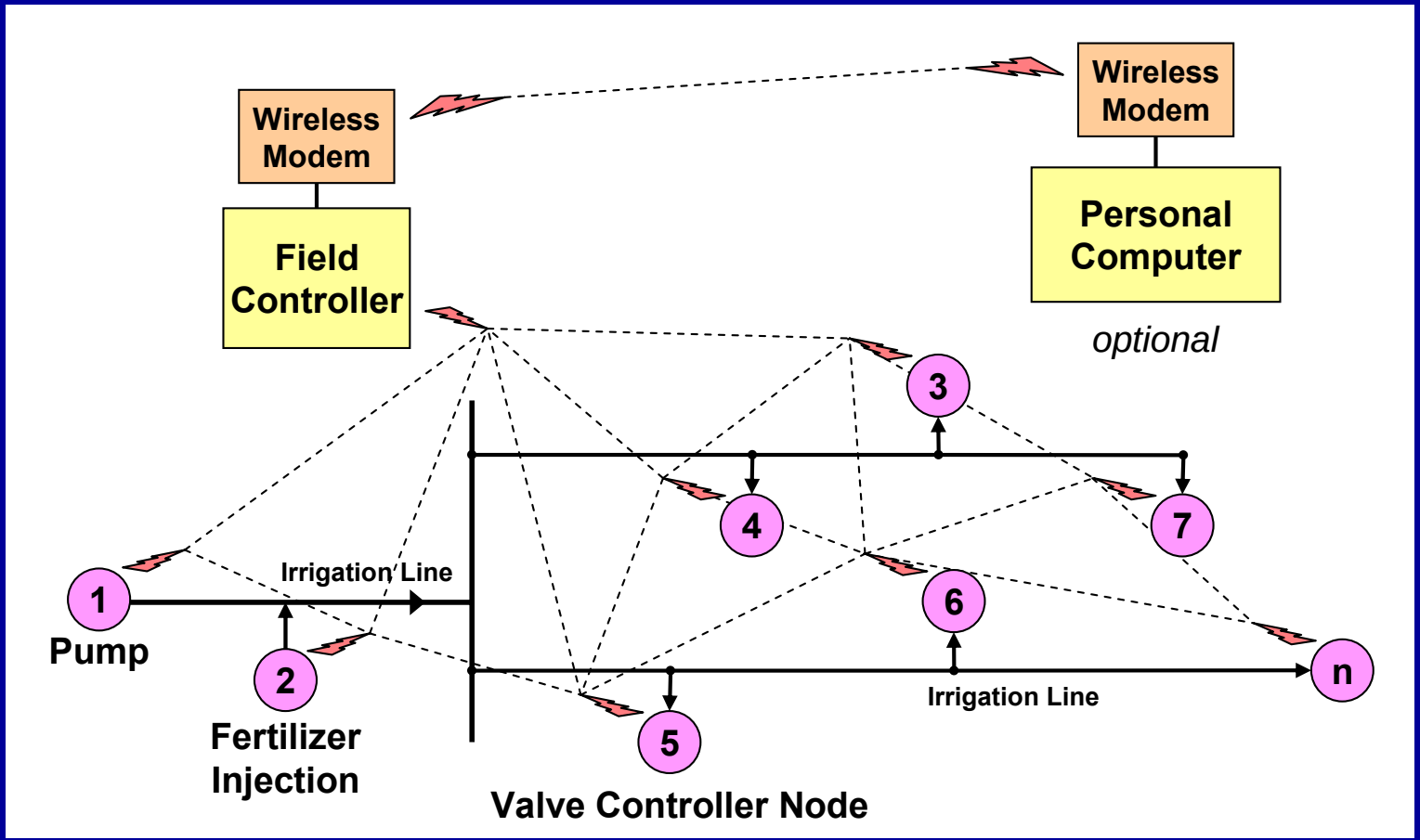
⇒ Yield variation within an orchard



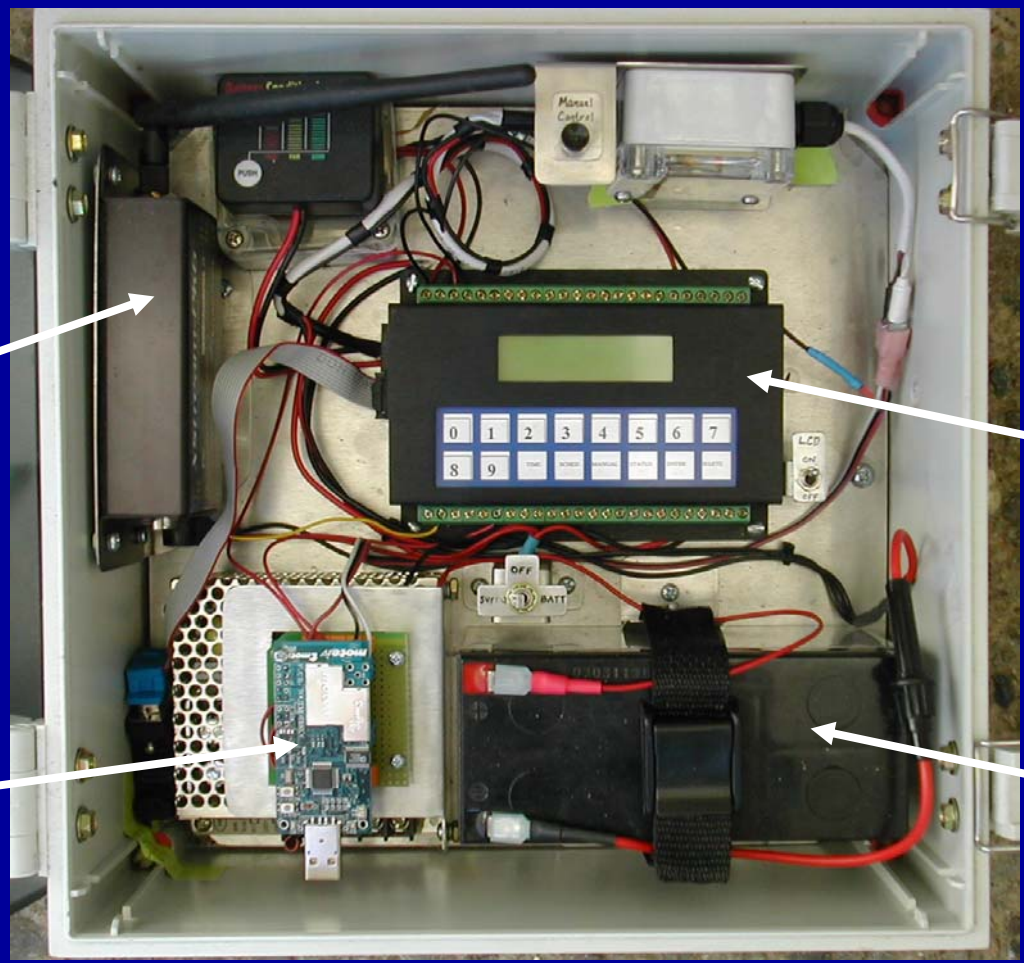
Intelligent Microsprinkler Network



Wireless Network



Field Controller

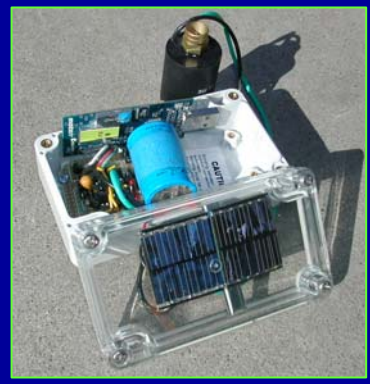


Field Controller

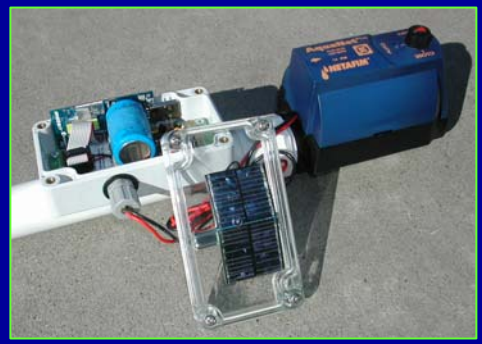
Mesh Network Example

Node #1

Node #2



Node #4



Node #3

Node #5

