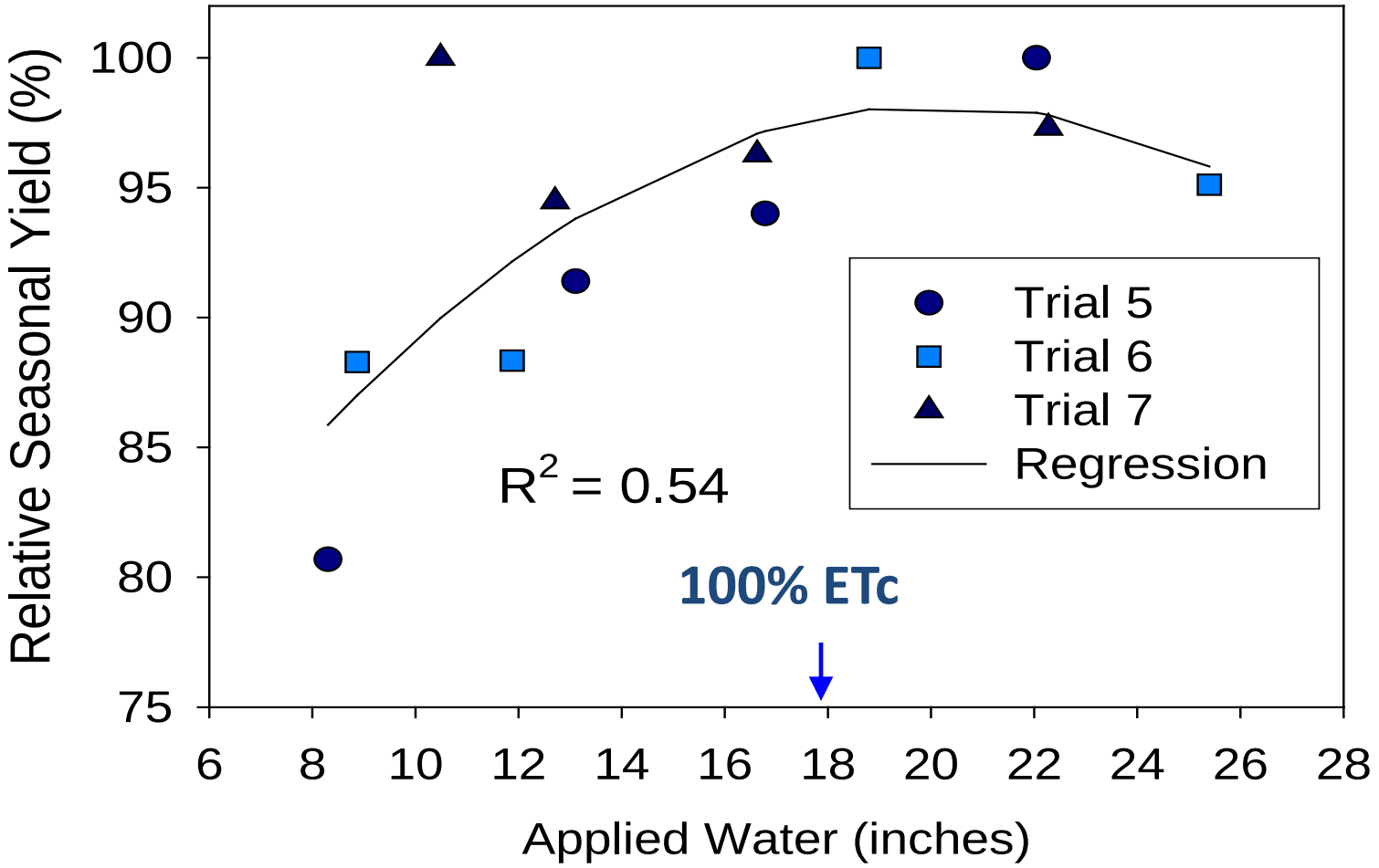
Development of a web-based irrigation and nitrogen management tool for caneberries

Michael Cahn
Irrigation and Water Resources Advisor
University of California, Cooperative Extension
Monterey, San Benito, Santa Cruz Counties
831-759-7377

Tools for Managing Water and Nitrogen Fertilizer in Vegetables

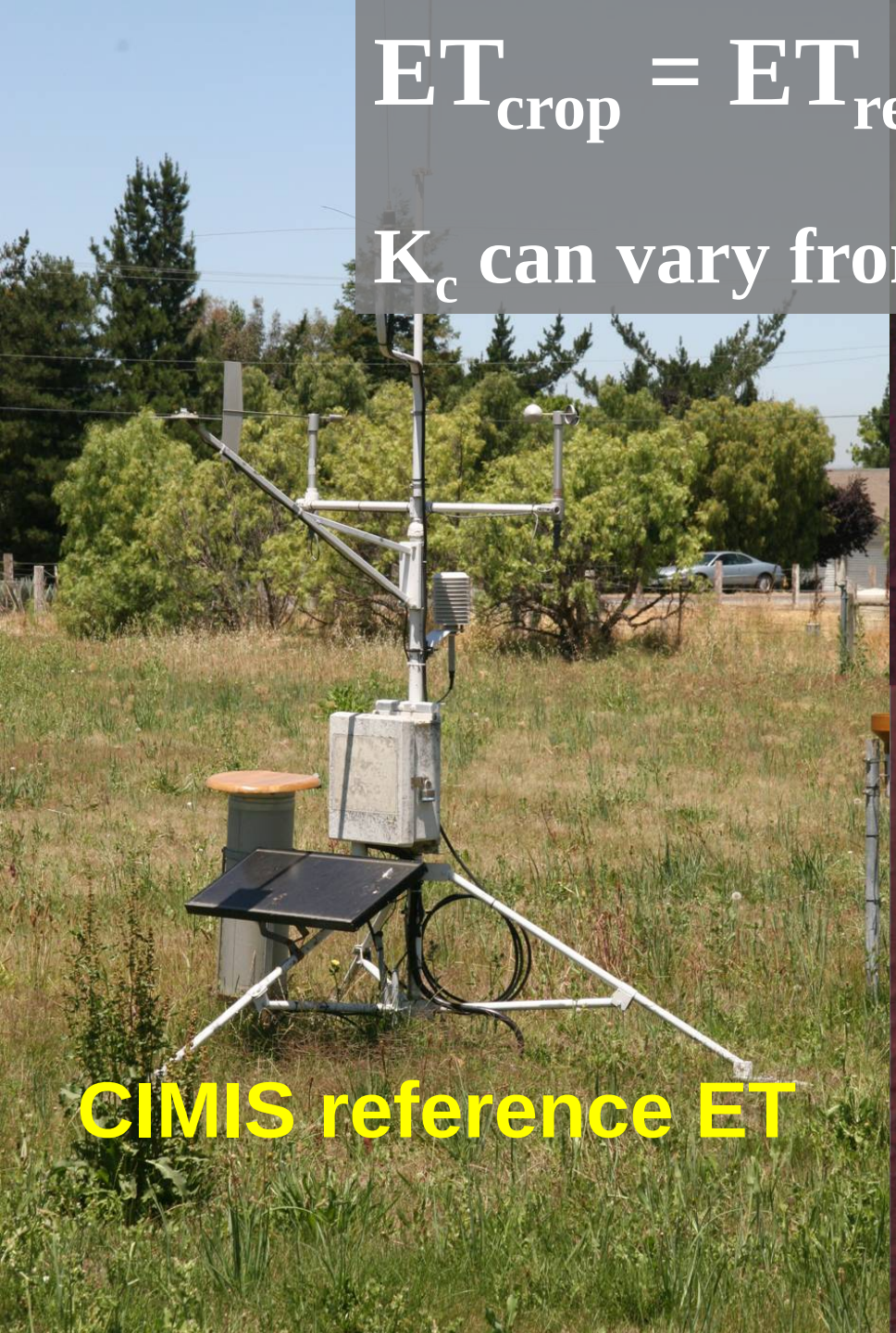
- Quick nitrate soil test
- Weather-based irrigation scheduling

Raspberry:
Applied Water vs Relative Fruit Yield
(Fall Crop, 2004, Trials 5-7)

