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Frost Cycling, Irrigation, and Heat Stress in Cranberry

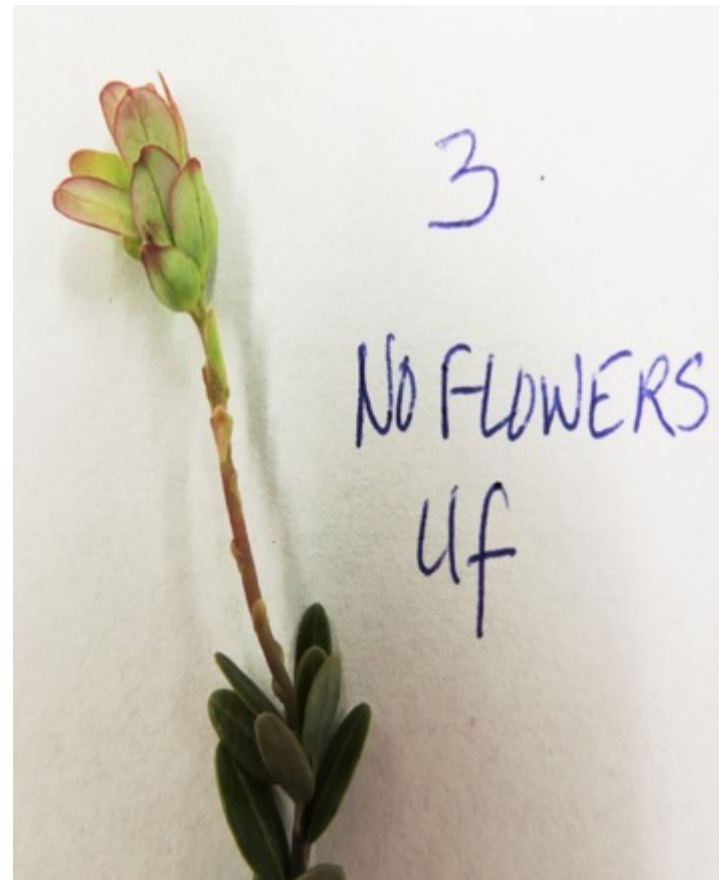
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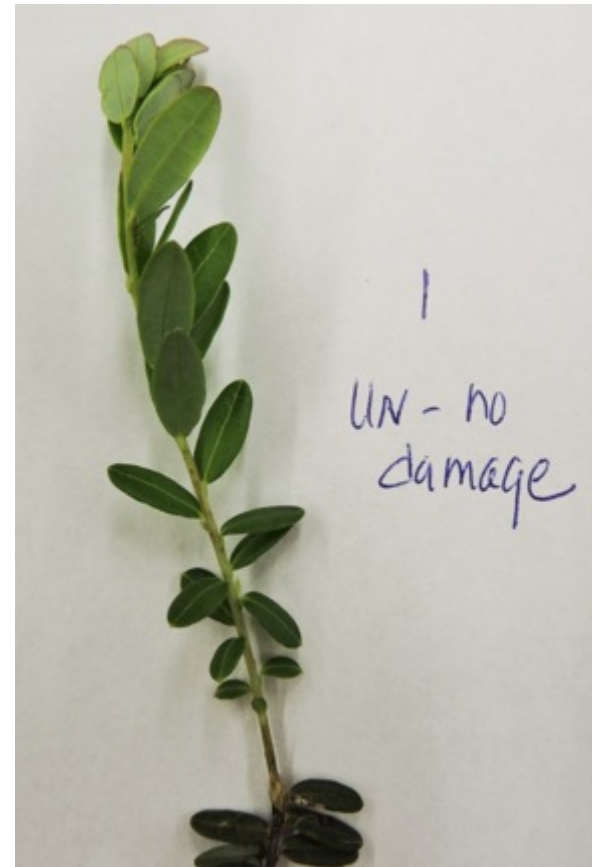
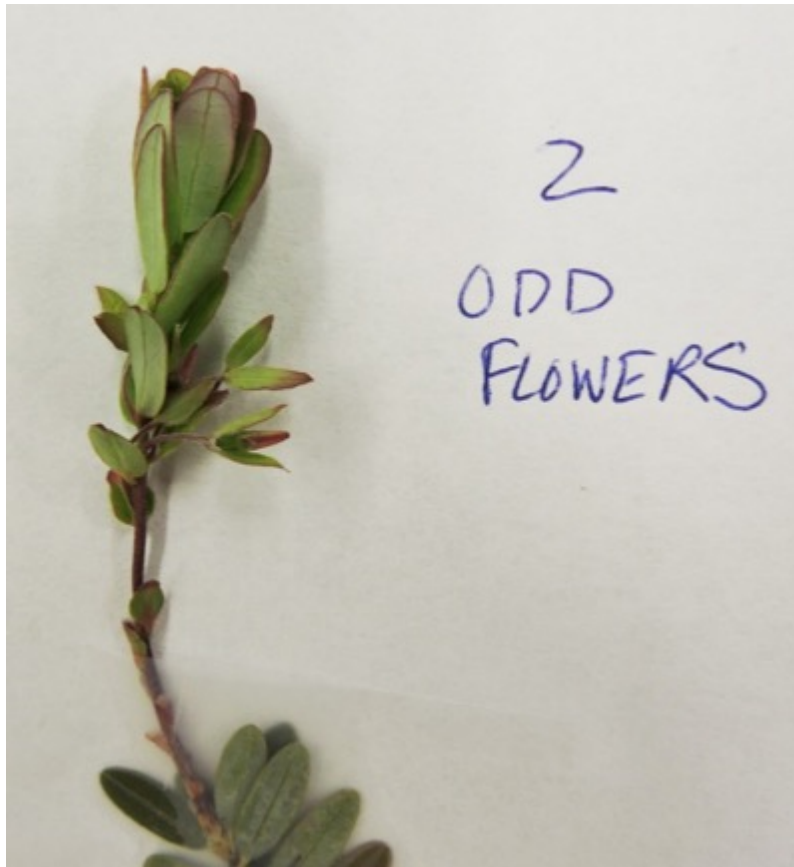
Peter Jeranyama, Casey Kennedy
and Carolyn DeMoranville