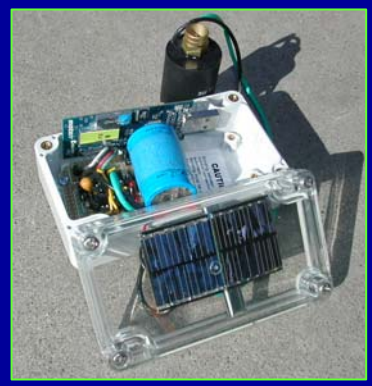
Node #6

Field Controller

Node #1

Node #2

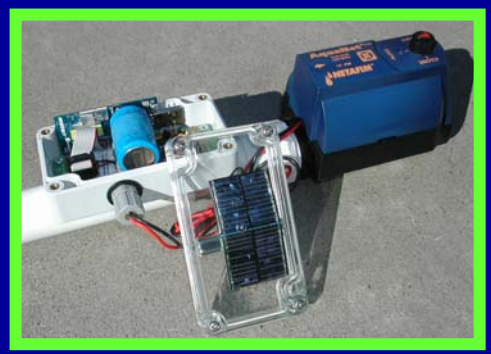
Base to Remote
Command
(‘Drip’ Broadcast)



Node #4

Node #3

Node #5



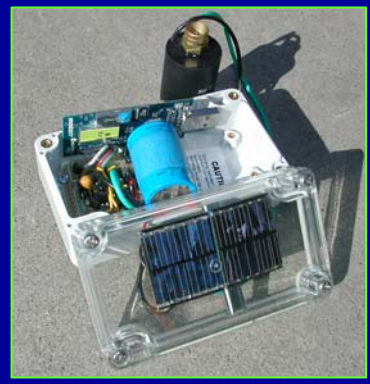
Node #6

Field Controller

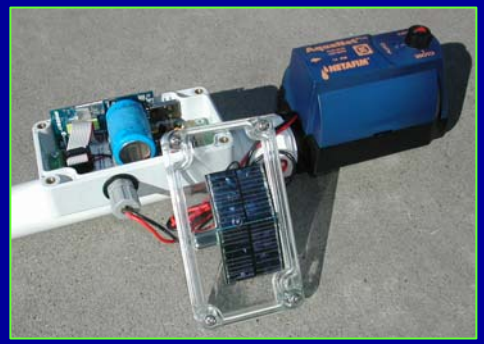
Node #1

Node #2

Remote to Base
Acknowledgment
('MHop' Routing)

