

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



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# Tools for Managing Water and Nitrogen Fertilizer in Vegetables

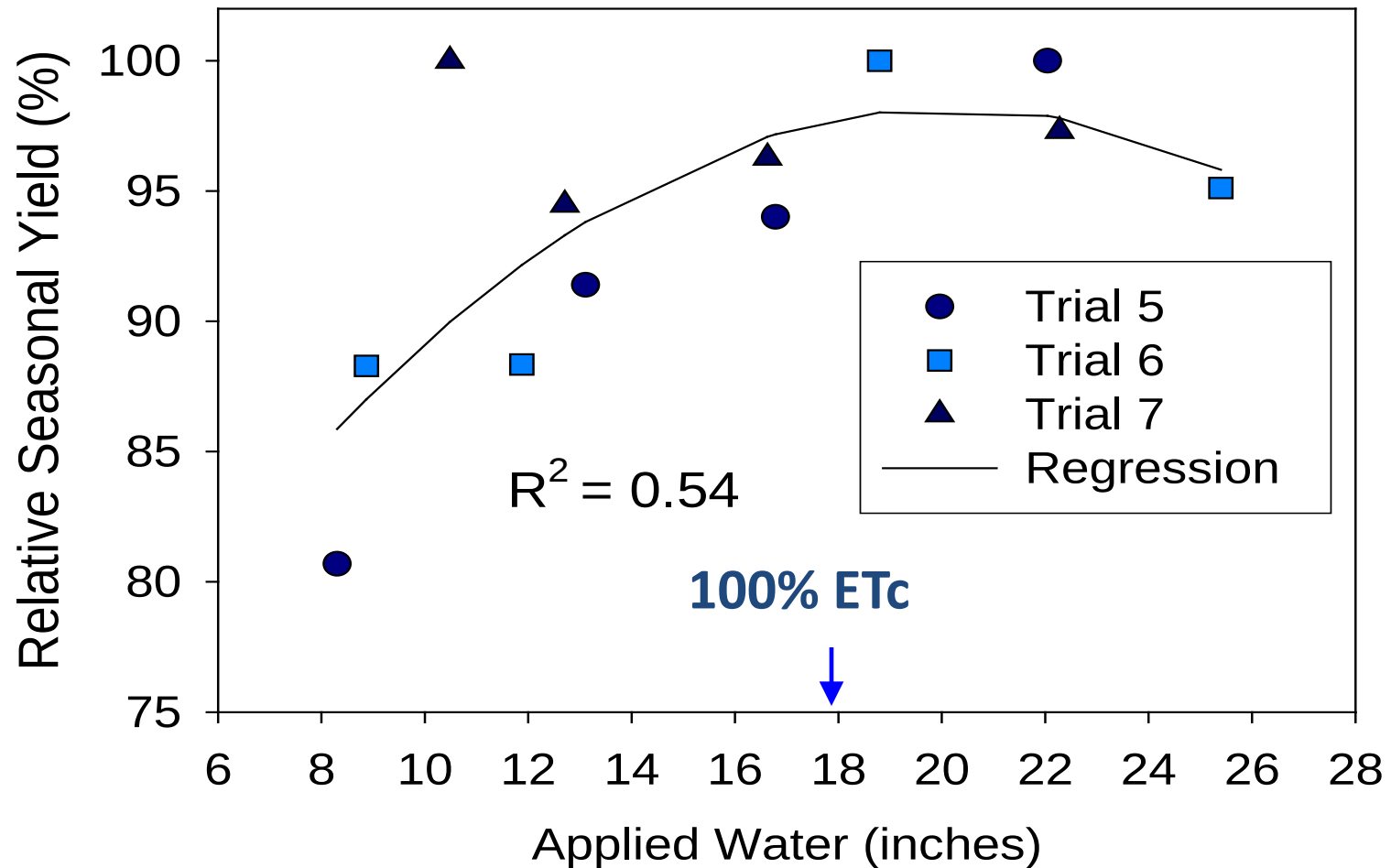
- Quick nitrate soil test
- Weather-based irrigation scheduling



# Raspberry:

## Applied Water vs Relative Fruit Yield

(Fall Crop, 2004, Trials 5-7)



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

$K_c$  can vary from 0.1 to 1.2

7% canopy

18% canopy

**CIMIS reference ET**

**Crop Coefficient**

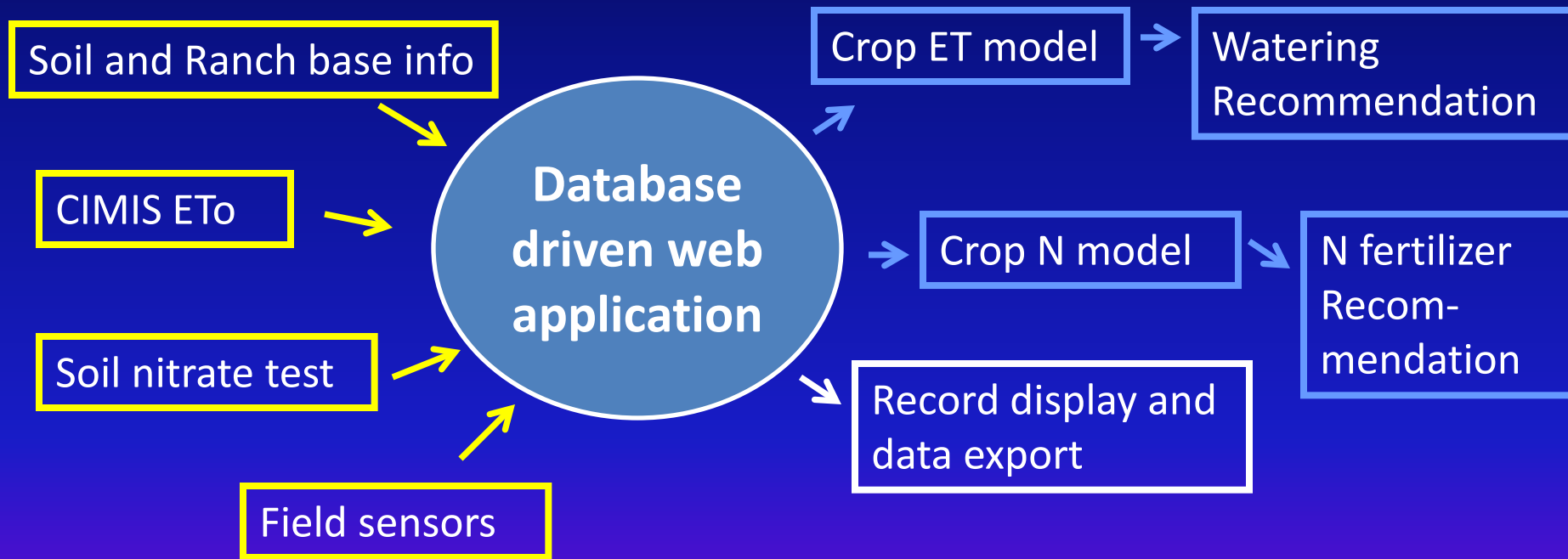
# CropManage Web-based Tool:

**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/

Google Search

File Edit View Favorites Tools Help

DELL 60° bing

Favorites UC CE Monterey County - Extensio... NDBC - Station 46042 (2) NDBC - Station 46042 Monterey County - Extensio... Monterey County - Extensio...

Crop Management Internet Explorer cannot dis...

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# CropManage

## Login

To login enter your e-mail and password below.

**E-mail Address**

mdcahn@ucdavis.edu

**Password**

Login

[Forgot Password](#)

[Create New Account](#)

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Irrigation Summary

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

Fertilizer Summary

Show / Hide Columns

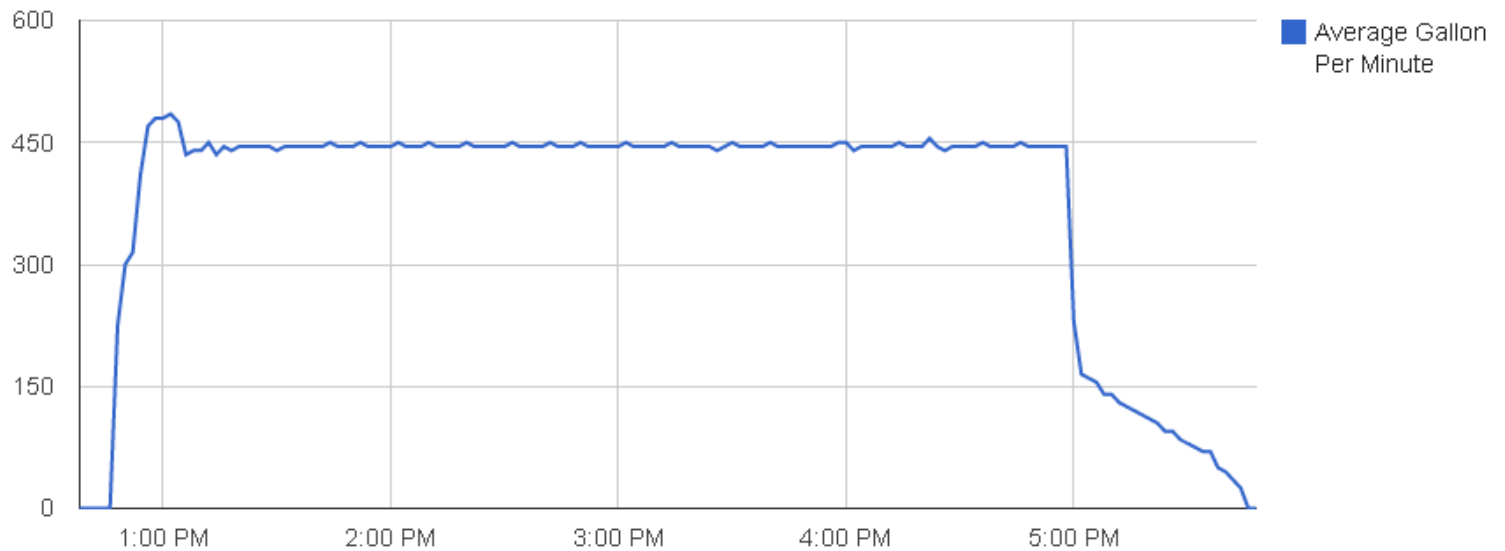
| Fertilizer Date         | Crop Stage           | Soil NO <sub>3</sub> -N (ppm) | Fertilizer N Recommended (lb N/acre) | Cumulative N Uptake | Fertilizer | Applied N (lb N/acre) | Applied Fertilizer |
|-------------------------|----------------------|-------------------------------|--------------------------------------|---------------------|------------|-----------------------|--------------------|
| <a href="#">5/5/12</a>  | Pre-thinning         | 15.79                         | 14.2                                 | 4.02                | 15-8-4     | 78.0                  | 50.0 gallons/acre  |
| <a href="#">5/22/12</a> | 1st drip fertigation | 14.74                         | 21.5                                 | 13.82               | 28-0-0-5   | 37.1                  | 12.0 gallons/acre  |
| <a href="#">5/27/12</a> | 2nd drip fertigation | 23.68                         | 4.9                                  | 18.88               | 28-0-0-5   | 30.9                  | 10.0 gallons/acre  |
| <a href="#">6/7/12</a>  | 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