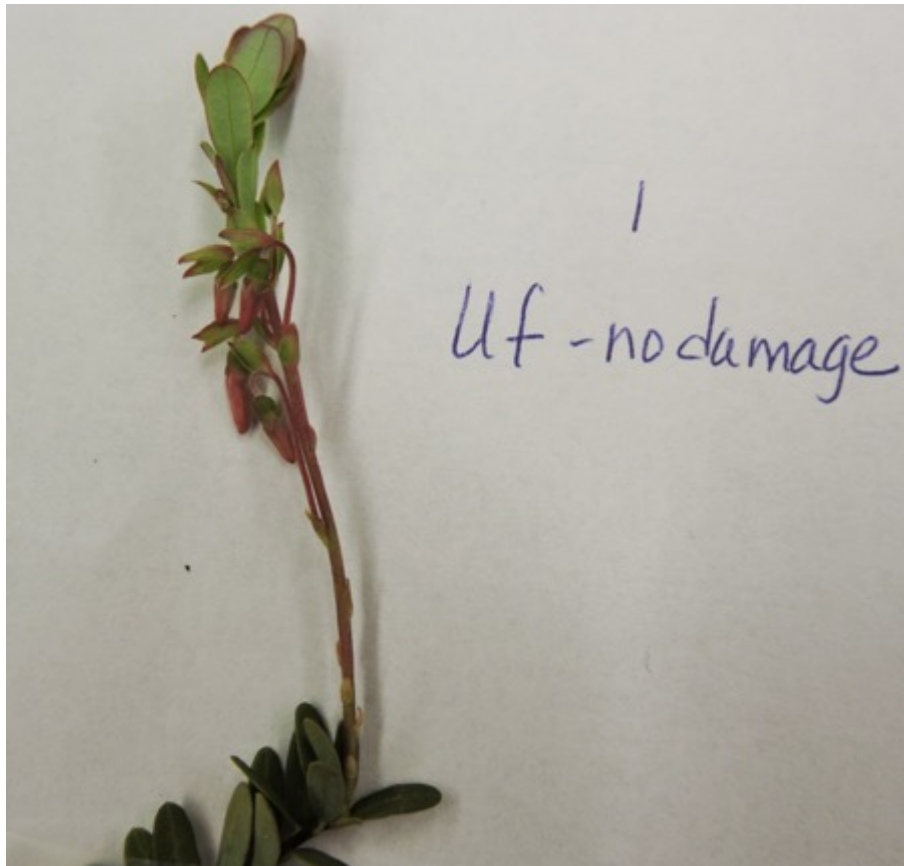
Dead bud & No flowers

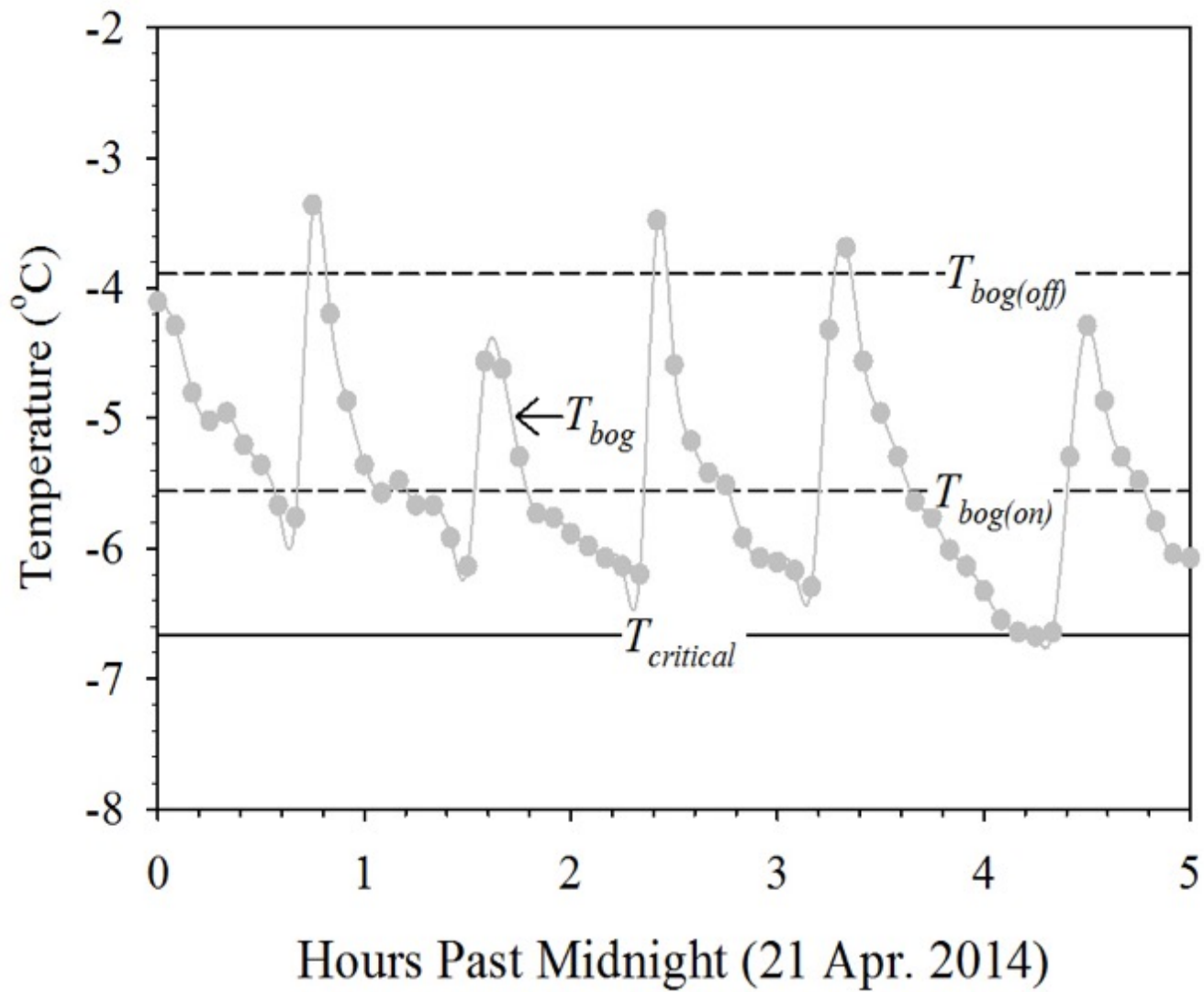


Odd flowers & no damage



No damage & umbrella bloom





Cranberry Yield (BBL/Ac) by Frost Protection Method

	Year 1		Year 2		Year 3	
Cultivar	CYC	CONV	CYC	CONV	CYC	CONV
EB	240a	150b	185a	165b	264a	242b
Stevens	307a	266a	468a	377b	246a	260a



Observations - Lampinen

- Most MA cranberry beds appear to be too wet during much of the season