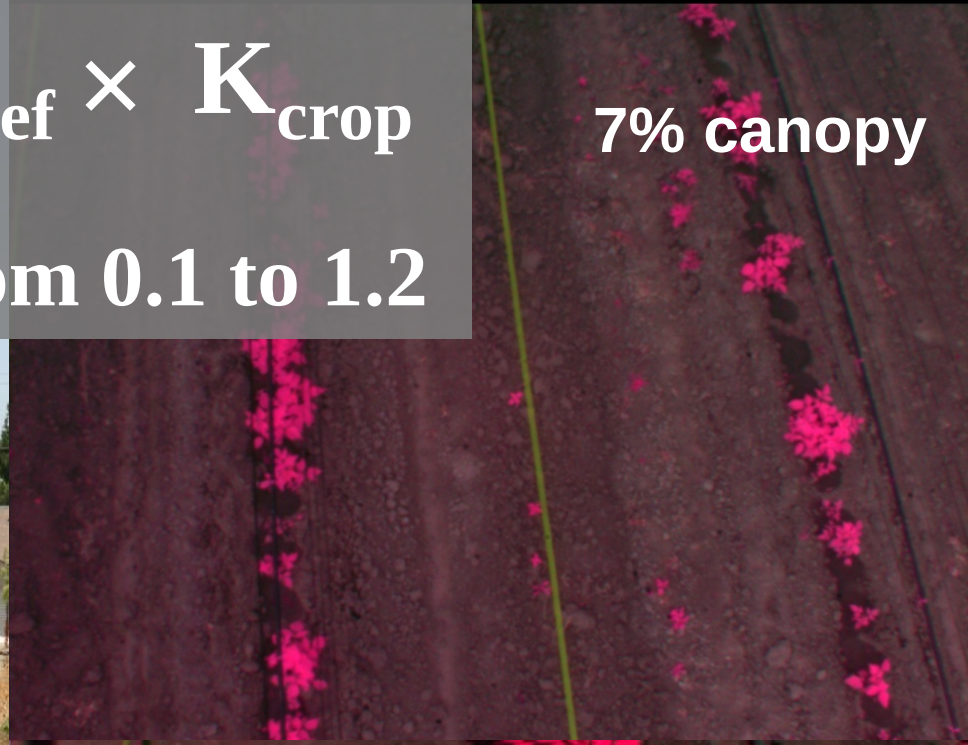


$$ET_{crop} = ET_{ref} \times K_{crop}$$

K_c can vary from 0.1 to 1.2



CIMIS reference ET



Crop Coefficient

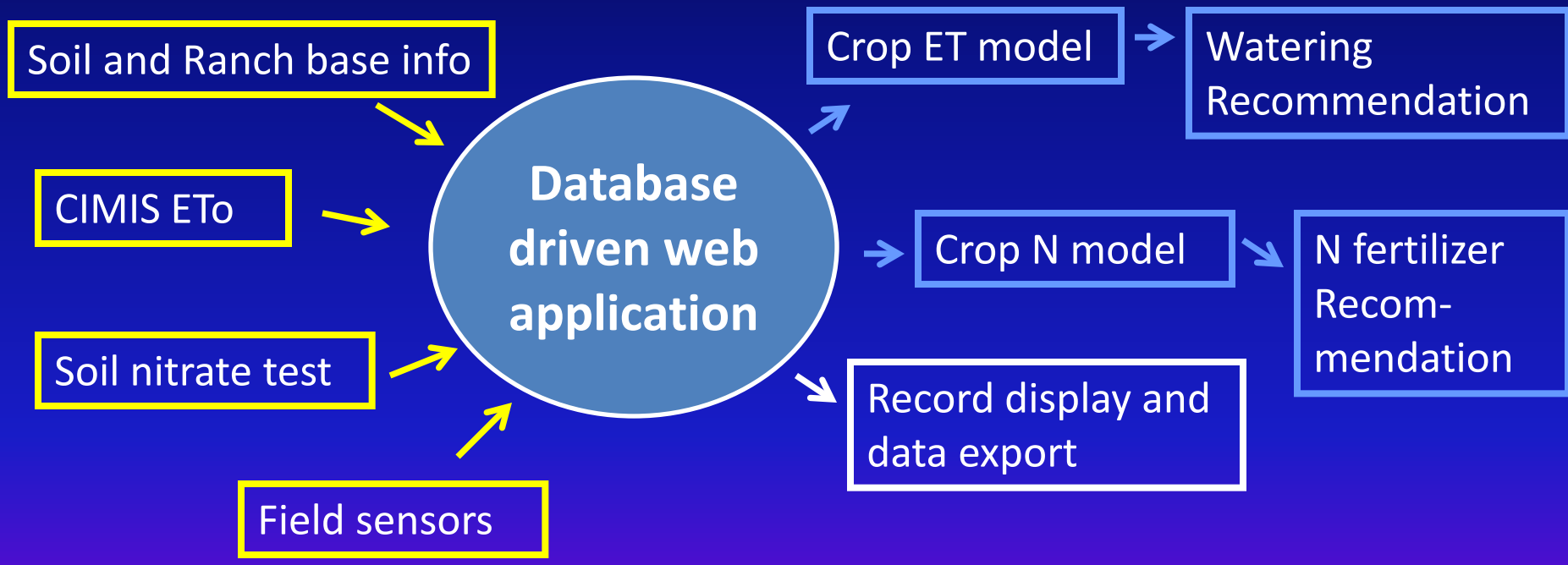
CropManage Web-based Tool:

Goal: Assist growers in making decisions on irrigation and nitrogen fertilizer management

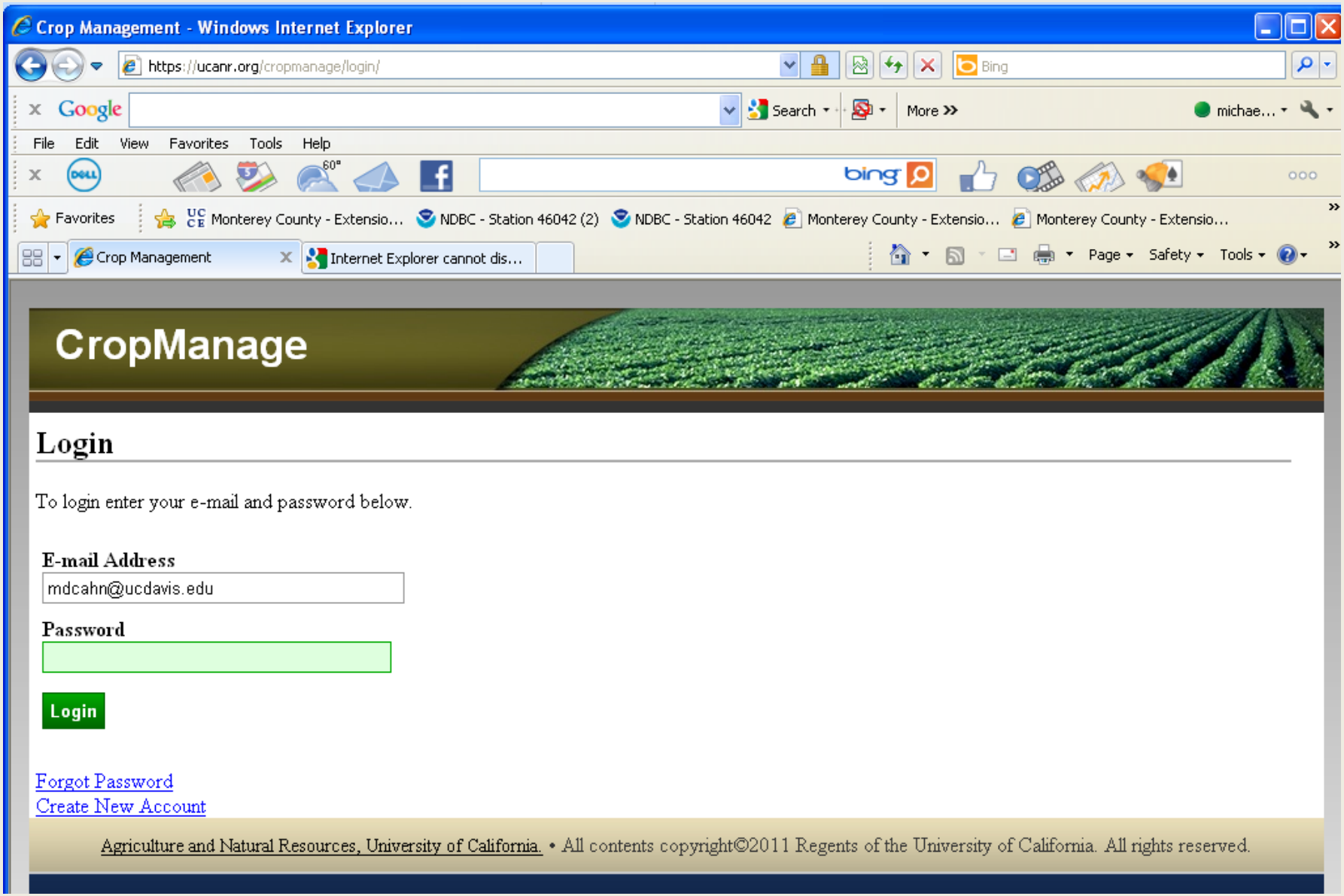
- ✓ Intuitive, simple, quick to use.
- ✓ Accessible from smart phone, tablet computer, desktop computer
- ✓ Guide irrigation schedules using CIMIS weather data.
- ✓ Guide nitrogen fertilization decisions using quick nitrate test data and crop N uptake models.
- ✓ Maintain and share irrigation, fertilizer, and soil test records for multiple fields and farms.

