Integrated Cranberry Crop Management for Wisconsin

Cranberry

Crop Management Newsletter

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This Issue:

Monitoring Cranberry Bed Moisture

Matt Lippert, Wood County

UW-Extension Agriculture Agent

I didn't know when I invited a Quebec group to contribute an article on monitoring soil moisture to the Cranberry Crop Management Newsletter that we would be receiving in some areas over 5" of rain in 24 hours. This on top of a season in Central Wisconsin that has already entered the record books as the wettest summer ever. Well, at least the reservoirs are in good shape! I would advise reserving a bit more time to critically evaluate the information presented in this article, for me at least, the tables take some time to reflect to be able to fully understand.

This article makes the case for stepping up the technique for evaluating cranberry bed moisture. It also suggests that improving drainage in some of our beds can yield real benefits. Further, some beds now installed in deep sands with a lower water table may benefit from products such as geotextile materials that help retain and stabilize soil moisture. How frustrating to have the tools to monitor optimal moisture level without the ability in the marsh to drain adequately to keep the bed on target.

Wisconsin growers participated in this project. I really appreciate this International contribution to the Cranberry Crop Management Newsletter. ❖❖❖

Irrigation Setpoints from Soil and Photosynthesis Measurements in Cranberry

JEAN CARON[1], SIMON BONIN[2] and STEEVE PÉPIN[1]

[1]Centre de recherche en horticulture and Département des sols et de génie agroenvironnement, Université Laval, Québec, (Québec) G1V 0A6

[2]Nature canneberge

Translated and Submitted by

Sébastien Marchand, agr. M.Sc.

Abstract

Irrigation management in cranberry is needed to optimize crop yield and to reduce water use. Irrigation guidelines are lacking though. The objective of this study was therefore to identify appropriate irrigation setpoints for cranberry production in Quebec. Those setpoints were evaluated from 3 different estimates: using soil physical properties, a hydrological model, field experiments and photosynthesis measurements carried out in a growth chamber. All three estimation methods suggested that adequate irrigation setpoints should be maintained in a range of soil water potential between -3.5 to -7 kPa for cranberry production and were consistent with the observed yield- water potential relationship at the field scale.

The Study

The objective of this study was to identify appropriate irrigation setpoints for cranberry production based on soil water potential measurements. The research was based on new technology that is available to monitor

Continued at ***Irrigation Setpoints*** *p. 2*

Atmospheric Nitrogen Fixation to Soil

Justin Olson, UWSP Intern for LADY BUG IPM

The Nitrogen Cycle. Nitrogen accounts for over 78 percent of the atmospheric gas on Earth. But despite its great abundance as a gas, nitrogen is often a limiting factor in cranberry growth. Most of the nitrogen obtained by cranberries is in the form of commercial fertilizers such as ammonium sulfate. Nitrogen is essential to plant growth but cannot be obtained by plants in the gaseous form. Aside from additions to the soil, nitrogen is converted to plant available forms "fixed" in two different ways. The first is through nitrogen fixing bacteria which convert atmospheric nitrogen (N_2) to compounds that plants can use. And the second natural nitrogen source is by lightning.

How Lightning Fixes Nitrogen. When lightning strikes in the atmosphere, gaseous nitrogen (N_2) is converted to an oxidized form (2NO). It then combines with oxygen to form nitrogen dioxide (2 NO_2). This form of nitrogen easily dissolves in rainwater and falls to the ground as nitric acid (HNO_3). It then reacts with soil to form nitrates that are readily available for plant uptake. The equations can be seen below in *(Equation 1)*.

Lightning strikes and nitrogen is oxidized.

$N_2 + O_2$ --------------> 2 NO

Combines with oxygen

2 NO + O_2 ------------> $2NO_2$

Dissolves in rainwater

2 NO_2 + H_2O ----------> HNO_3

Reacts with soil

HNO_3 -------------> H^+ + NO_3^- (**nitrate**)

Equation 1

Is This a Significant Source of Nitrogen to Cranberries? Quantifying the amount of nitrogen fixed by lightning has proven to be a challenge to scientists and there are still differences in theories. One estimate is that about 4 percent of the total nitrogen fixed to the soil is caused by lightning. While this number represents only a small fraction, it should not be disregarded. There have been many questions this growing season as to if the large amounts of storms have been a contributing factor to any excessive vine growth. Certain growers have reported using less nitrogen while yield potentials are higher than average. There is no doubt that this process of nitrogen fixation is happening, but there are some things that refute lightning as the main cause for the lush growth. One is that with many storms comes lots of rain and nitrates are very easily leached out of soil; especially sandy soil. The second reason is that while cranberries can utilize nitrogen in the form of nitrates, they prefer ammonia as a nitrogen source.