- Evaporative demand study -for many weeks in the season, cranberries require less than 1-inch applied as irrigation/week.



Dr. H. J. Franklin Observations (1948)

Dr. H. J. Franklin of the Massachusetts Cranberry Station, observed that cranberry soils are **“too wet oftener than too dry”** (Franklin, 1948)



Irrigation Survey Questions-2015

1. Do you use a tensiometer or sensor to schedule your irrigation?

82% No; 18% Yes

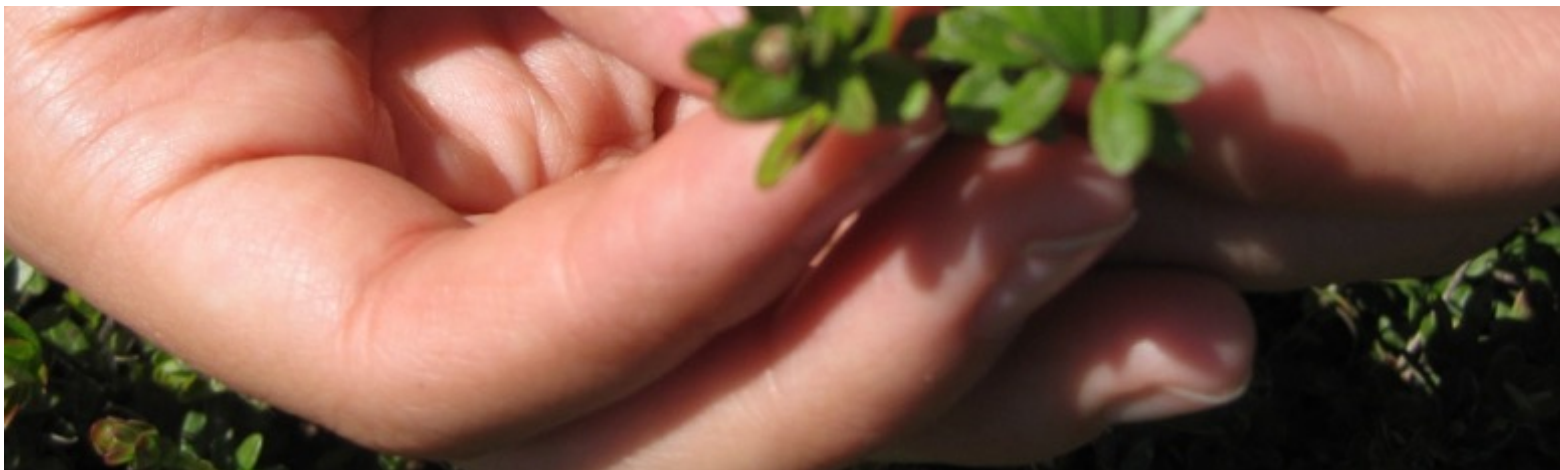
2. If you have a tensiometer, is it linked to your automation system?