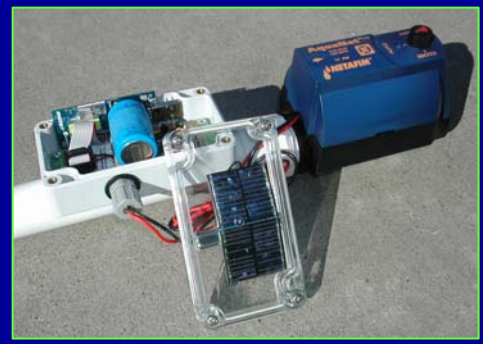


Node #4

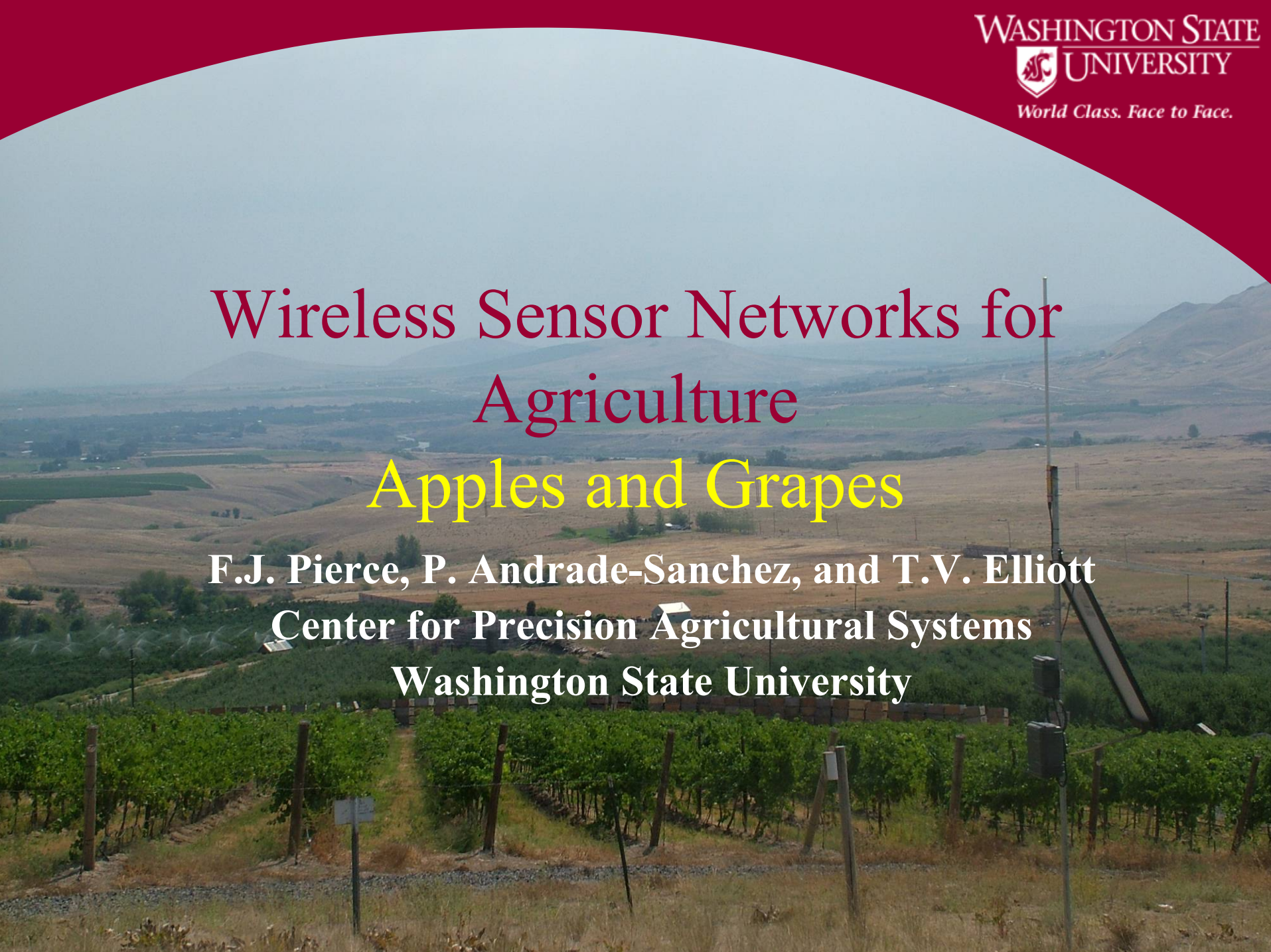


Node #3

Node #5



Node #6



Wireless Sensor Networks for Agriculture
Apples and Grapes

F.J. Pierce, P. Andrade-Sanchez, and T.V. Elliott
Center for Precision Agricultural Systems
Washington State University