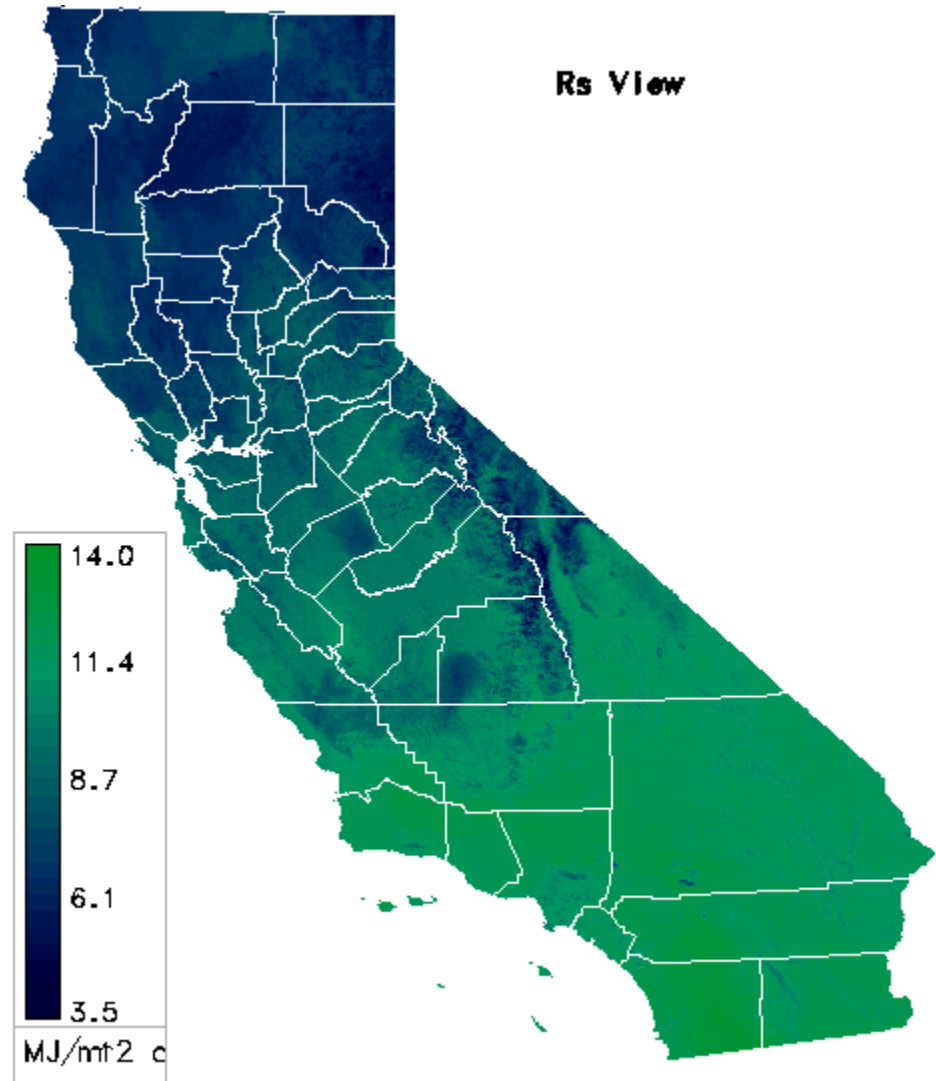
# How much water was applied?