CropManage

Integrate information from multiple sources



Decision support using crop models


Crop Management - Windows Internet Explorer
https://ucanr.org/cropmanage/login/
Bing
Google
Search
More
michae...
File Edit View Favorites Tools Help
Favorites
Monterey County - Extensio...
NDBC - Station 46042 (2)
NDBC - Station 46042
Monterey County - Extensio...
Monterey County - Extensio...
Crop Management
Internet Explorer cannot dis...
Page
Safety
Tools
CropManage
Login
To login enter your e-mail and password below.
E-mail Address
mdcahn@ucdavis.edu
Password
Login
Forgot Password
Create New Account
Agriculture and Natural Resources, University of California. • All contents copyright©2011 Regents of the University of California. All rights reserved.

Irrigation Summary

Show / Hide Columns | Show Previous Co

Water Date	Irrigation Method	Recommended Irrigation Interval (days)	Recommended Irrigation Amount (inches)	Recommended Irrigation Time (hours)	Irrigation Water Applied (inches)	Kc	Canopy Cover (%)	
4/17/12	Sprinkler	N/A	N/A	N/A	0.94 in	0.00	0	
4/19/12	Sprinkler	0.7	0.35 in	1.15 hrs	0.49 in	0.70	0	
4/21/12	Sprinkler	0.6	0.40 in	1.34 hrs	0.61 in	0.70	0	
4/23/12	Sprinkler	0.6	0.38 in	1.28 hrs	0.58 in	0.70	0	
4/26/12	Sprinkler	1.3	0.09 in	0.30 hrs	0.28 in	0.48	0	
5/6/12	Sprinkler	2.9	0.41 in	1.36 hrs	1.30 in	0.16	2	
5/18/12	Drip	4.9	0.58 in	3.84 hrs	0.91 in	0.20	12	
5/22/12	Drip	6.5	0.24 in	1.61 hrs	0.74 in	0.23	21	
5/27/12	Drip	4.7	0.45 in	3.03 hrs	0.64 in	0.37	35	
6/1/12	Drip	3.4	0.70 in	4.65 hrs	0.44 in	0.56	52	
6/3/12	Drip	3.0	0.35 in	2.34 hrs	0.11 in	0.69	58	
Totals			**3.95 in**	**20.89 hrs**	**7.04 in**			

New Watering | View Flow Meter Data | View Rainfall Data

Fertilizer Summary

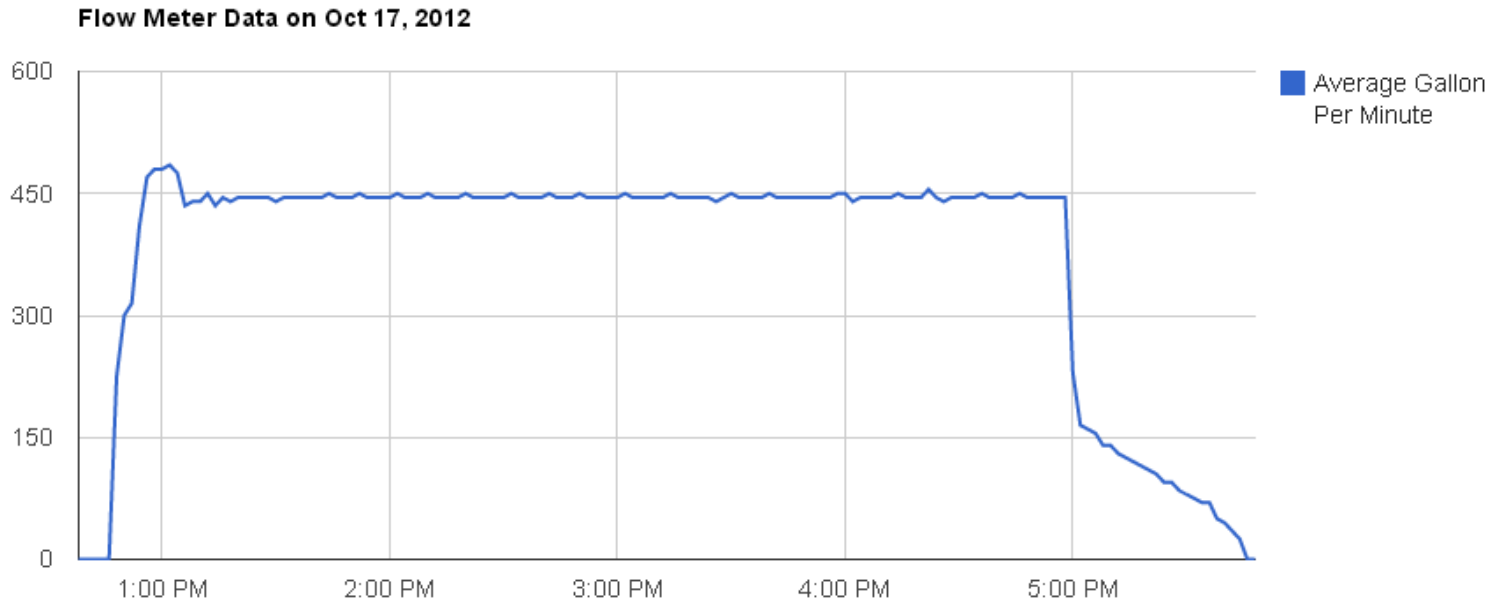
Show / Hide Columns

Fertilizer Date	Crop Stage	Soil NO_3-N (ppm)	Fertilizer N Recommended (lb N/acre)	Cumulative N Uptake	Fertilizer	Applied N (lb N/acre)	Applied Fertilizer
5/5/12	Pre-thinning	15.79	14.2	4.02	15-8-4	78.0	50.0 gallons/acre
5/22/12	1st drip fertigation	14.74	21.5	13.82	28-0-0-5	37.1	12.0 gallons/acre
5/27/12	2nd drip fertigation	23.68	4.9	18.88	28-0-0-5	30.9	10.0 gallons/acre
6/7/12	3rd drip fertigation	23.68	11.8	36.25	28-0-0-5	30.9	10.0 gallons/acre
Totals			**52.4**			**176.9**	