68% No; 32% Yes

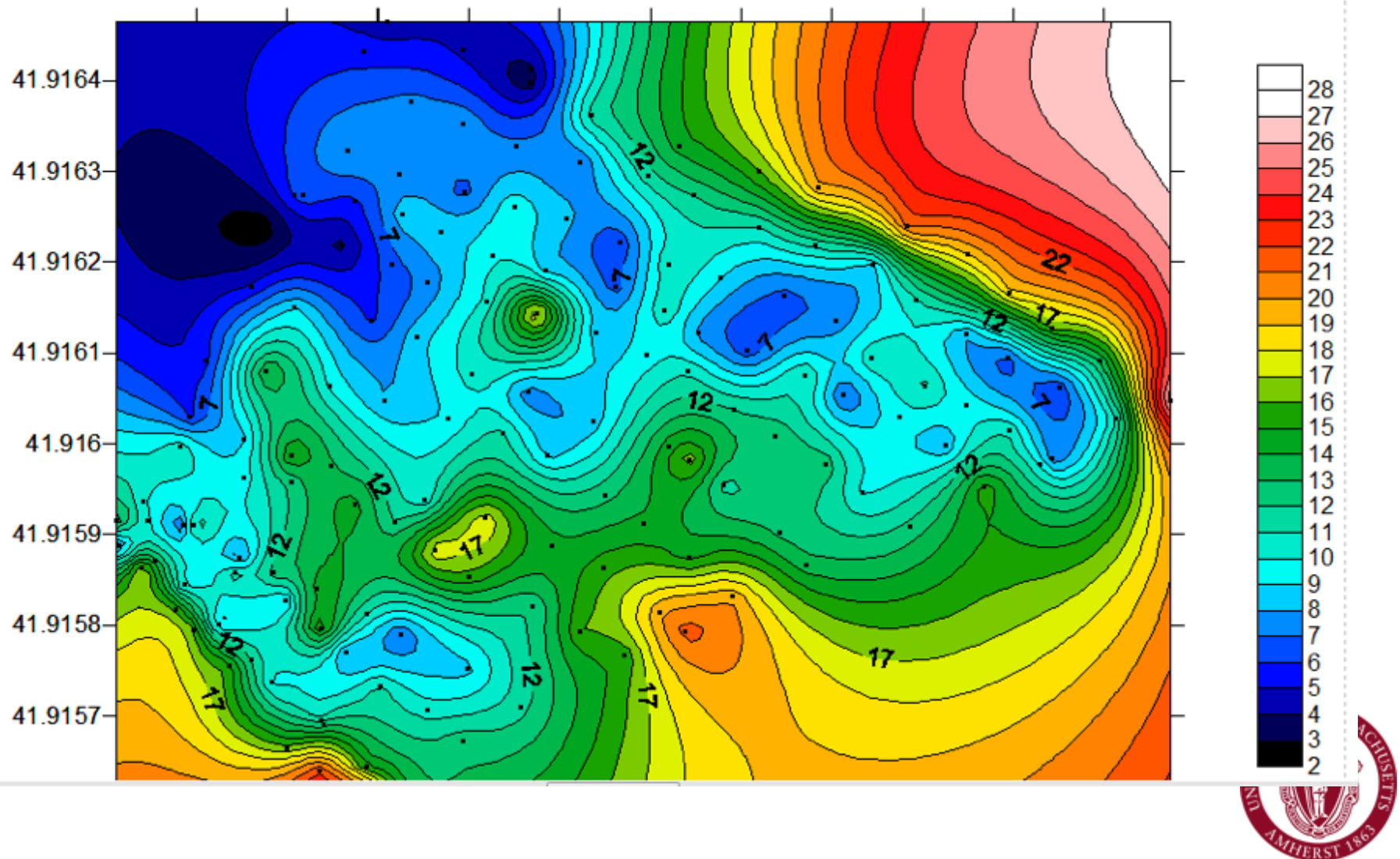


Objectives

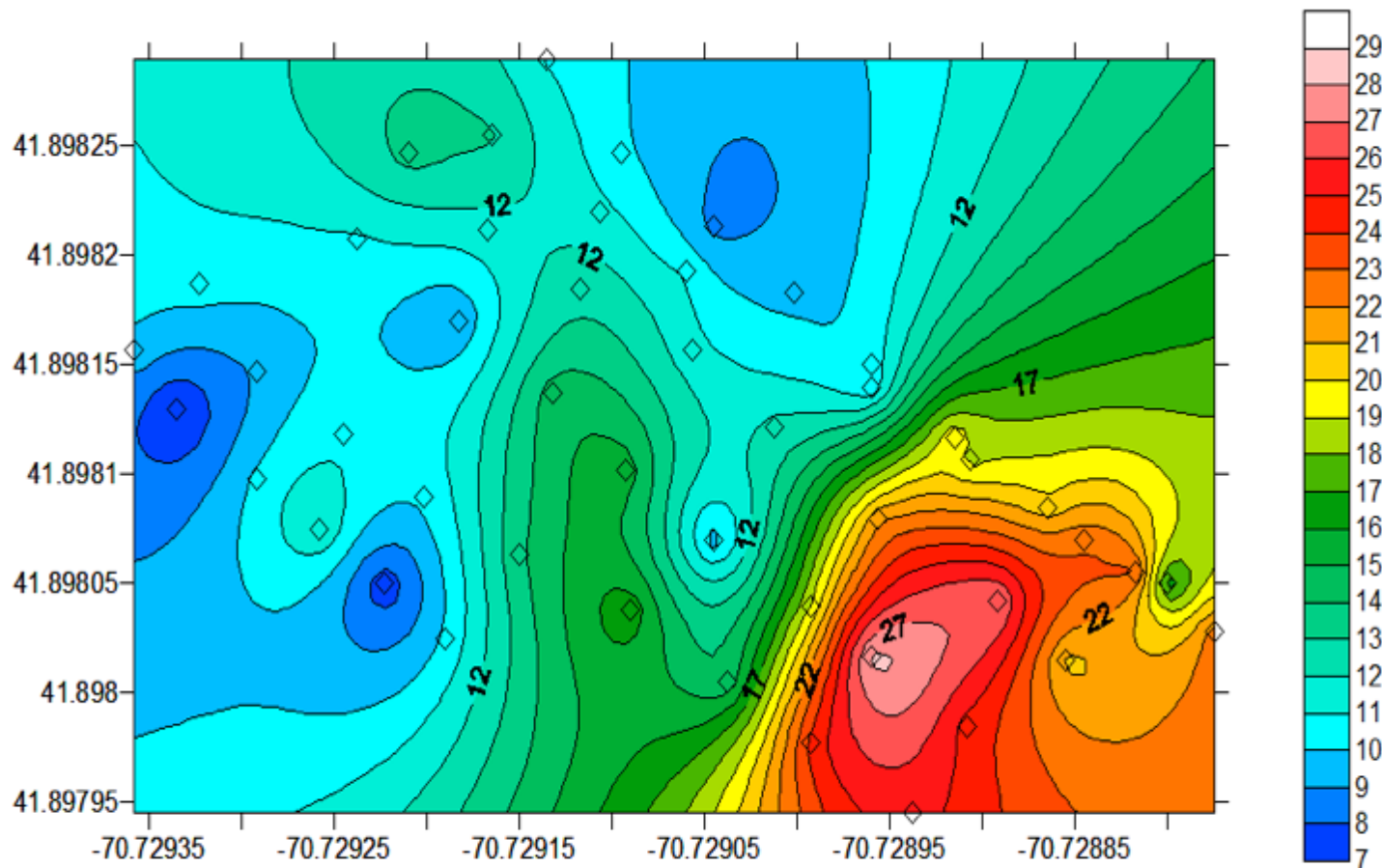
- (i) To evaluate the effects of irrigation management on soil tension
- (ii) Develop a relationship between soil tension and volumetric water content
- (iii) Assess effect of soil tension on cranberry fruit rot and yield.