## Flow Meter Data

Flow Meter Data on Oct 17, 2012



# 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)

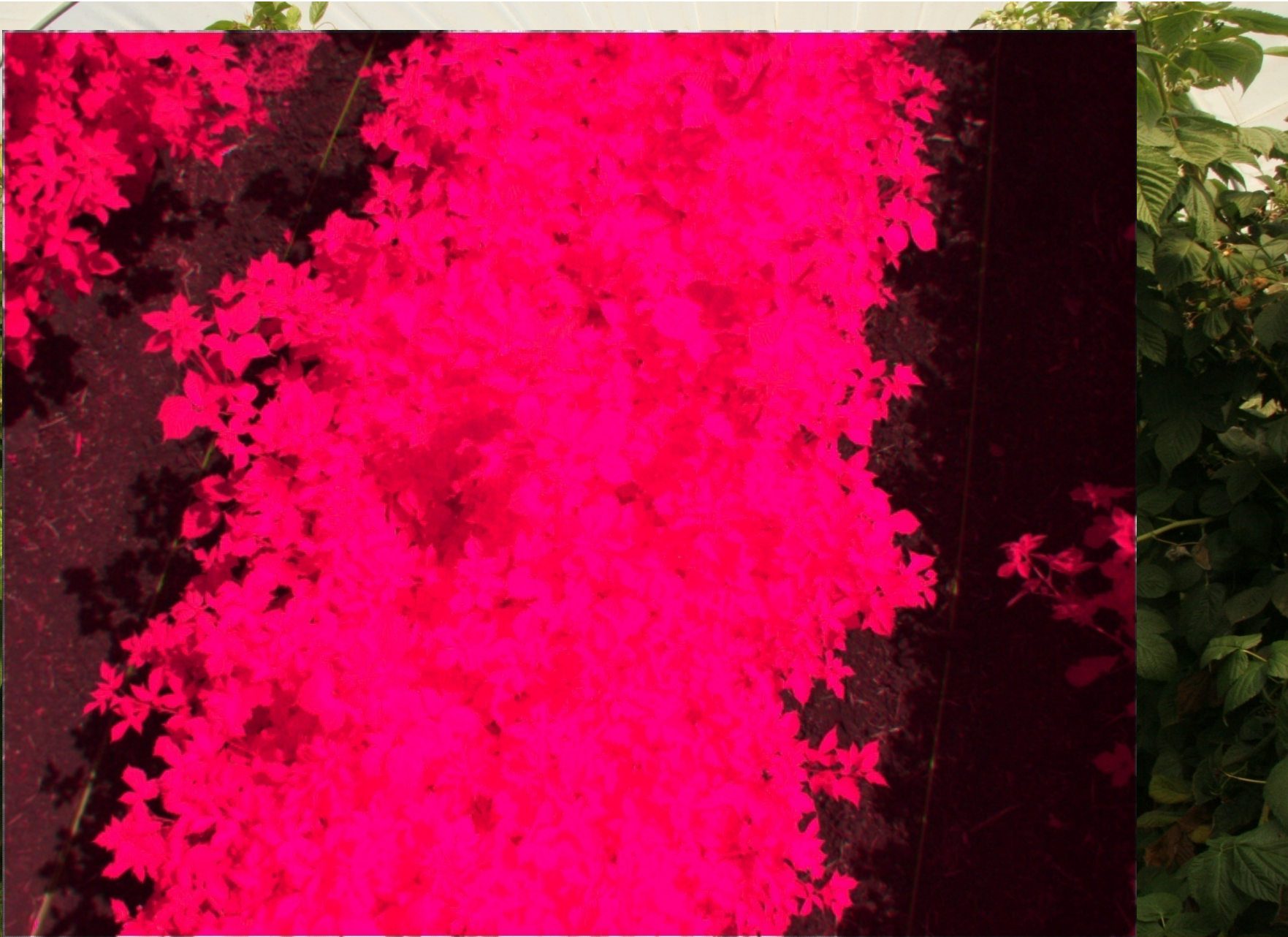
## Year 2

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