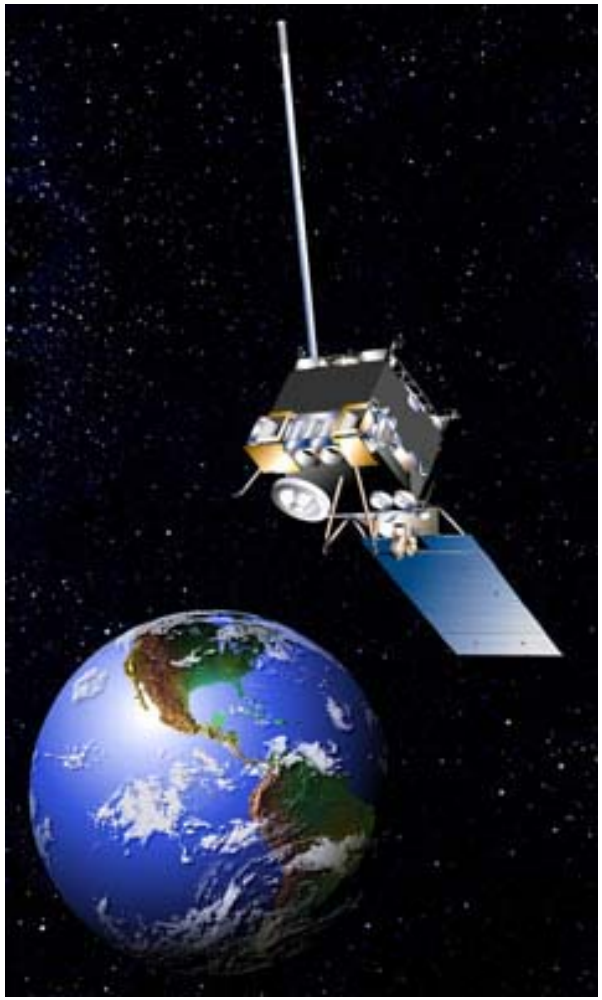
New Fertilizing

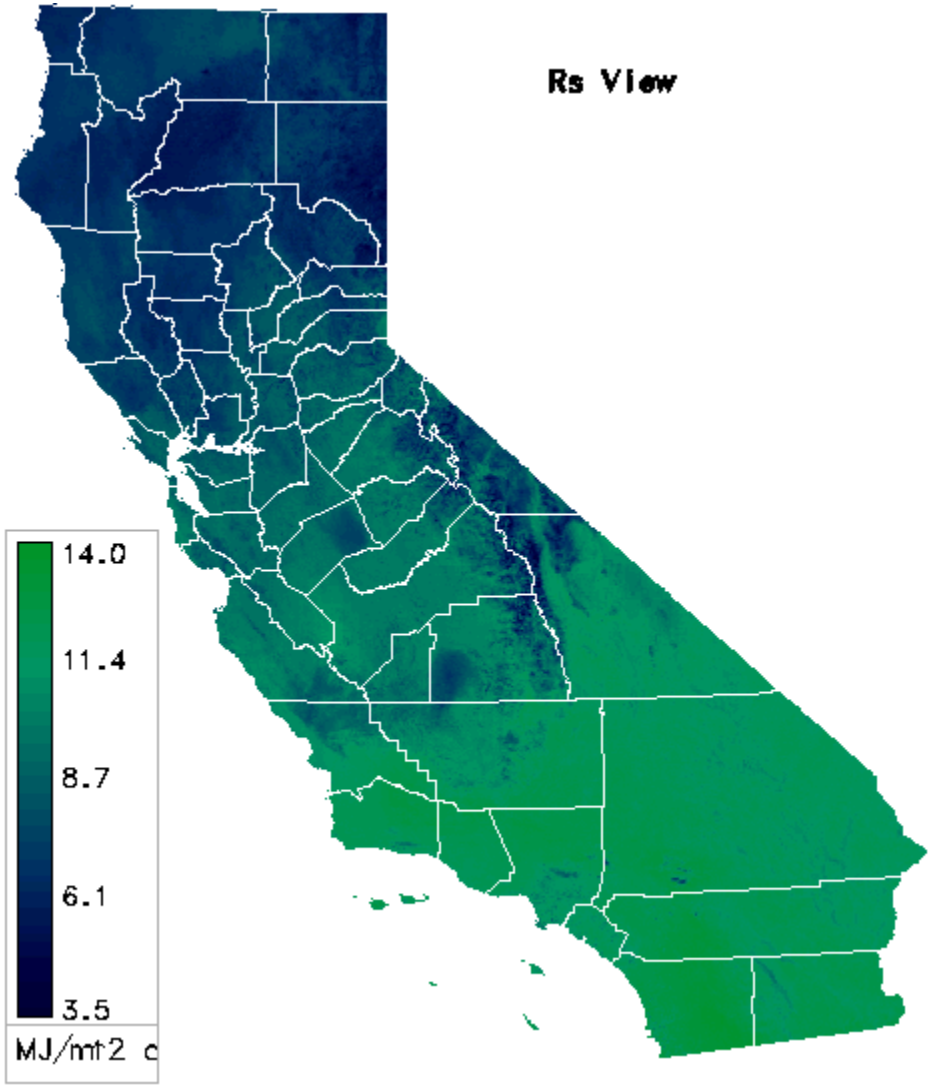
How much water was applied?

Flow Meter Data



Spatial CIMIS ETo Reporting





Parameters must be determined for crop model

Planting Settings

Planting Name
CSUMB trt1

Year
2012

Lot
4N

Acres
0.43

Crop
Iceberg 2 row, 40 inch bed

Wet Date
5/4/2012

Harvest Date
7/10/2012

Previous Harvest Date
m/d/yyyy

Previous Crop
Lettuce

Initial Residue Mineralization Rate (lb N/acre/day)
1.5

Leaching Factor (%)
0

Soil Settings

Soil Type
Chualar loam

Soil Series
Chualar

Soil Texture
loam

Sand 1ft (%)
44

Silt 1ft (%)
41

Sand 2ft (%)
45

Silt 2ft (%)
35

Soil Bulk Density 1ft (g/cc)
1.4

Soil Bulk Density 2ft (g/cc)
1.4

Saturated Soil Tension 1ft (cbar)
7

Saturated Soil Tension 2ft (cbar)
5

Crop Settings

N uptake coefficient A
0.0186

N uptake coefficient B
4.0028

Fertilizer Yo
-0.0198

Minimum Rooting Depth Time (days)
10

Maximum Rooting Depth Time (days)
50

Maximum Crop N Uptake (lb N/acre)
125

Canopy A
6.7801

Canopy B
-11.61

Canopy GMax
80

Canopy Intercept
0.63

Canopy C
1.5

Developing a web-based application for caneberries:

- Crop model development
- Software development
- Field testing and outreach

Developing a web-based application for caneberries:

Decision support algorithms needed:

- Canopy and root development model
- Nutrient (nitrogen) uptake model
- Soil moisture tension threshold
- Soil nitrate threshold
- Integrate effects of cultural practices (macro-tunnels, trellising, pruning)

Data collection plan

Year 1

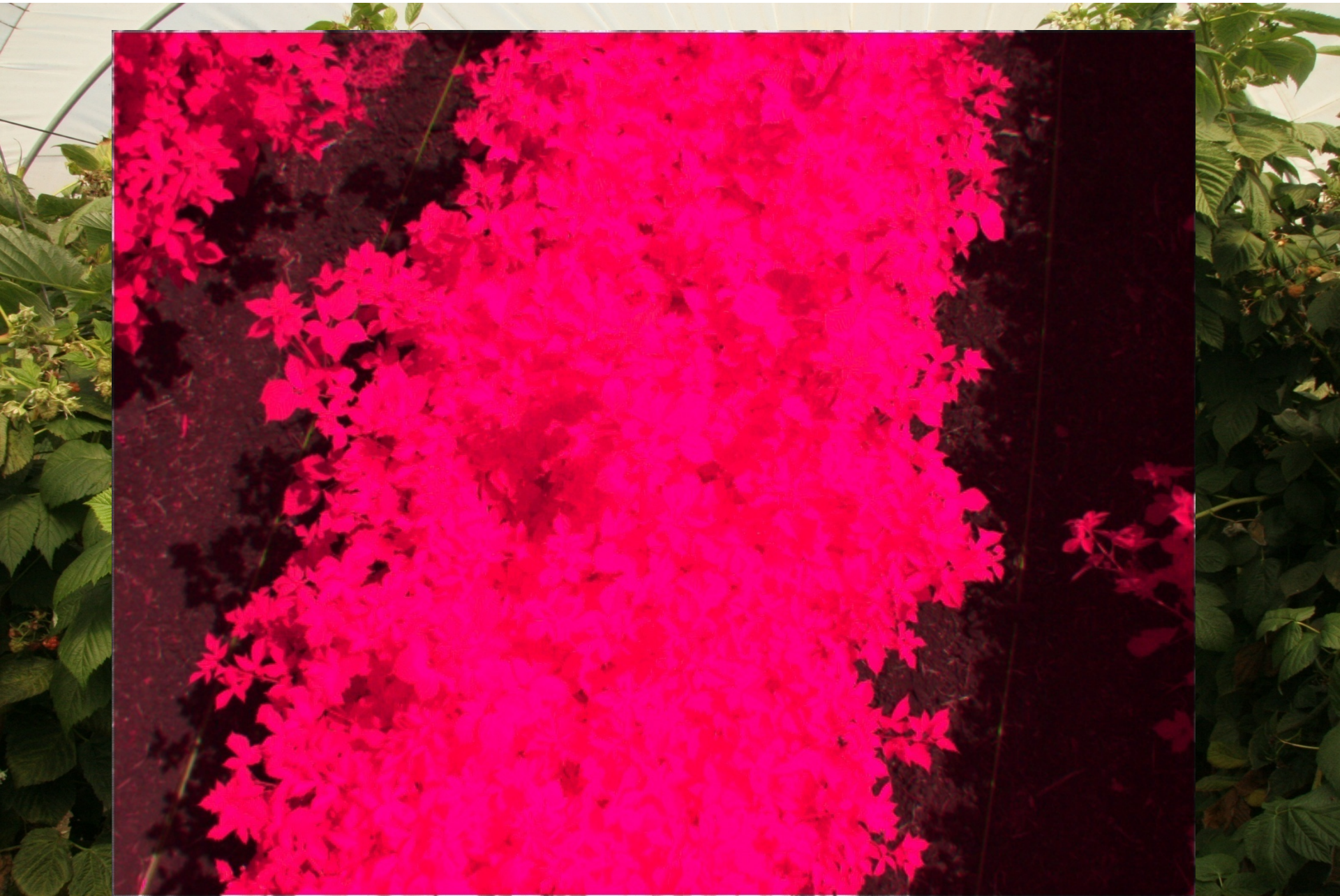
- 3 fields 1st year raspberry (Proprietary Variety)
- 3 fields 1st year blackberries (Proprietary Variety)