A more conceivable reason for the lush growth that growers have been experiencing is that this summer has brought warm temperatures with plenty of precipitation. These created the Ideal growing conditions for cranberries. Growing degree days were well ahead of the average for the entire state. No matter where your nitrogen comes from, it is always a good idea to perform routine soil and tissue tests to be exactly sure what your plants need. ❖❖❖

IRRIGATION SETPOINTS *continued from p. 1*

real time soil water potential data: wireless tensiometer from Hortau. The tensiometer measures are based on soil water potential, which is more sensitive to monitor cranberry water needs than soil water content because of the physical properties of sandy soils used to grow cranberry (a flat water desorption curve). Since few references exist relating for recommended soil water potential for cranberry (3 out of 70 years), there was a need to establish norms for cranberry production.

Results

With unsaturated hydraulic conductivity and water desorption data, an ideal -3.5 to -7.5 kPa range was identified (Figure 1). Also, a minimum value of -8 kPa was determined from a hydrological model combined with field estimation of evapotranspiration (data not shown).

Growth chamber experiments confirmed that the ideal range was in the -3.5 to -8 kPa, range limited at its upper boundary by aeration constraints and at the lower boundary by a low unsaturated hydraulic conductivity (Figure 2).

Yield data (Figure 3) showed the same trend as photosynthesis in growth cabinets experiments and were consistent with soil characteristics of Figure 1 (the blueline and first red line) and the model of (second red line) for setpoints estimation. The field experimental data were collected from 17 different commercial growers in Wisconsin and Québec in 2004 and 2006. *Continued next page at **Irrigation Setpoints***

*Continued from **Irrigation Setpoints** from previous page.*

Conclusions

The conclusions of this study are that irrigation set points seem to oscillate between -3 and -8 kPa during the production period for cranberry in coarse and fine soils. Prior literature was suggesting -2 to -4 kPa, which seems too wet. Those norms are now in use by growers.

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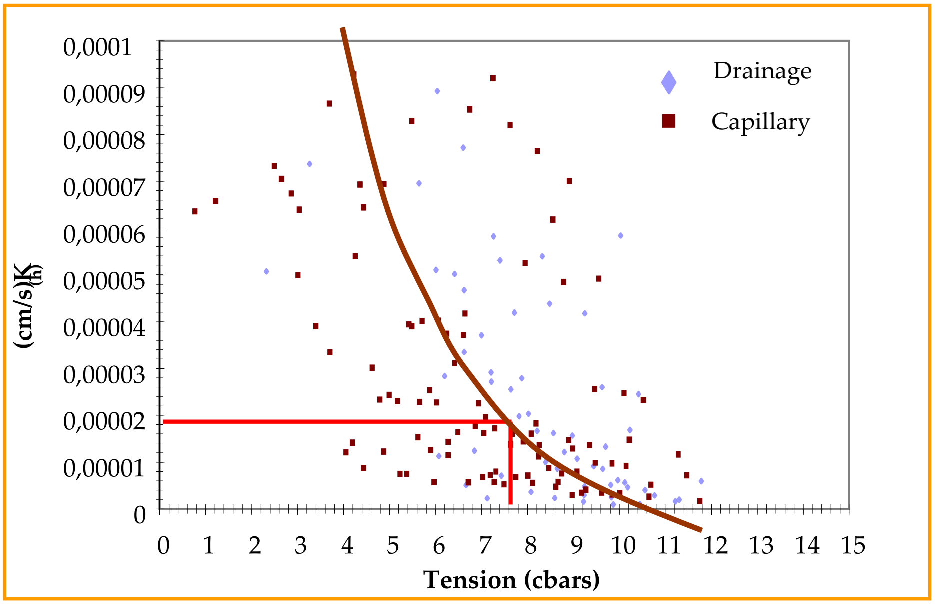