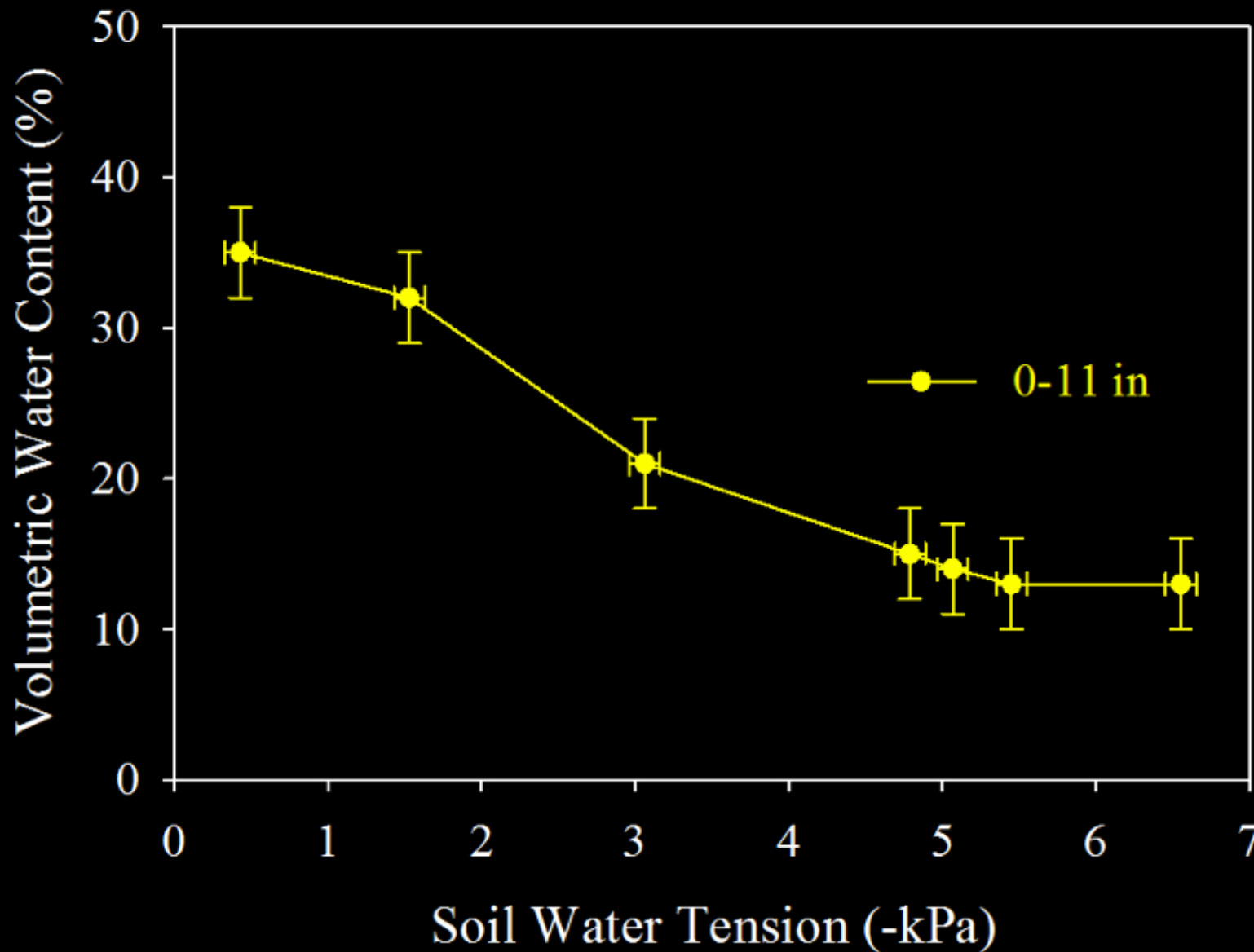
Volumetric Water Content in a Cranberry Bed on July 27, 2016



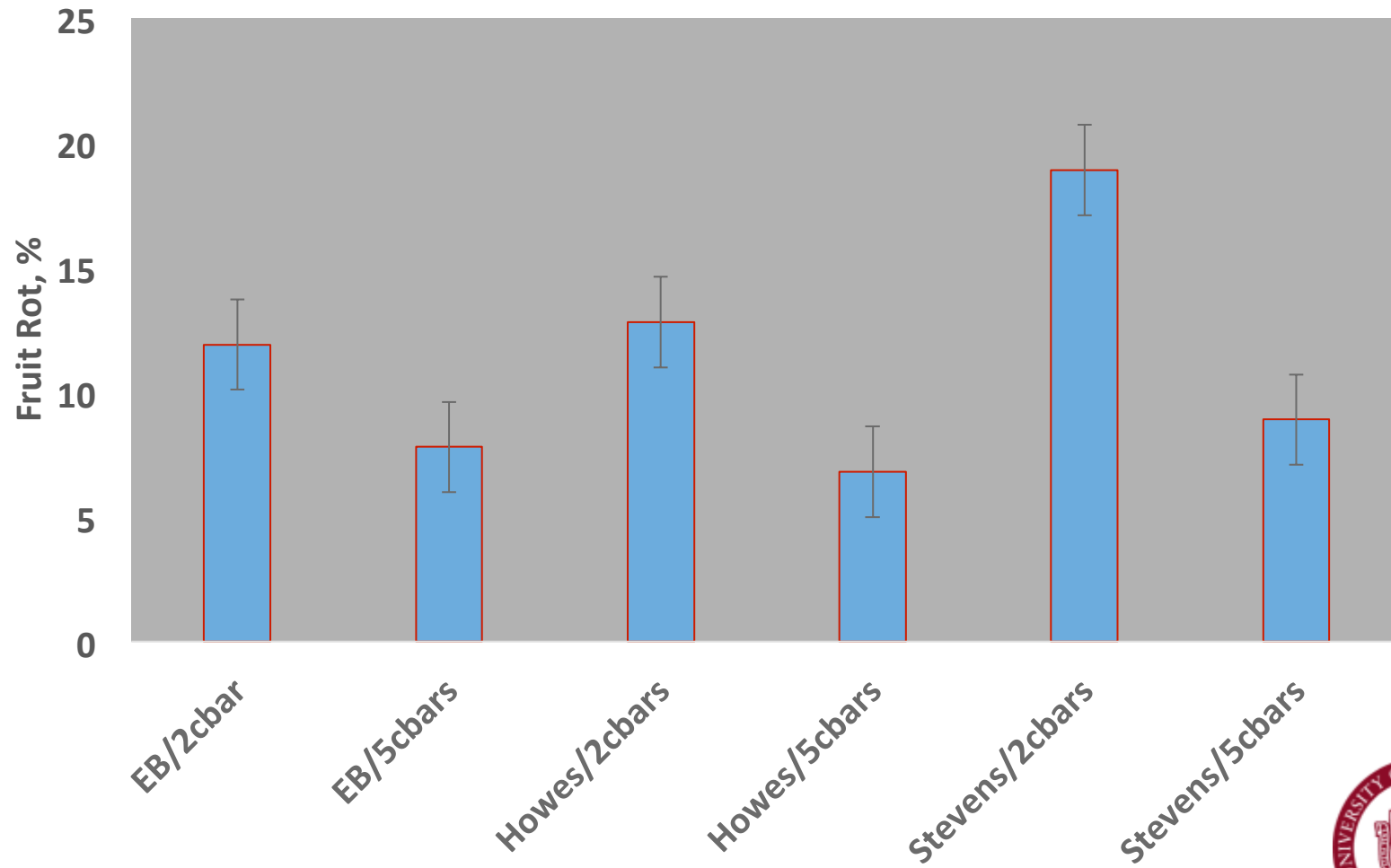
Volumetric Soil Moisture Variations on a Bog in Carver in August, 2016