Year 2

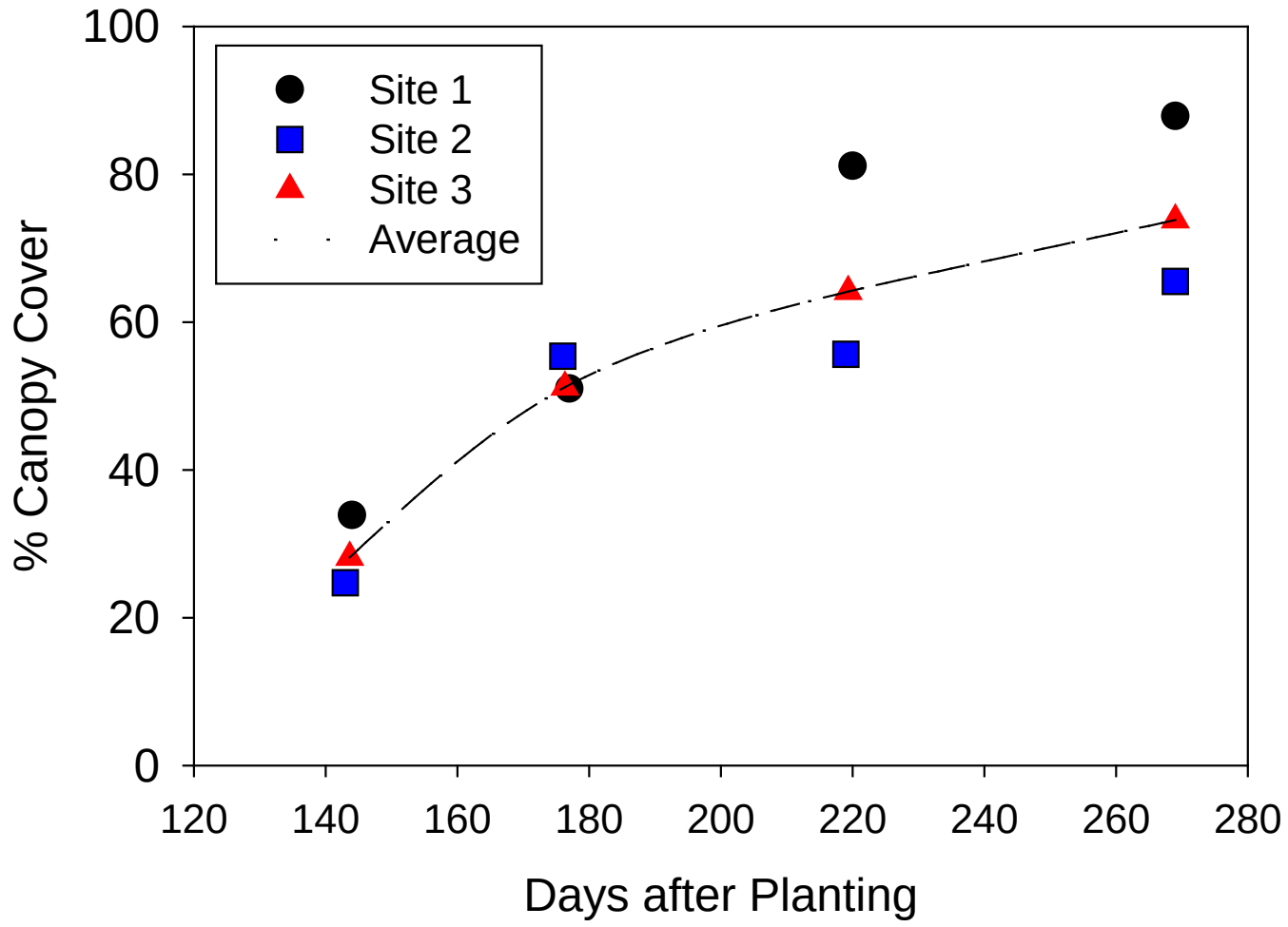
- 3 fields 2nd year raspberry
- 3 fields 2nd year blackberries

