CRANBERRY CROP MANAGEMENT JOURNAL
DIVISION OF EXTENSION
Volume 34 • Issue 5 UNIVERSITY OF WISCONSIN-MADISON July 21, 2021

Reviewing Critical Cranberry Irrigation Thresholds

By Allison Jonjak

Dr. Amaya Atucha's presentation at July's Virtual Cranberry Brown Bag [https://fruit.wisc.edu/webinars/cranberry/] addressed soil water content and irrigation information during cranberry fruit set, development, and ripening. She referenced research done at Laval University and published in 2016 and 2017 as the source for many of her observations, and I promised to review those papers to reacquaint growers with their results.

As we dive in, the researchers note that their research has been done on beds with 6 to 15" of sand over an impenetrable layer. The critical growth stages apply to all cranberries regardless of bed construction, but those with deep sand or those with peat beds should monitor and use judgement before adapting the exact kPa tensiometer cutoffs to their beds.

Cranberries, like all vascular plants, have an optimum range of soil water potential under which they grow best and produce highest yields. In beds similar to those tested by [1], [2], [4], and [5], the overall "wettest" soil that still lets cranberries flourish is -4 kPa. The overall "driest" soil that still lets cranberries flourish is -7 kPa. This is a narrow range! Cranberries can survive conditions wetter than -4 kPa or drier than -7 kPa, but they will not produce top yields.

Too Wet

Cranberries can tolerate too-wet conditions more or less successfully, depending on growth stage. Experimental results show bud elongation and bud set are especially vulnerable to lowered yield from too much moisture. Our understanding of the vines' nutrient and carbohydrate demands during these stages lines up with these experimental results.

In [4], Pelletier et al. put cranberries in a growth chamber, and saturated the root zone of different plants during 3 different growth stages. They measured photosynthesis directly, and found that bud elongation is when plants suffered most, and most quickly, from lack of oxygen in the root zone. During bud elongation, just 1 day of soil saturation decreased photosynthesis 28% (compared with the unsaturated control). After 5 days of saturation, photosynthesis was down 46%. During flowering, photosynthesis gradually slowed when the root zone was saturated, but was only significantly lower than the control by the 5th day of saturation. During fruit development (2 weeks after fruit set), photosynthesis was not significantly different from the control, even after 5 days of saturation. While this study looked at photosynthesis instead of yield because photosynthesis is more direct, it's a pretty safe bet that the vines which were only photosynthesizing half as well as their neighbors will have lower yield, and so growers should take to keep the water table low, especially during bud

elongation.

The other period to keep a sharp eye on drainage and maintain the water table well below the root zone, is during bud formation. In [5], Pelletier et al. measured yield directly, as well as fruiting uprights per area and marketable berries per area. Across 2 years, regions of 3 production fields were maintained all summer using “wet”, “control”, and “dry” watering triggers, as measured with tensiometers. (“Control” was the grower’s usual method, as these growers were all experienced at timing their irrigation based on tensiometer measurements.) 2012 was a wet year, and so the researchers returned to the treatment sites in 2013 to check fruiting uprights per area. The control treatments had 60 fruiting uprights per area the following year, the dry treatments had 57 fruiting uprights per area—but the wet treatments had 38 fruiting uprights per area. Bud initiation seems to drop off when roots are too wet, so make sure roots are well drained as next year’s buds begin to form.

Too Dry

Cranberry vines suffer in predictable ways from being too dry: reduced fruit set [5], heat stress [1], wilting [5], and salt accumulation [1].

Fruit set is when the cranberry upright decides how many berries it can support through harvest. If the plant is stressed by insufficient water during this stage, we measure fewer berries per upright, fewer berries per flower, and fewer berries per area, than in unstressed vines. Monitoring soil water content during fruit set and not letting it become drier than -7kPa will encourage high fruit set.

Heat stress hurts fruit development (yield and quality) when the canopy temperature reaches 90°F and higher. Pelletier [2] recommends turning on irrigation for 20 minutes when canopy temperatures reach this threshold. This irrigation is to cool the leaves, not to recharge the soil water profile, so there is no need to run for longer durations.

During dry periods or when the water table is held too low (below 24”, as measured [1]), capillary rise may slow or stop providing moisture to be taken up by roots. If needed, water table rise or overhead irrigation can be used to recharge capillary action. Capillary action may sometimes be too slow to provide the 2.5mm to 7.5mm of water needed each day to support evapotranspiration--when soil tensiometers read -7kPa (in 6-15” sand), water should be provided to cranberries to prevent wilting.

For those who use subsurface irrigation, it is important to watch salinity levels. Salts from fertilizer applications can wick up in the soil during irrigation, and affect vine development and yield under salty conditions. If you use subsurface irrigation and salt concentrations are increasing in your beds, use sprinkler irrigation to flush the salts lower.