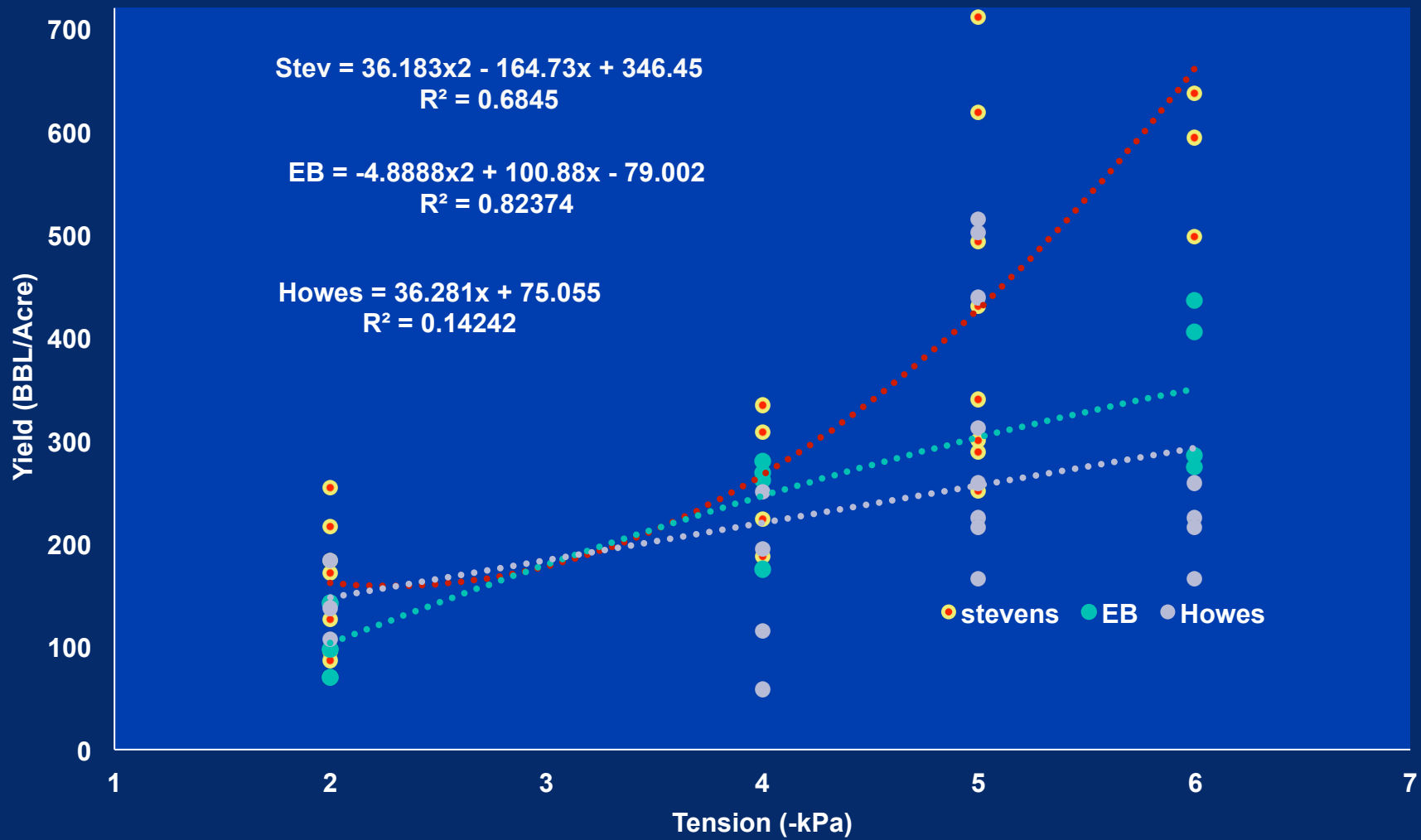


Relationship between Volumetric Water Content and Soil Tension



Fruit Rot as affected by Water Regime



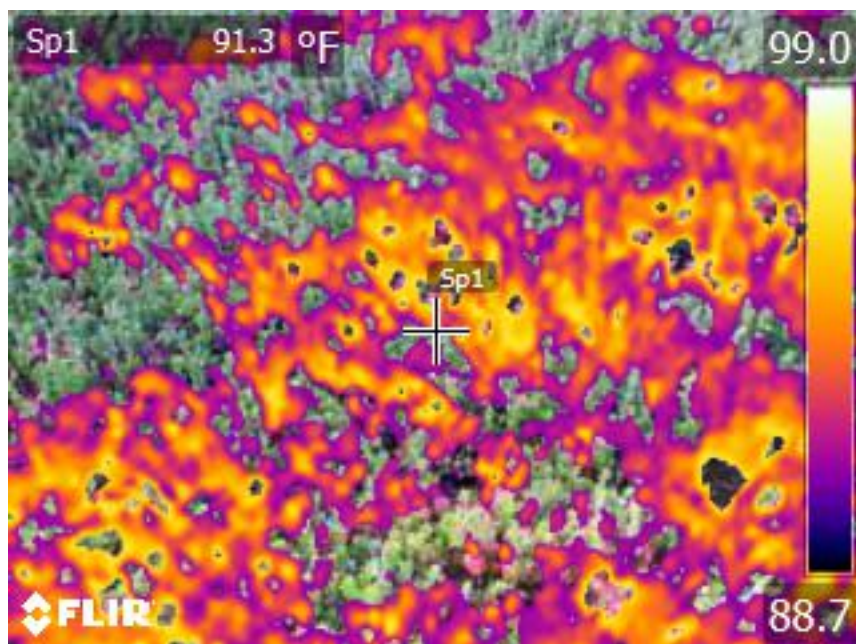


Typical Conditions for High-Temperature Scald

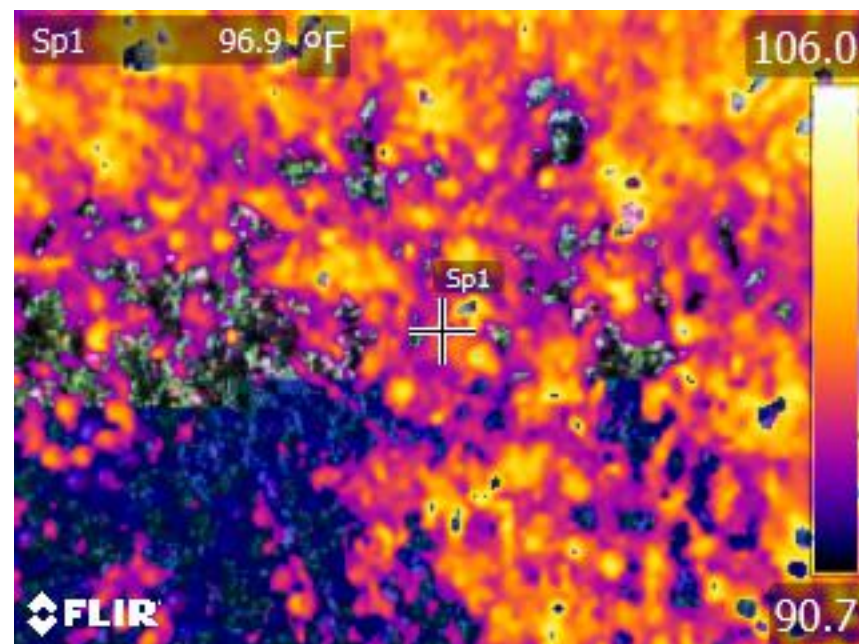
- Sunny and still days with high humidity
- Air temperatures $>85^{\circ}\text{F}$.
- Condition is associated with a thick boundary layer of resistance
- This decreases the ability for the plant to cool the fruit.
- An 85°F air temperature is approx. 105°F on the bog