Canopy Cover Development

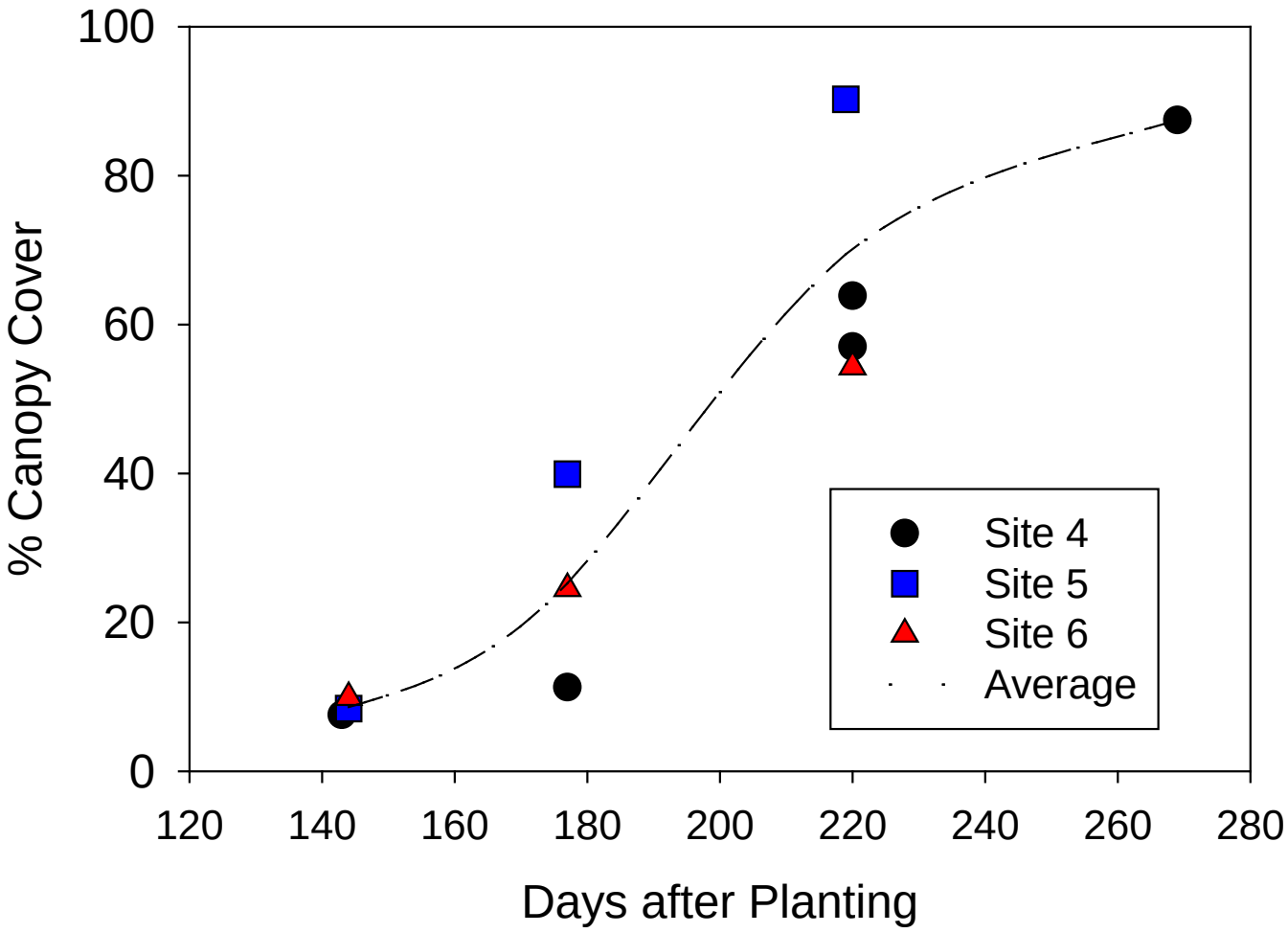
Canopy Cover



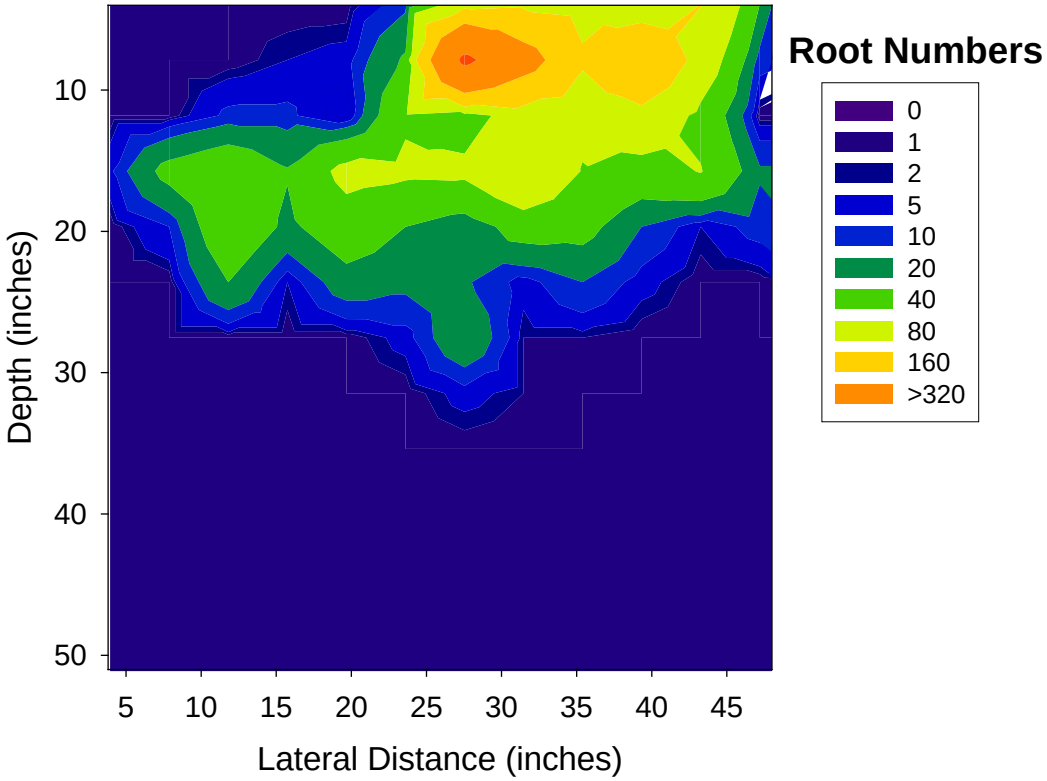
Canopy Cover of Raspberries (1st year)



Canopy Cover of Blackberries (1st year)