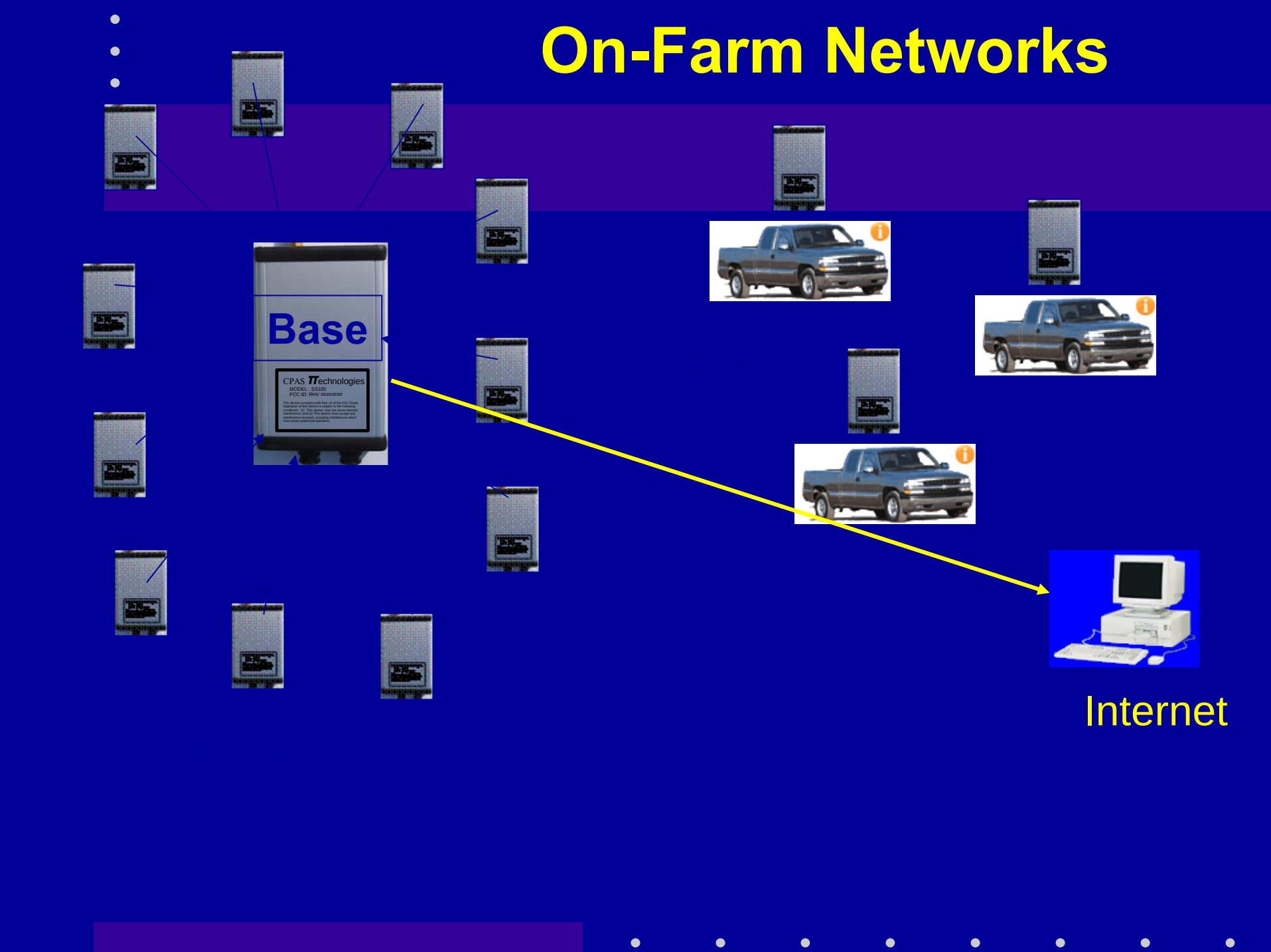
Frost Protection

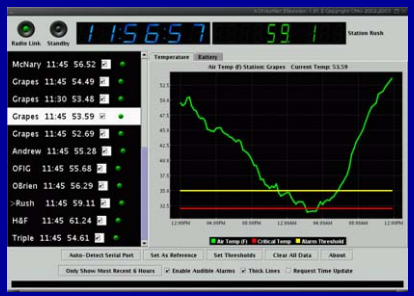
Grapes

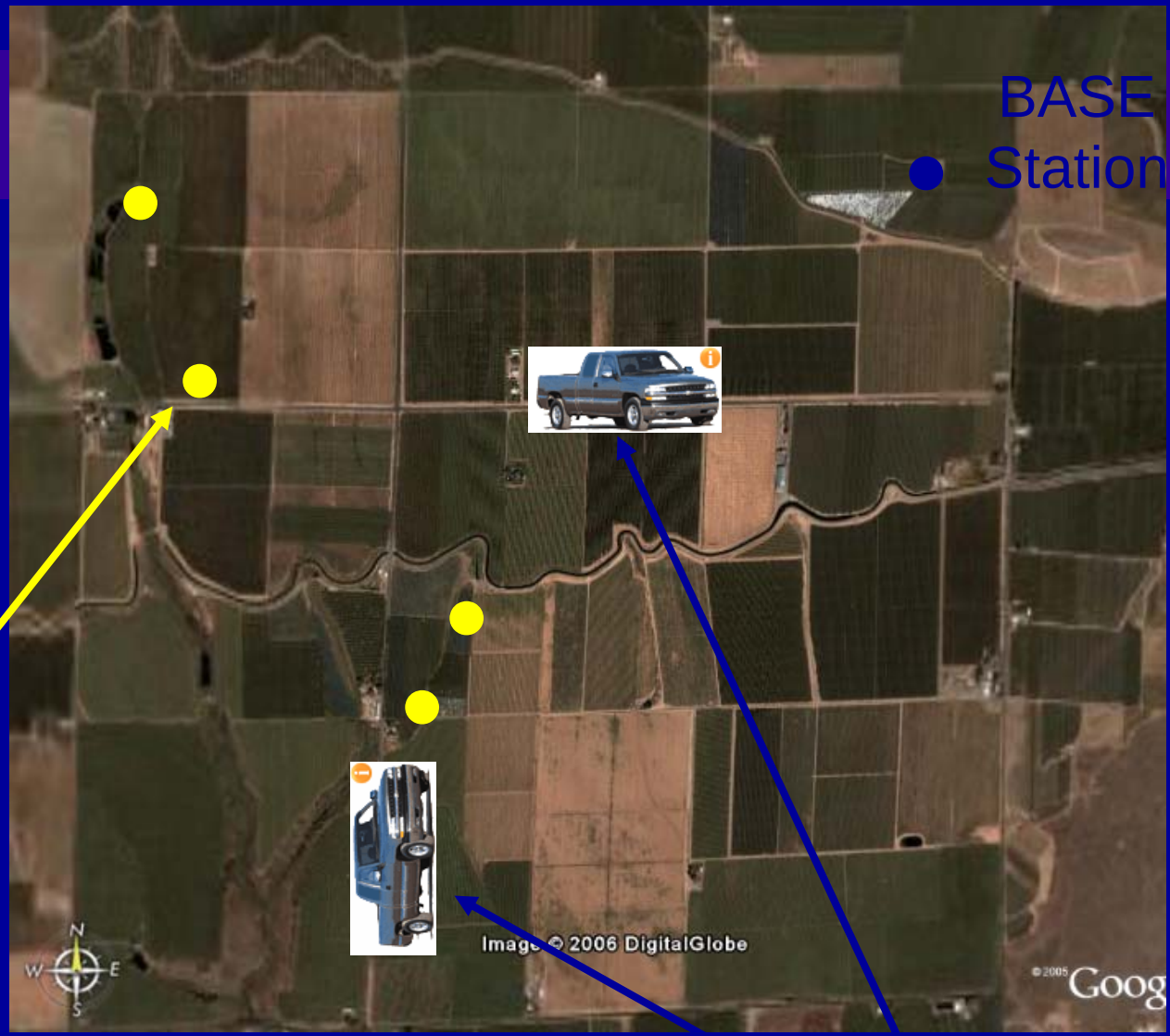
Apples

Temp. Sensors → Computer → Heaters, Irrigation, Wind Machines

On-Farm Networks



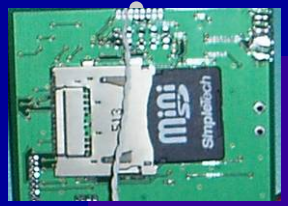


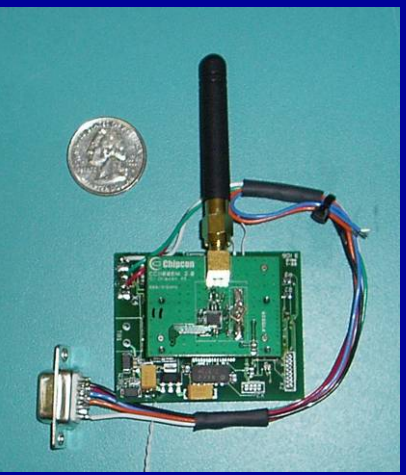


Temperature Station

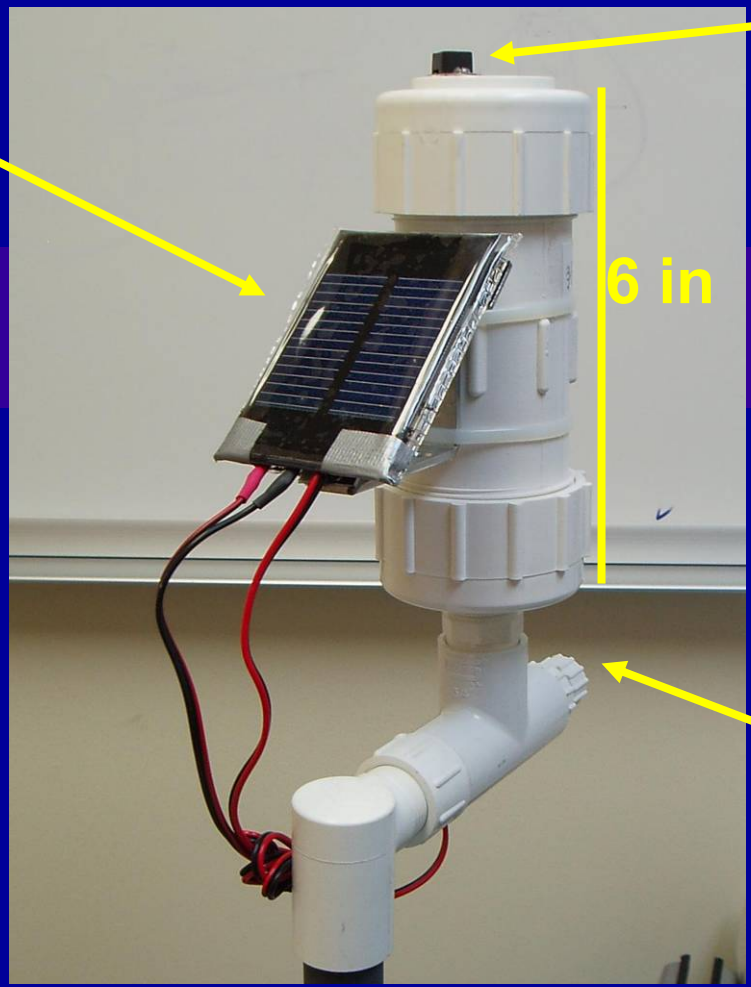
CPAS CC1100 Eval

Solar Panel





500-1000 ft
< $100



Inside

Radio
Antenna
Lithium Ion Battery
Battery re-charger

Thermistor

WITHIN - FIELD

Early Detection and Mapping of Citrus Greening (HLB) Using Ground-Based Hyperspectral Imaging

Reza Ehsani*, Gene Albrigo, Won-Suk Lee

University of Florida
Citrus Research and Education Center
Lake Alfred, FL
***ehsani@ufl.edu**

Precision Technology Lab

Description of Problem

The current inspection method for HLB is:

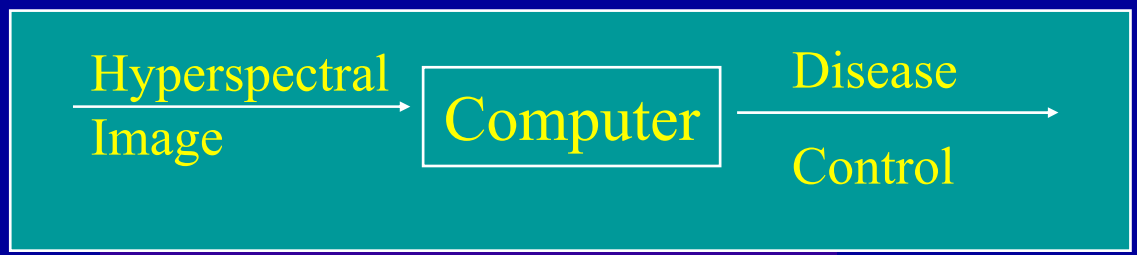
→Costly

- Scouting is the immediate cost of HLB
- Estimated at $75 per acre

→Time consuming

→Prone to human error due to fatigue

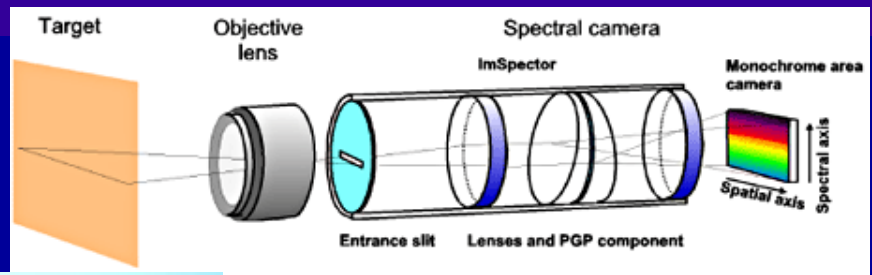
→Detection is based on visual symptoms



Precision Technology Lab

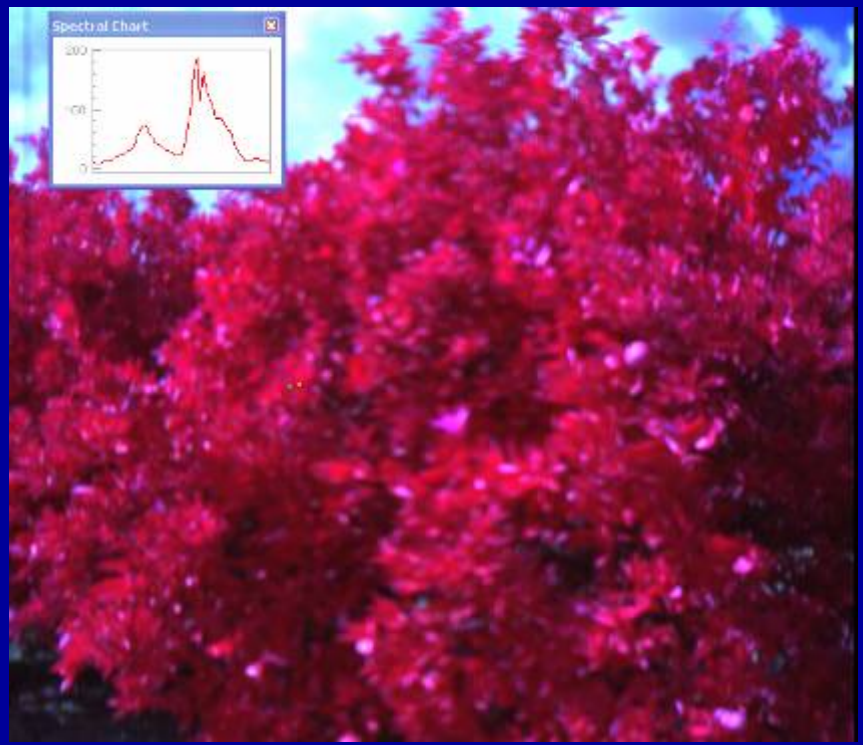
Materials & Methods:

Hyperspectral Imaging

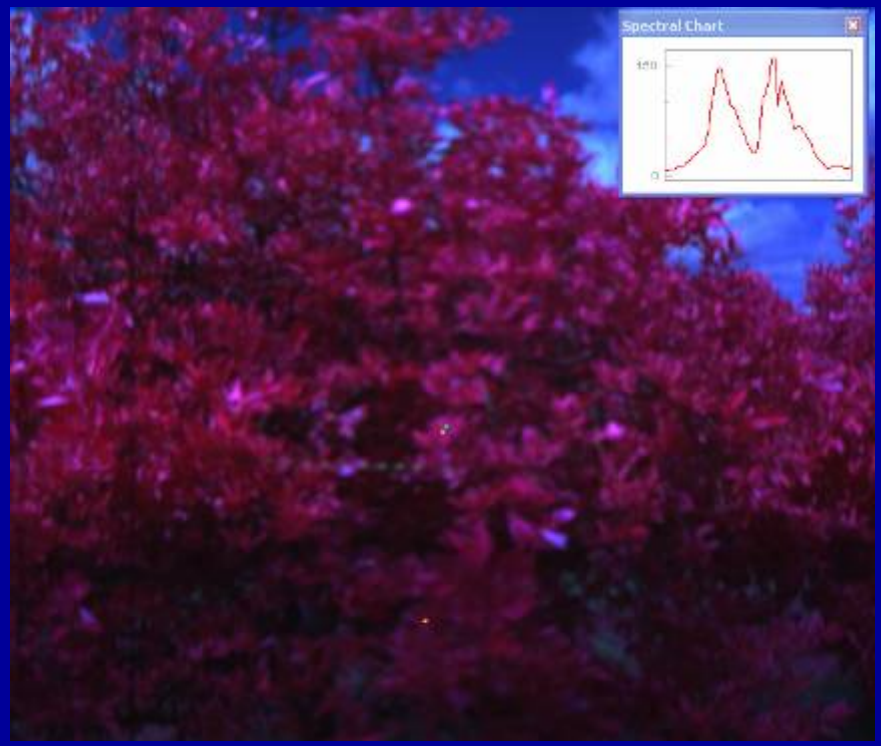


Precision Technology Lab

Healthy Tree