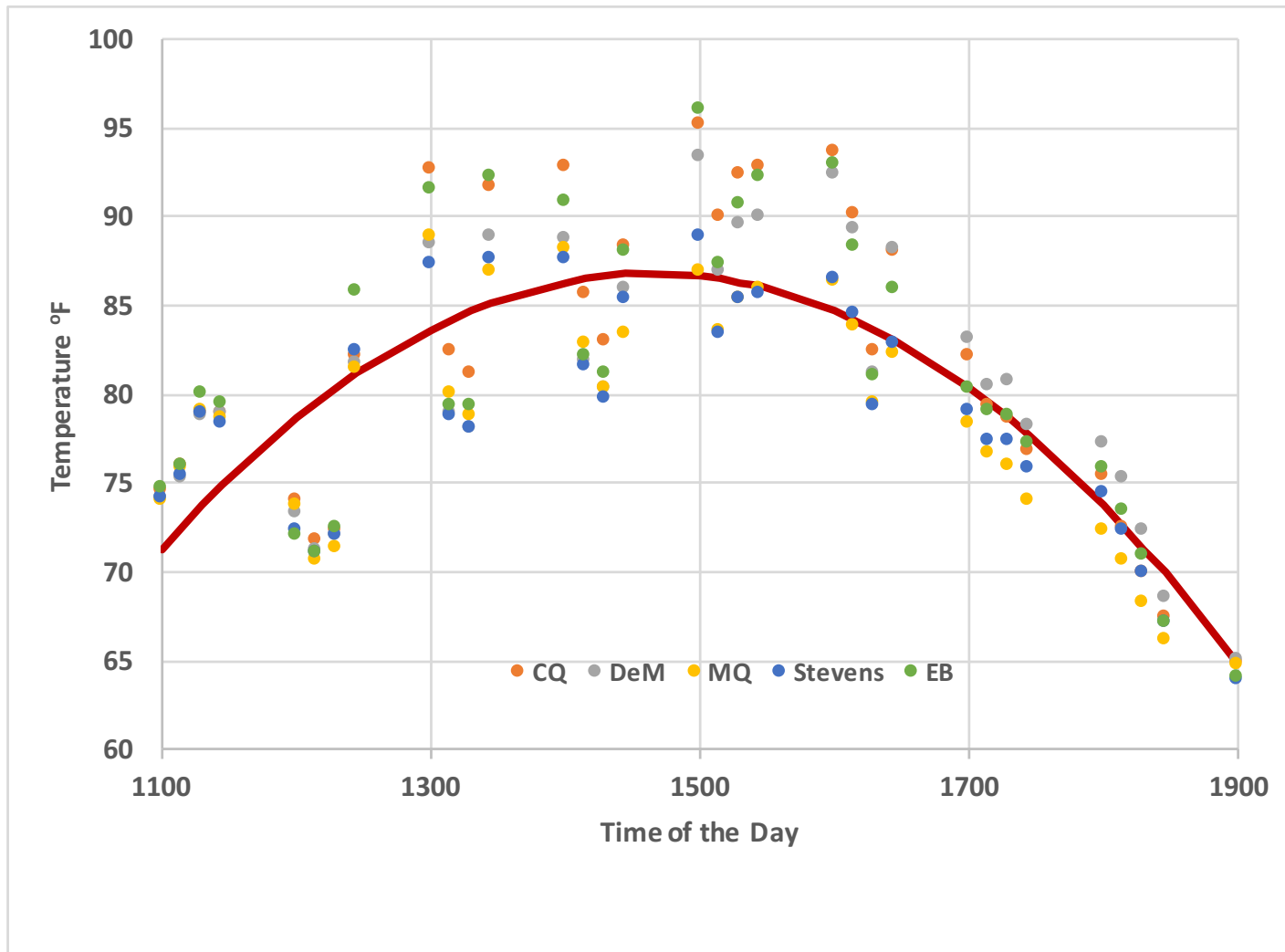
Mullica Queen



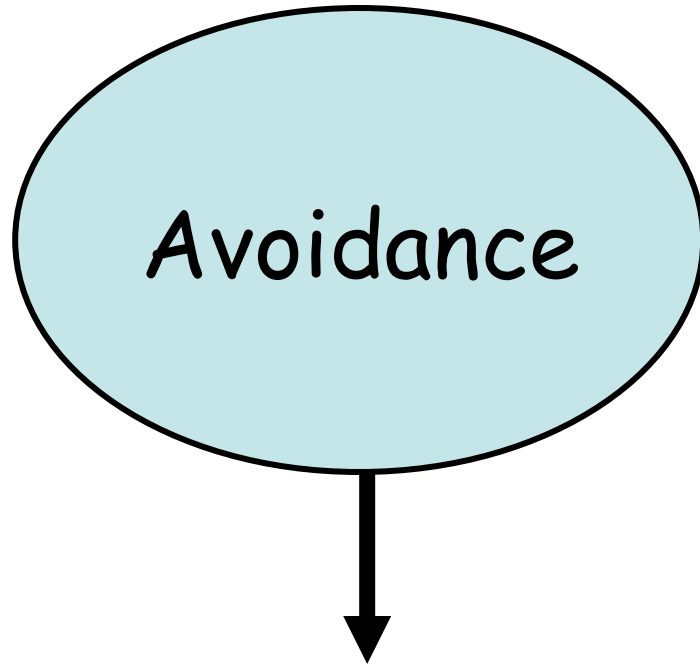
Stevens



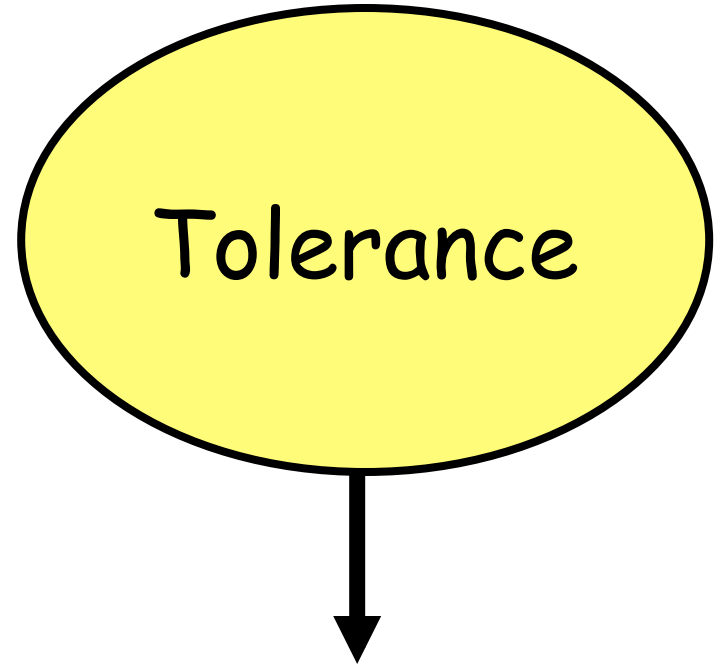
Berry Temperature on Sept-11-2016



Heat stress mechanisms



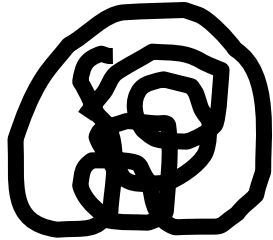
- Morphological changes
- Transpirational cooling



Mechanisms that help prevent cellular injury at high temp.

Heat Shock Proteins (HSP)

Normal protein



Heat

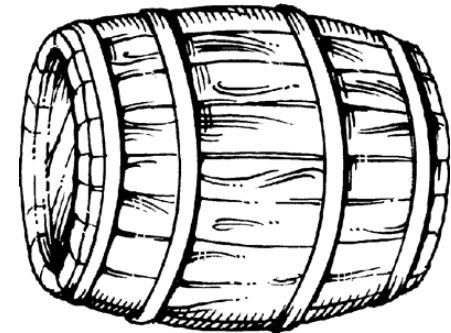


Denatured protein



Refolded protein

HSP



Summary

1. The grower practice of supplying 25 mm of water a week resulted in an average tension of < -2 kPa and VW of $> 25\%$.
2. Fruit rot was reduced in beds managed using tensiometer as trigger for irrigation (~ -5 kPa).
3. Fruit yield increased in all cultivars as beds were kept drier and optimum yields were obtained at tensions > -5 kPa.
4. Volumetric water sensors could be used in place of tensiometers within acceptable accuracy.



Acknowledgments