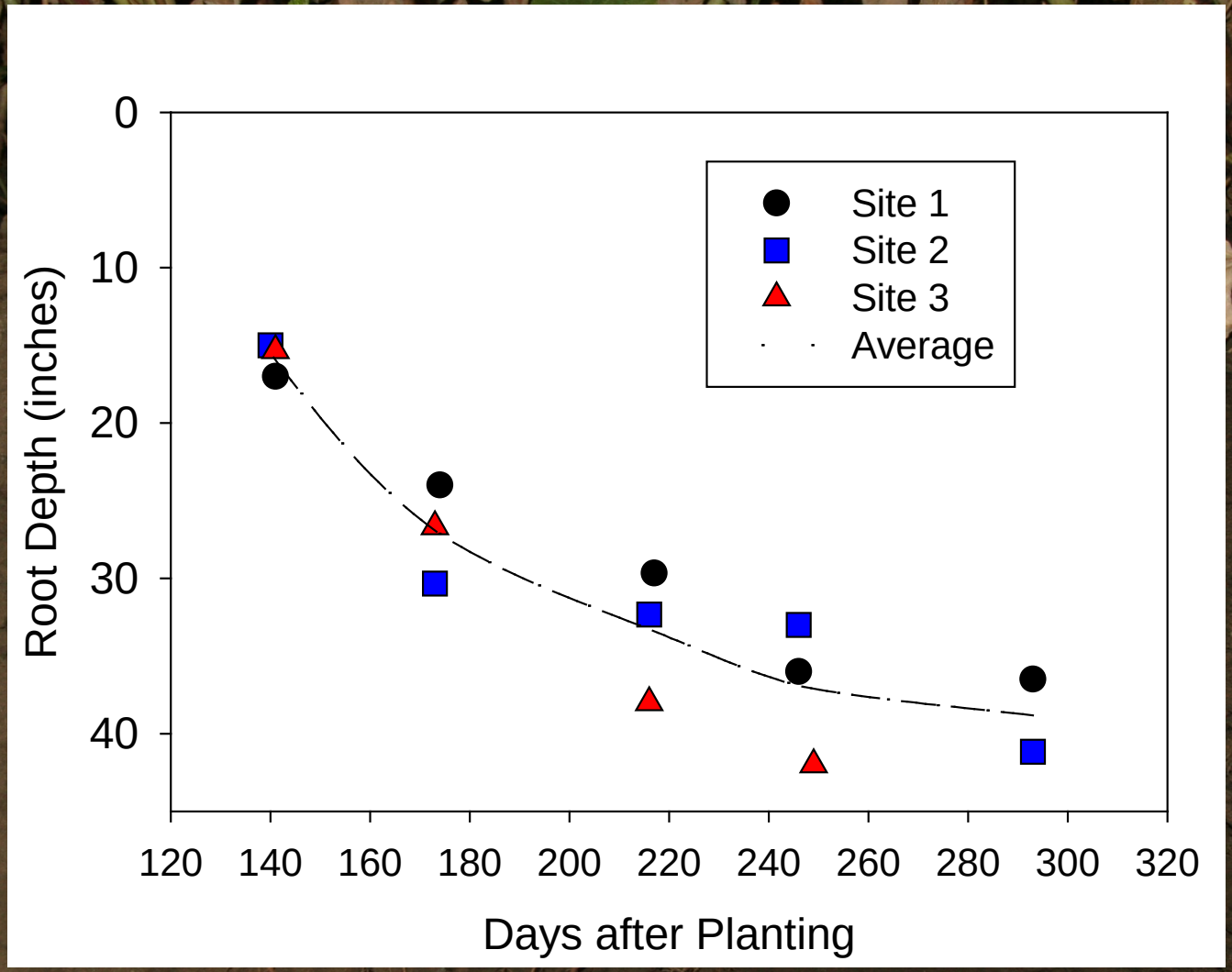


1st Year Raspberry, Watsonville CA

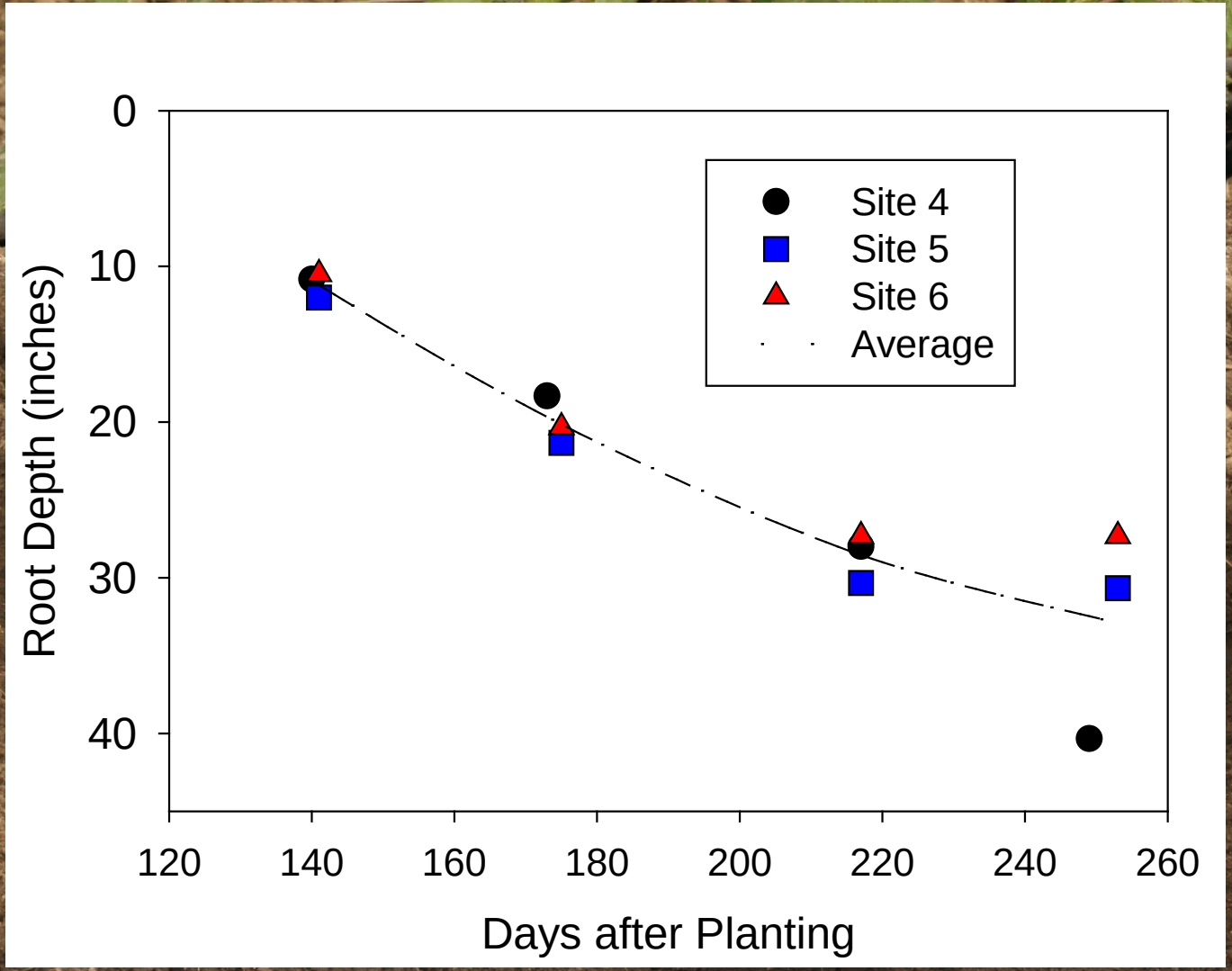


Rooting depth of caneberries

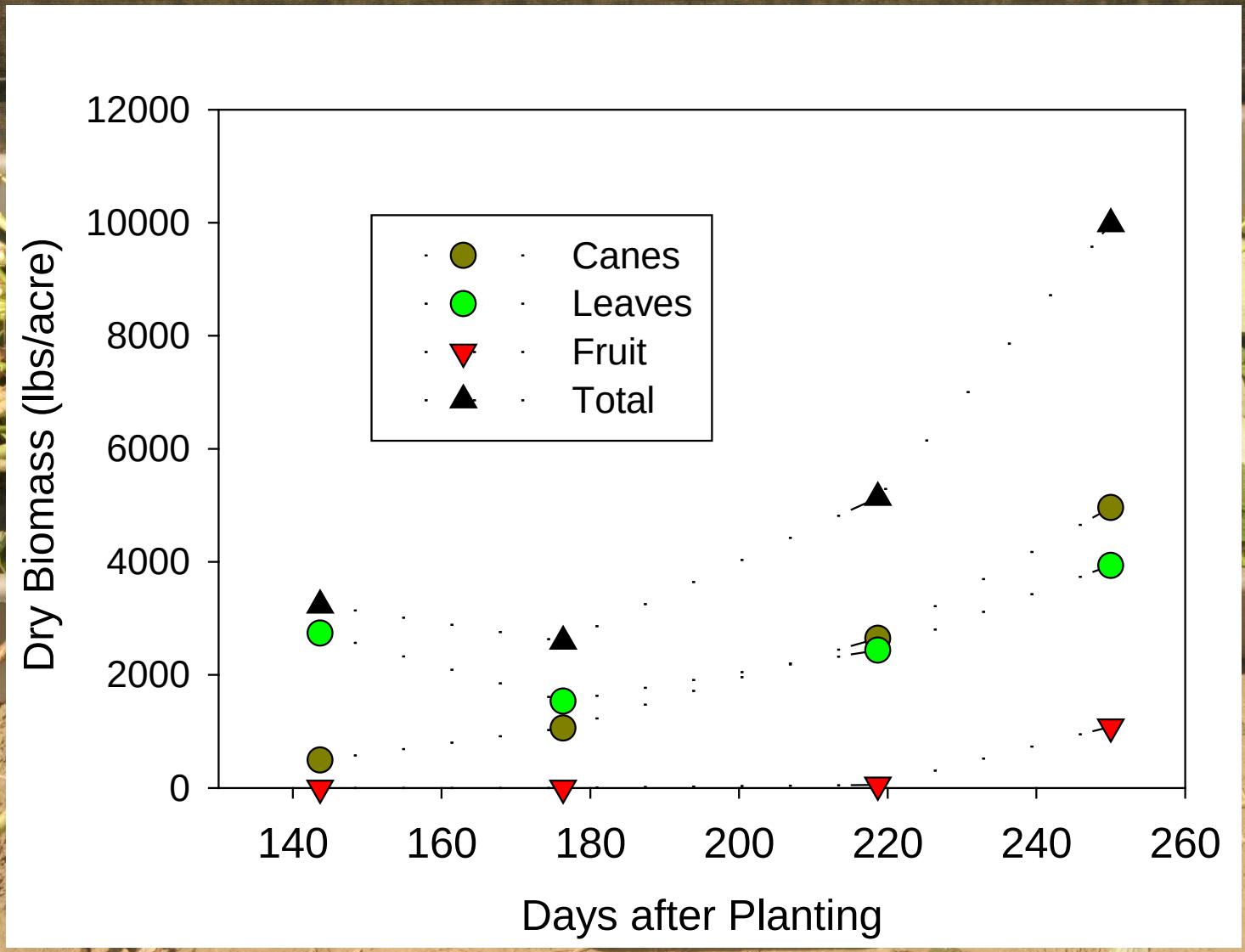
Rooting depth of raspberry (1st year)