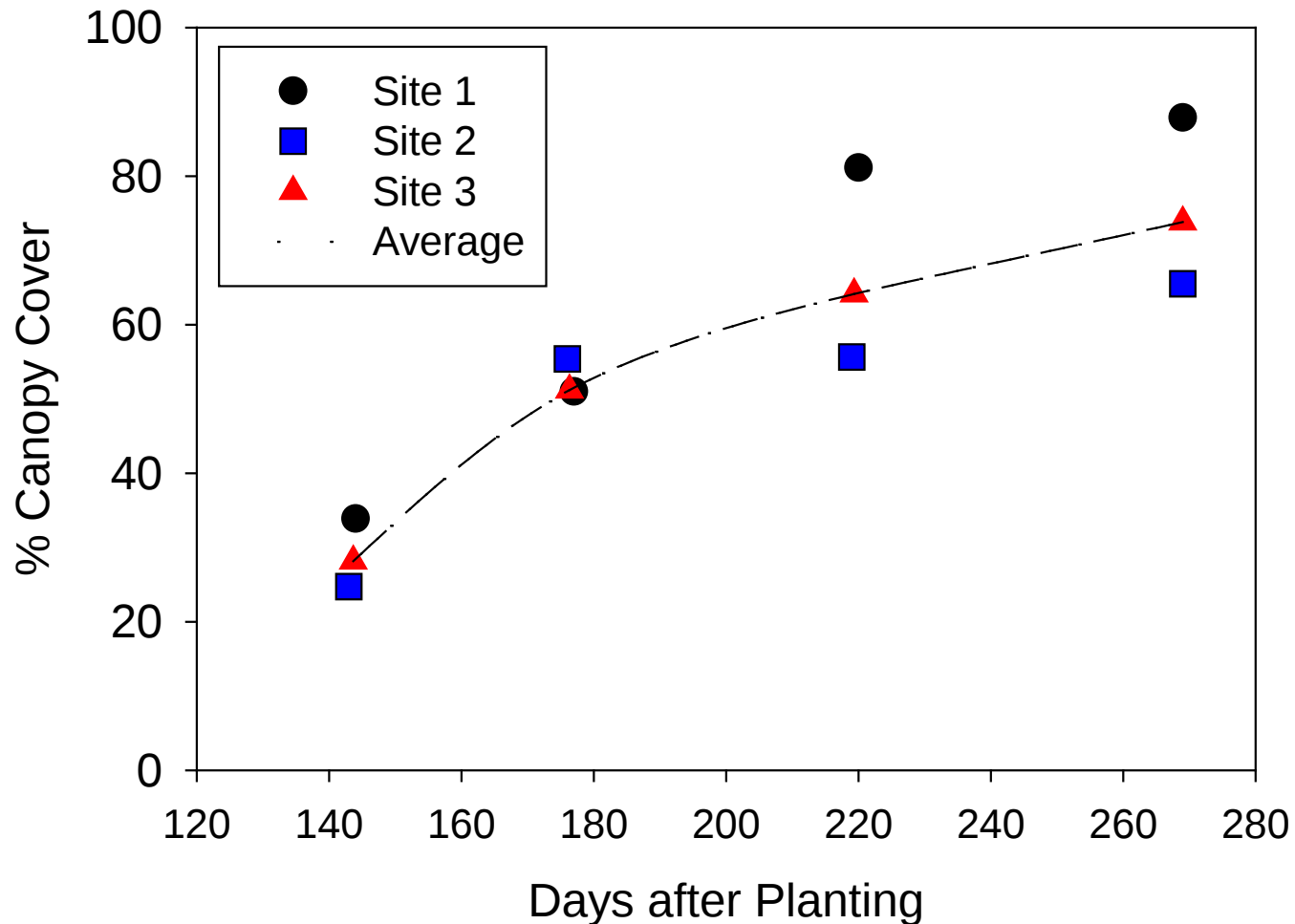
# Canopy Cover Development



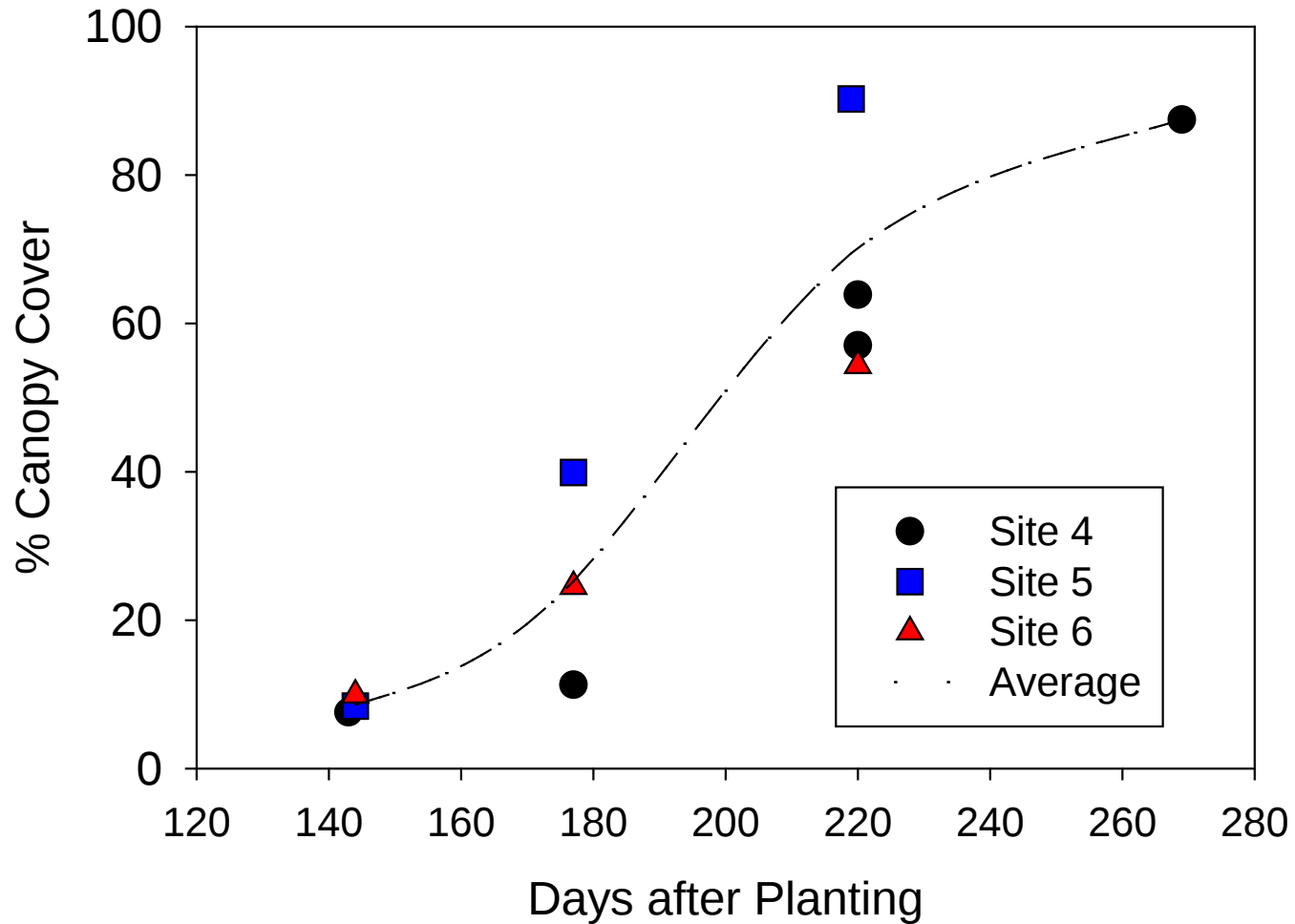
# Canopy Cover



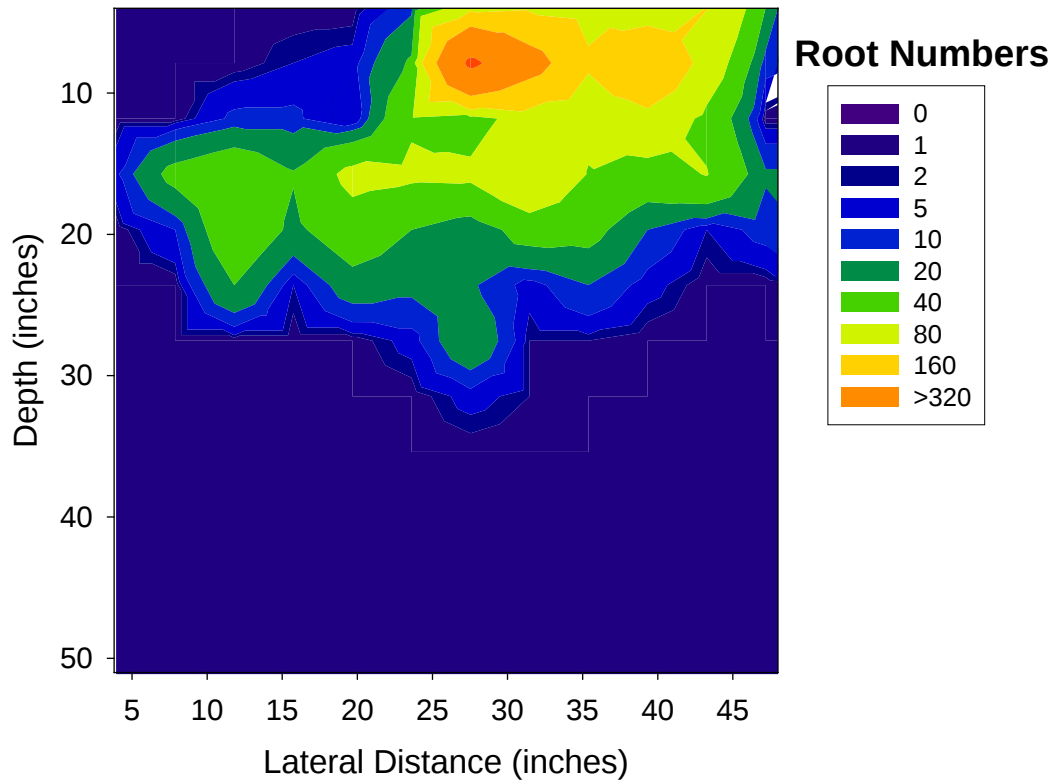