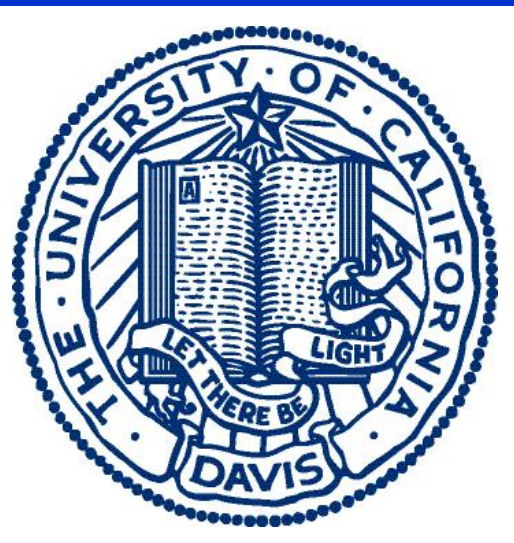
HLB Infected Tree



Precision Technology Lab

Site-Specific application of fumigants to minimize input, reduce cost, and protect the environment

By
Shrini K. Upadhyaya
Greg Browne
Bob Coates
Mir Shafii



Introduction

Replant Problems — Nutrient deficiencies, toxicities, improper pH, soil water problems, root or vascular system disease caused by nematodes (Phytophethora species), or even unknown causes