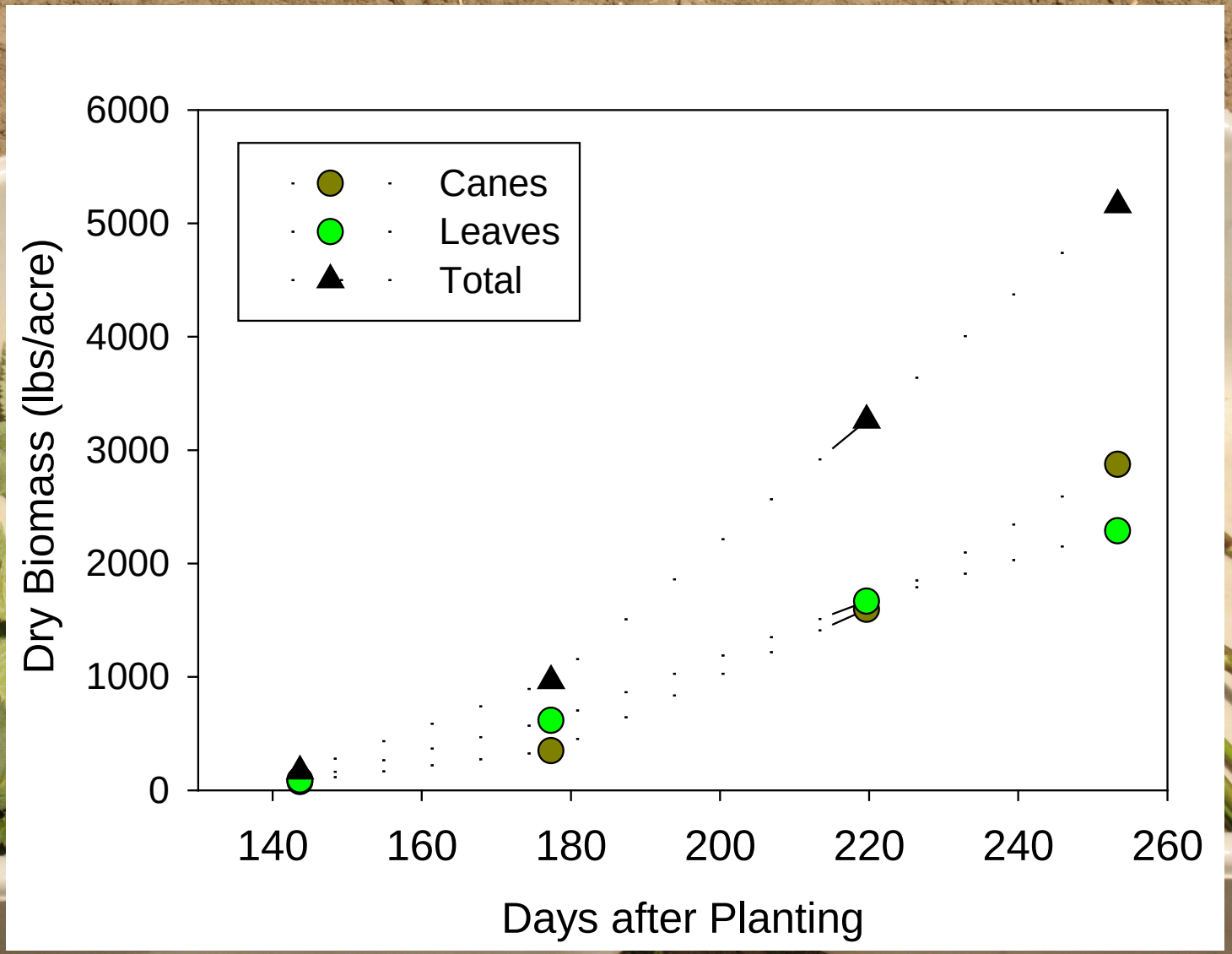
Rooting depth of blackberry (1st year)



Biomass of 1st year Raspberries



Biomass of 1st year Blackberries



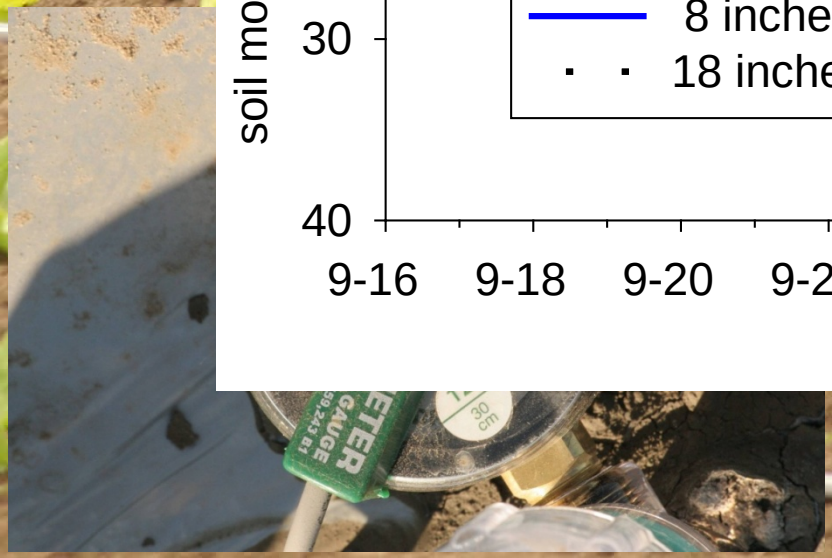
Additional Data Collected

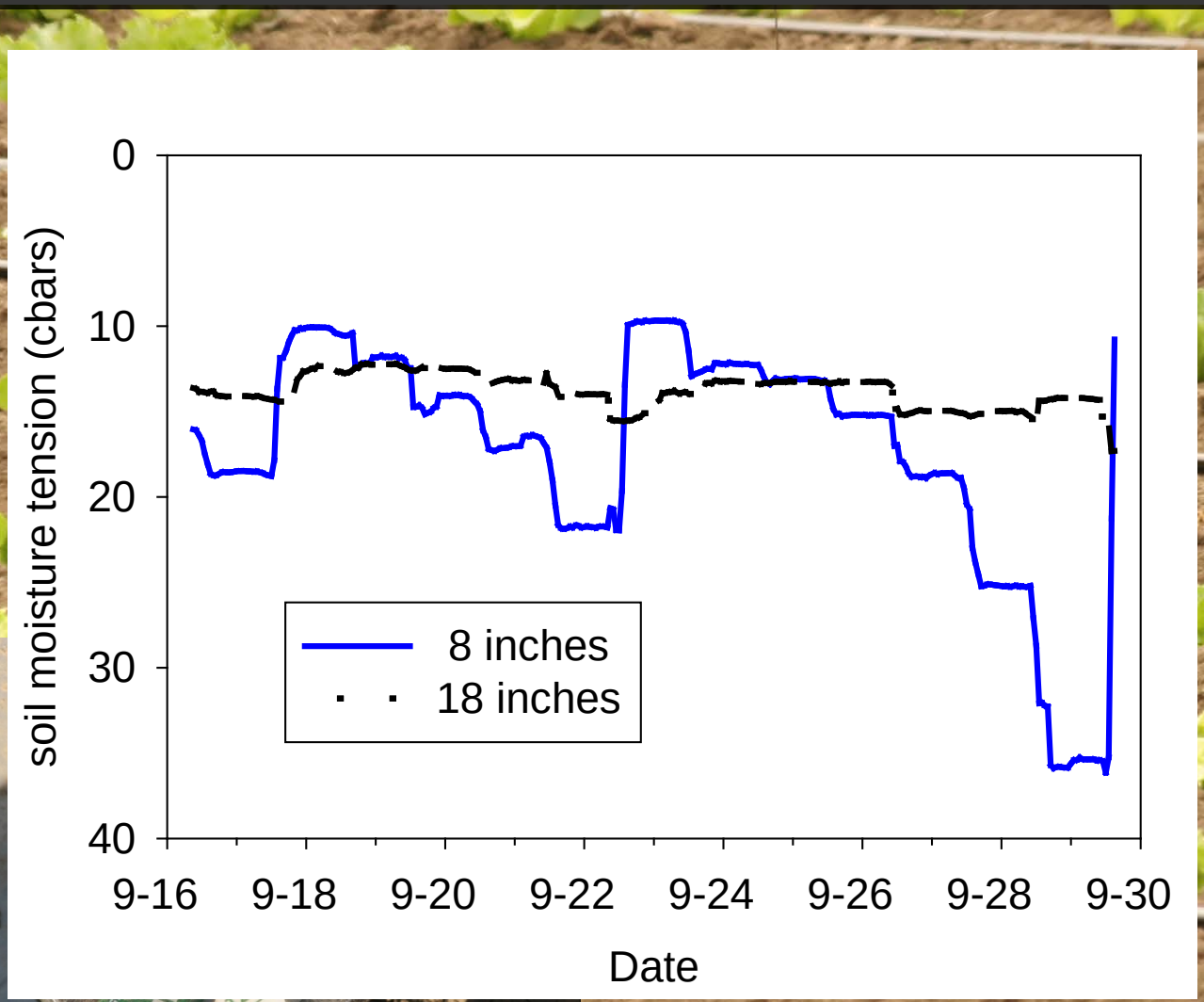
- Soil nitrate at 1 and 2 foot depths
- Fertilizer N applications (total N applied preplant and in season)*
- Fruit yield (monthly for calculating N uptake in fruit)*

*Data provided by Grower

The road ahead…

Soil moisture monitoring





Final Thoughts

- Web-based applications can integrate complex data and models into simple to use decision support tools

- We will need your participation to make this tool relevant to your needs.

- We will offer training workshops on CropManage beginning March 2013.