# Canopy Cover of Raspberries (1<sup>st</sup> year)



# Canopy Cover of Blackberries (1<sup>st</sup> year)



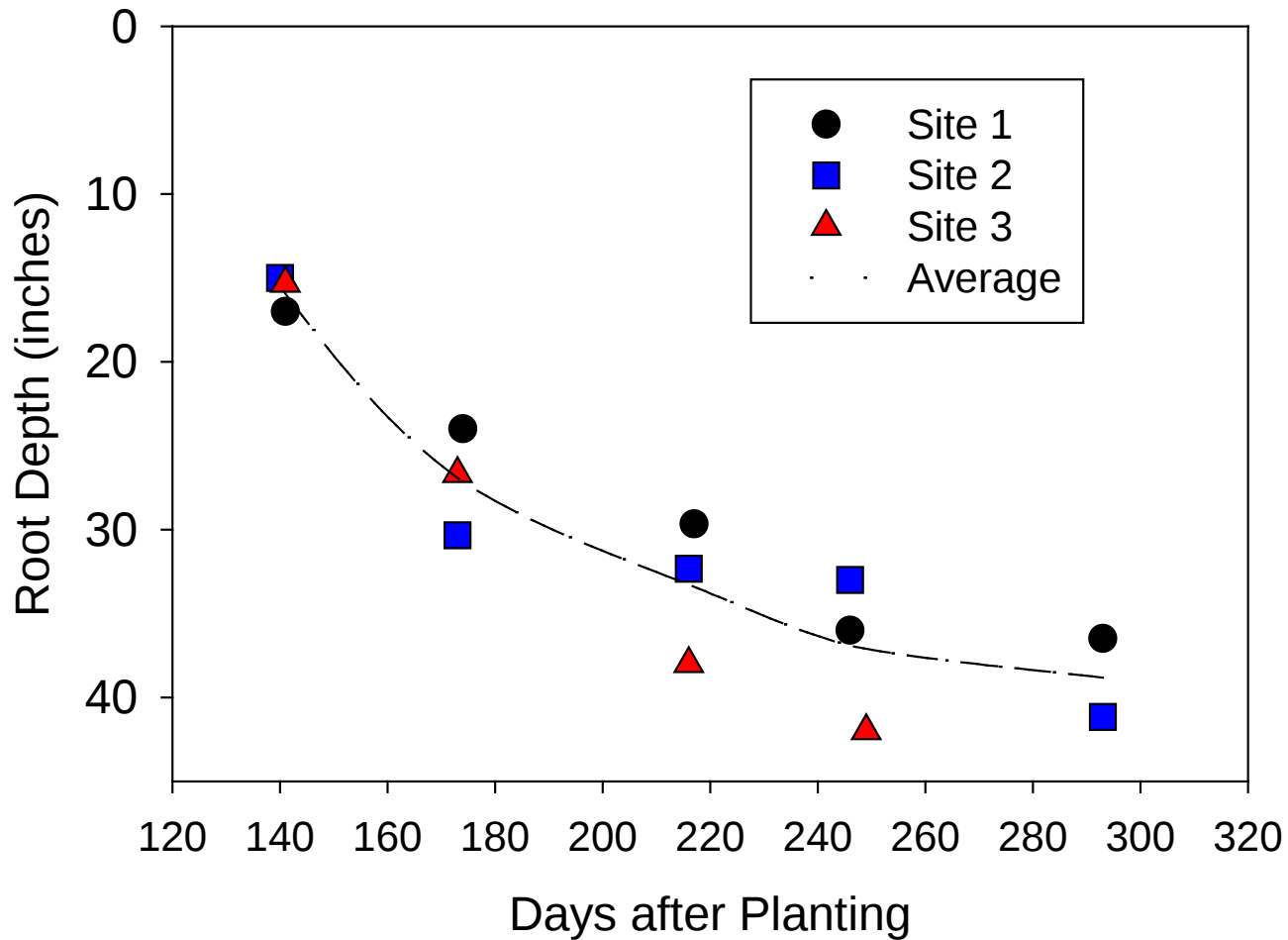
# 1<sup>st</sup> Year Raspberry, Watsonville CA