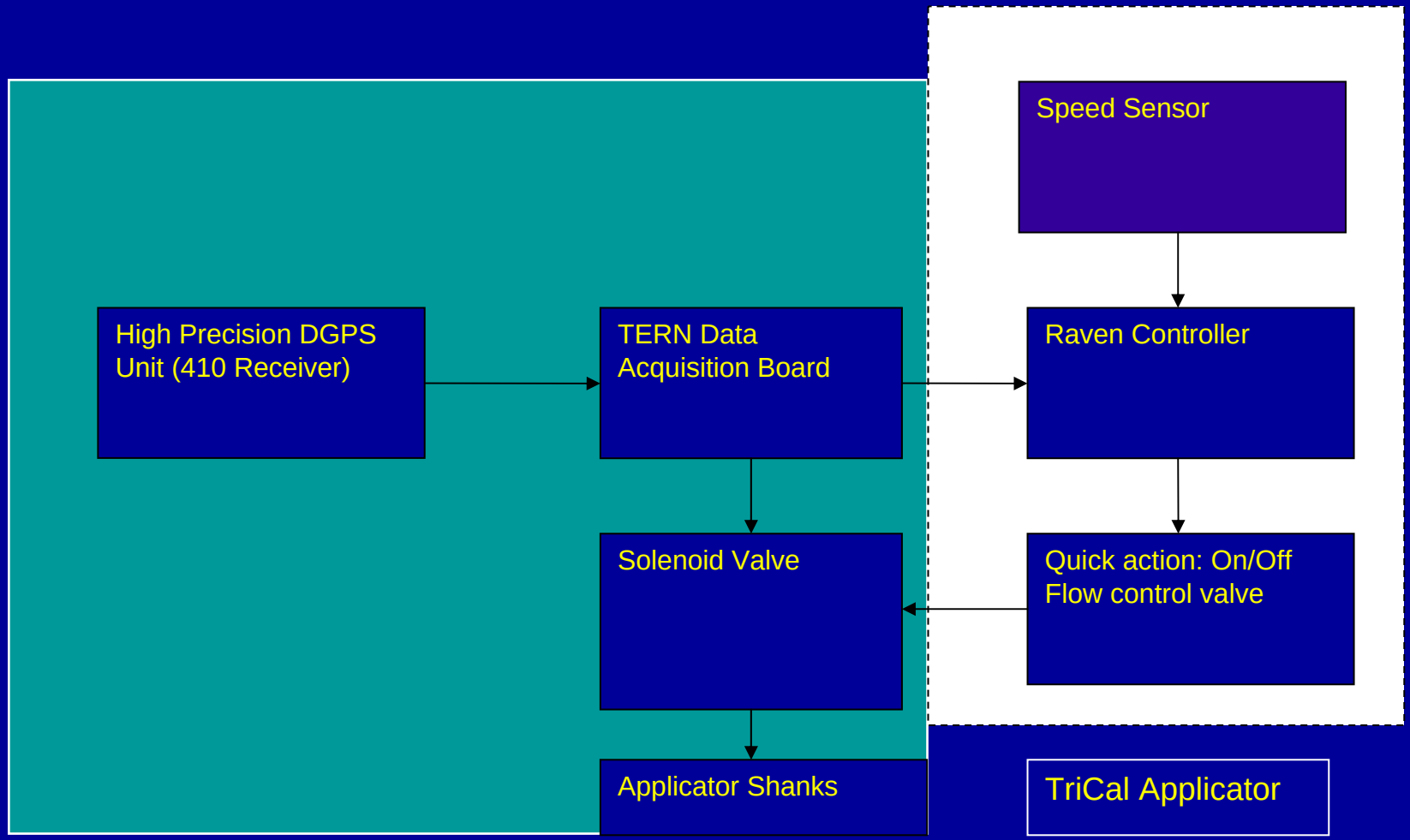
Treatment — Site-specific application of one of the several alternative fumigants at a low rate (< 50 lb/acre) can prevent severe incidence of RD.

Savings – 58 to 76% in Chemicals or $120 to $155/acre (-depending on planting density)!

GPS Based Plant Specific Fumigant applicator

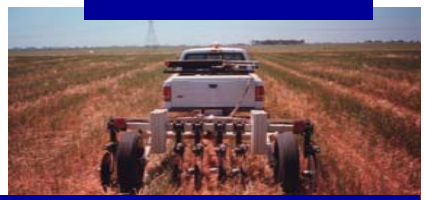
Location Detection → Computer → Fumigant Control

Tree-specific fumigant application



Fumigant Applicator in Paramount Orchard

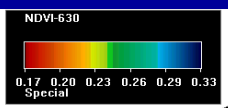
INPUTS



EC

Fertility and pH

Soil Compaction & MC

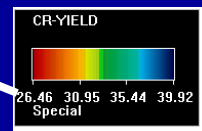


Aerial Images

GPS

VRA

Yield Monitor



Yield map

Thank you!

Citrus Census- Information system

FASS/FFO and FDAC

- ⇒**Number of Citrus trees in production**
- ⇒**Acres utilized**
- ⇒**Variety**
- ⇒**Year planted**

Why Count Trees?

We want to count citrus trees to see if domestic crop forecast can be automated:
Andrew Meadows, Spokesperson, FDOC(USA Today, December 8, 2004)

⇒Crop management: tree development (size) and health

⇒Property appraisal

Wide Spaced Grove

Grove Statistics

Area: approx 8.0 acres

Density: approx. 112 trees/acre

Total Tree #: 898