Figure 1. **Unsaturated hydraulic conductivity (Kh) of 63 different soils profiles. This indicates that at about a tension on 7.5 kPa (a water potential of -7.5 kPa), the speed of water movement in the soil is just fast enough to compensate for the cranberry evapotraspiration, illustrated by the horizontal red line. If the tension increases, the speed of water movement drop below 0.00002 cm s^{-1}, which may generate stress for the plant.**

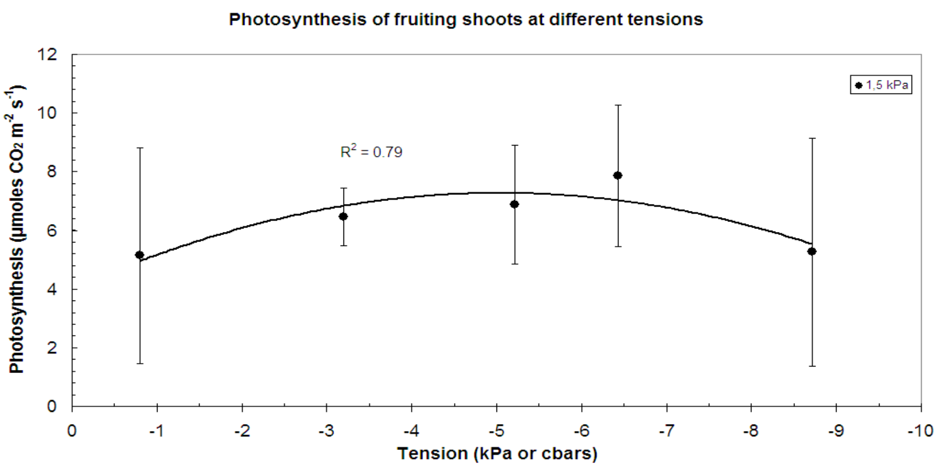

Figure 2. **Photosynthesis-soil water potential relationship in the growth cabinet experiment**

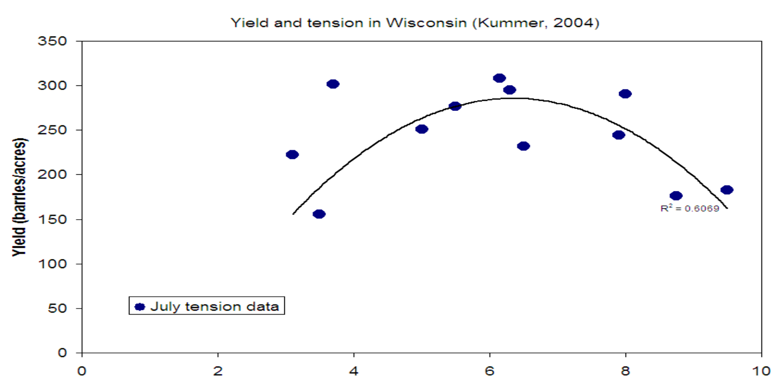

Figure 3. **Yield-soil water potential relationship in the field in Wisconsin**

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Wood County UW-Extension
400 Market Street, Courthouse
PO Box 8095
Wisconsin Rapids, WI 54495-8095

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UW-Extension Cranberry Specialists

Jed Colquhoun
UW-Extension Fruit Crops Weed Scientist
1575 Linden Drive
Madison, WI 53706
(608) 890-0980
jed.colquhoun@ces.uwex.edu

Rebecca Harbut
UW-Extension Fruit Crops Specialist
297 Horticulture; 1575 Linden Drive
Madison, WI 53706
(608) 262-6452
rebecca.harbut@ces.uwex.edu

Patty McManus
UW-Extension Fruit Crops Specialist
319B Russell Labs; 1630 Linden Drive
Madison, WI 53706
(608) 265-2047
patty.mcmanus@ces.uwex.edu

Matthew Lippert, Agricultural Agent
Wood County Courthouse
400 Market Street; P. O. Box 8095
Wisconsin Rapids, WI 54495-8095
(715) 421-8440
matthew.lippert@ces.uwex.edu

Brent McCown
UW-Madison Cranberry Plant Breeder
393 Horticulture; 1575 Linden Drive
Madison, WI 53706
608) 262-5201
bhmccown@wisc.edu