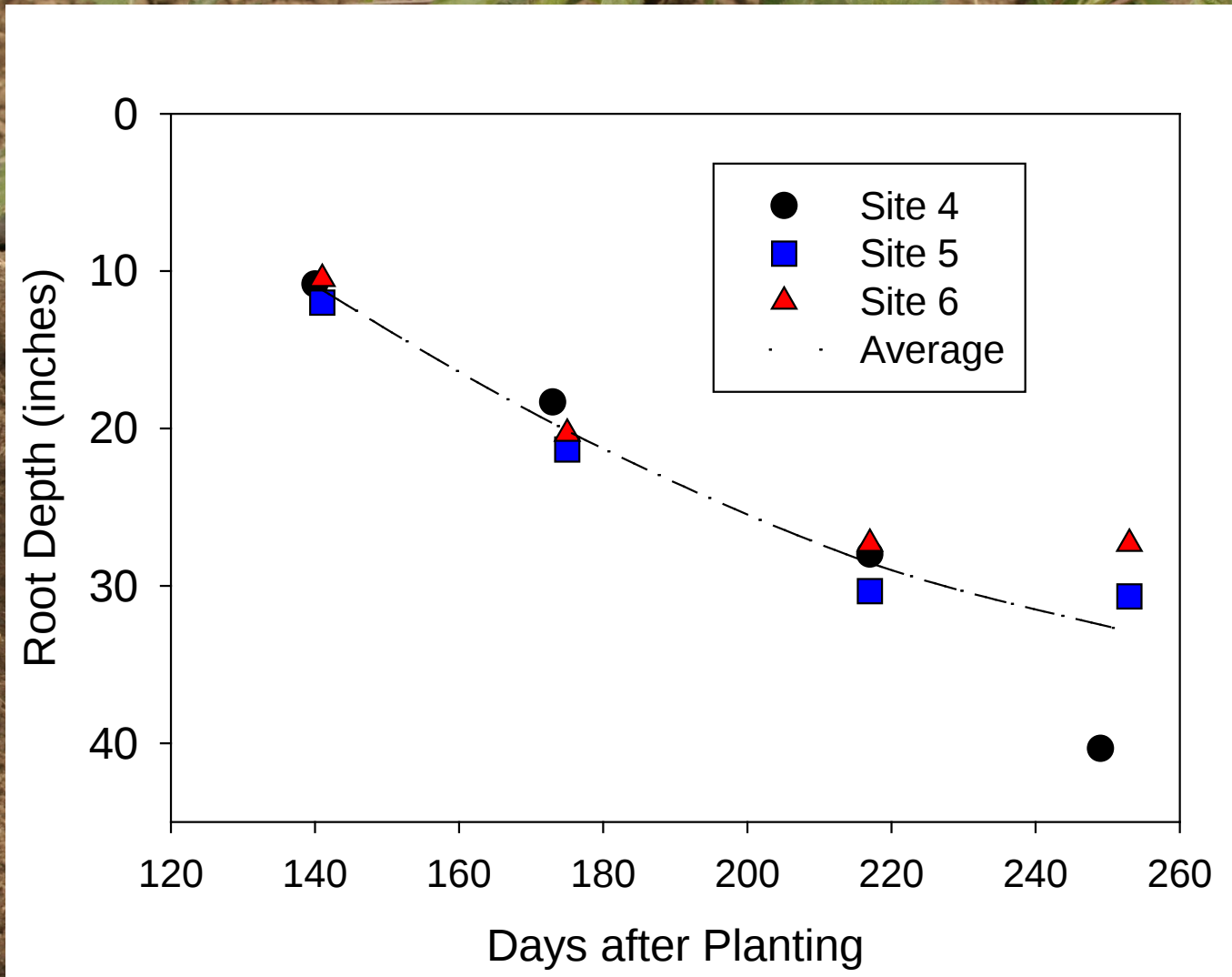
# Rooting depth of caneberries



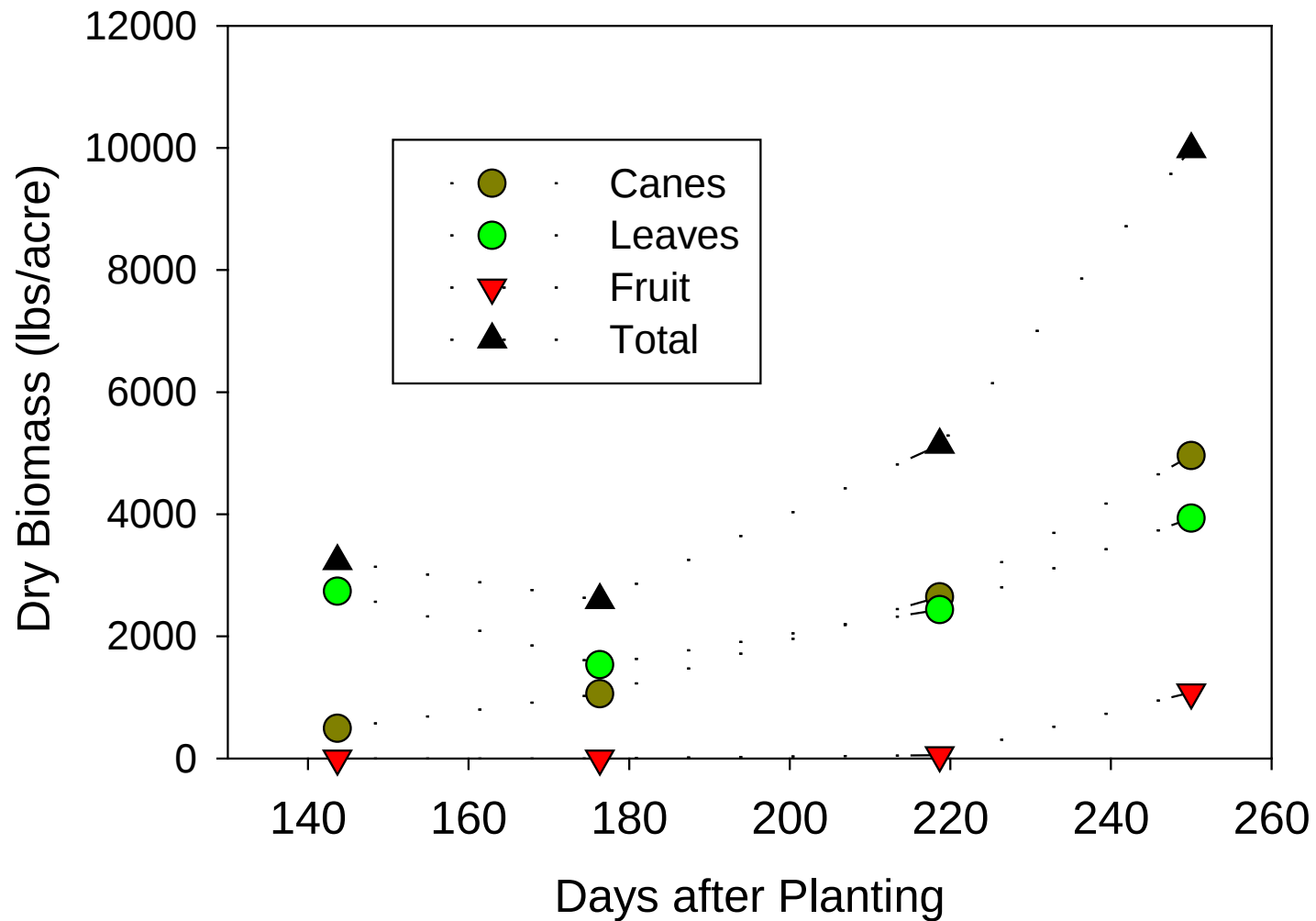
# Rooting depth of raspberry (1<sup>st</sup> year)



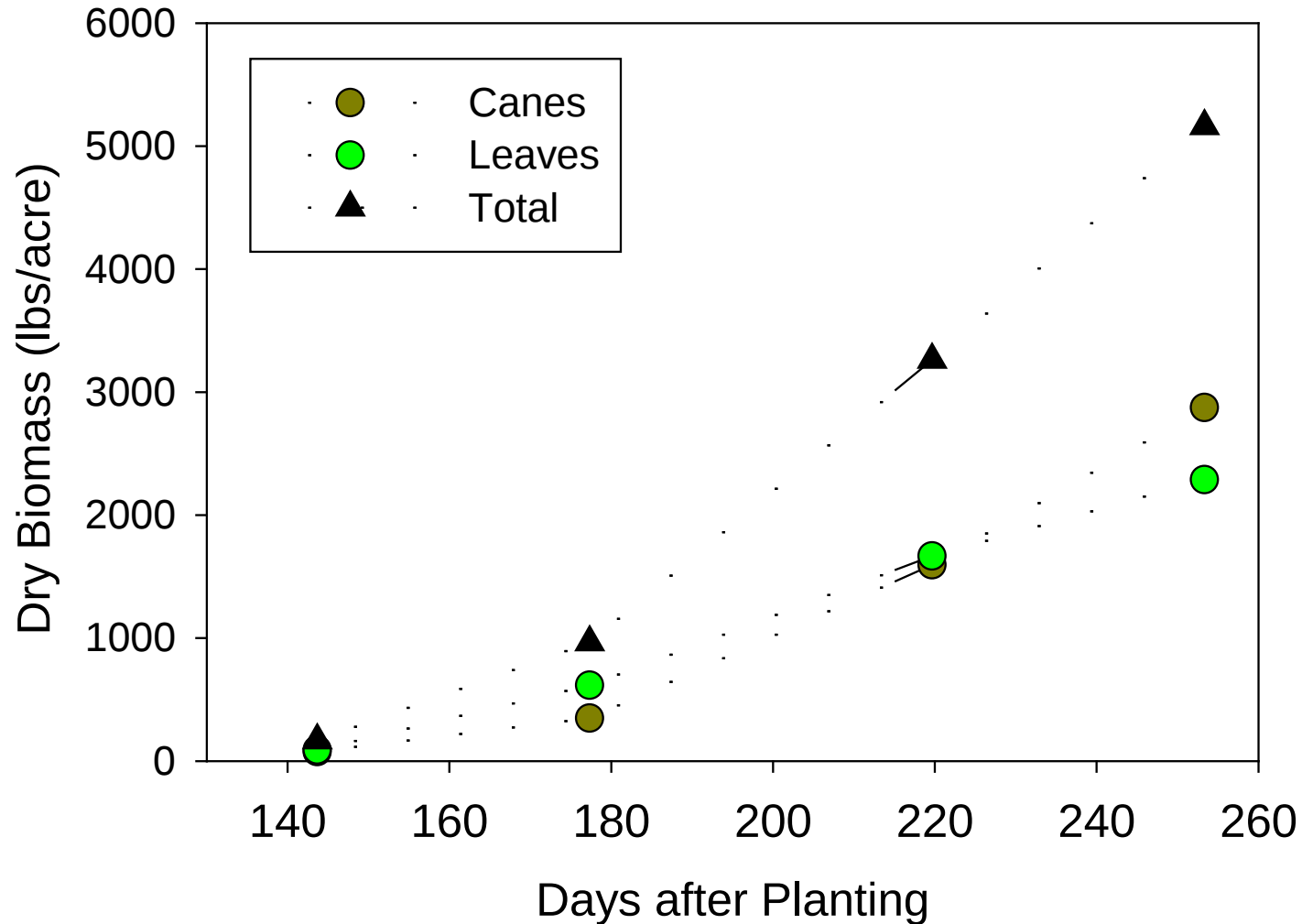
# Rooting depth of blackberry (1<sup>st</sup> year)



# Biomass of 1<sup>st</sup> year Raspberries



# Biomass of 1<sup>st</sup> year Blackberries



# Additional Data Collected

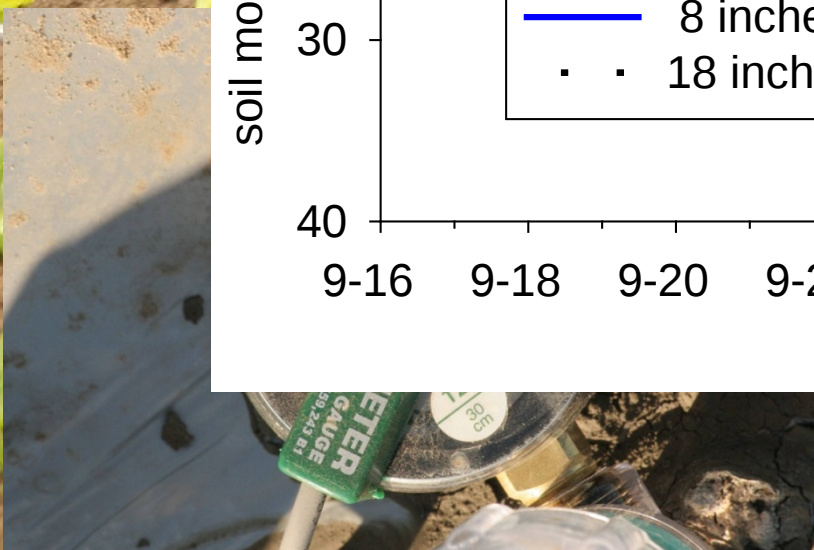
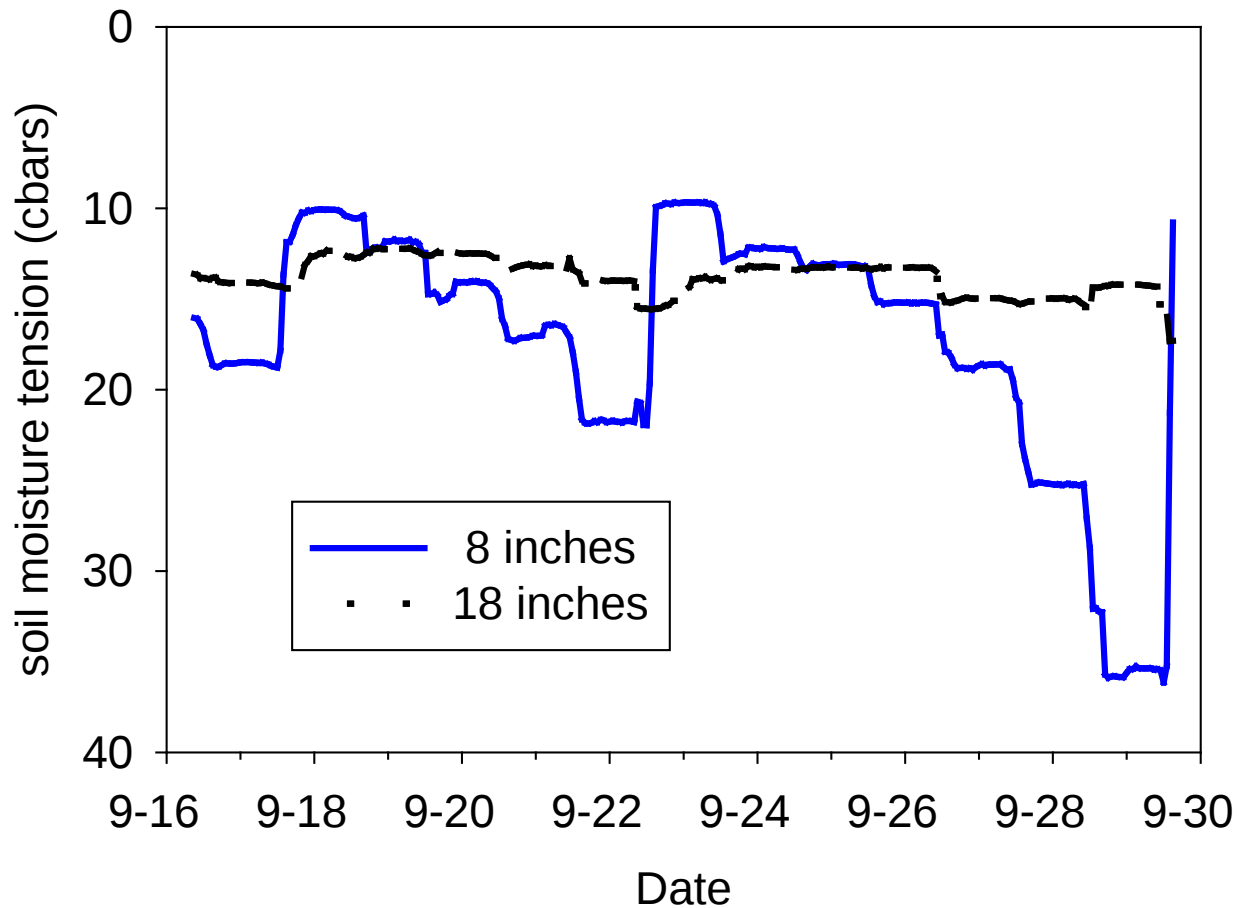
- Soil nitrate at 1 and 2 foot depths
- Fertilizer N applications (total N applied preplant and in season)\*
- Fruit yield (monthly for calculating N uptake in fruit)\*

\*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.