One final note: when Pelletier measured berry weight, the result was U-shaped: overwatering results in smaller berries, AND underwatering results in smaller berries. Berry size is maximized when soil water is kept in the ‘sweet spot’ of -4 to -7 kPa, making tensiometers pay for themselves in 5 to 20 months (depending on farm size and market price) [4].

[1] Guidelines of irrigation and drainage management strategies to enhance cranberry production and optimize water use in North America. Caron, et al. 2017.
[2] Critical irrigation threshold and cranberry yield components. V. Pelletier et al. 2016.
[3] Payback period in cranberry associated with a wireless irrigation technology. Jabet et al. 2016. https://cdnsciencepub.com/doi/10.1139/CJSS-2016-0011
[4] Cranberry Gas Exchange under Short-term Hypoxic Soil Conditions. Pelletier et al. 2016. https://www.hortau.com/wp-content/uploads/2021/02/17.-Cranberry-Gas-Exchange-under-Short-term-Hypoxic-Soil-Conditions-.pdf

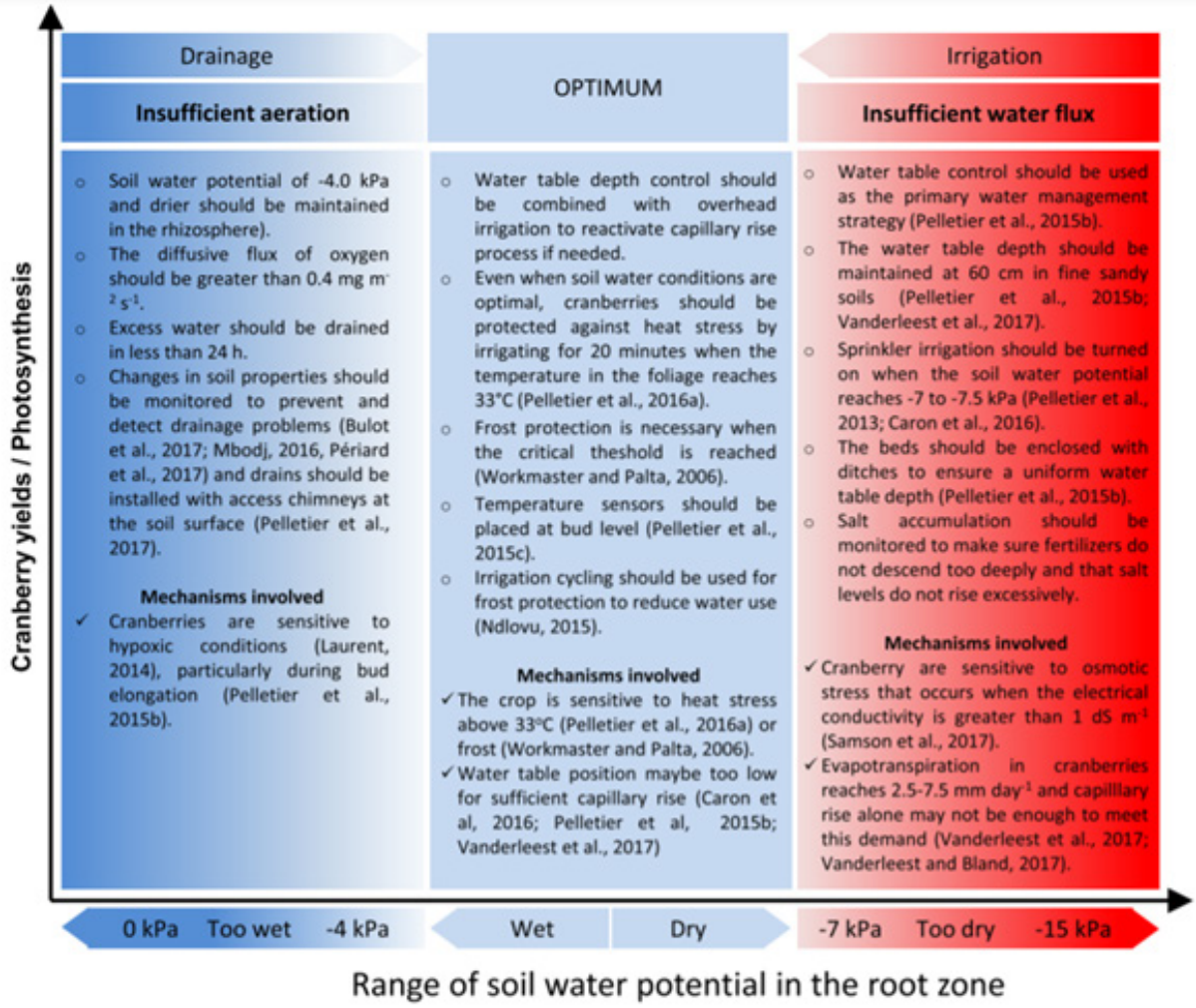


Fig 1. From [1], the risks that too-wet and too-dry conditions can present to cranberry yield.

Fig. 2. Some of the information missing in the literature on the possible effects of the maintained soil water potential range on cranberry yield response.

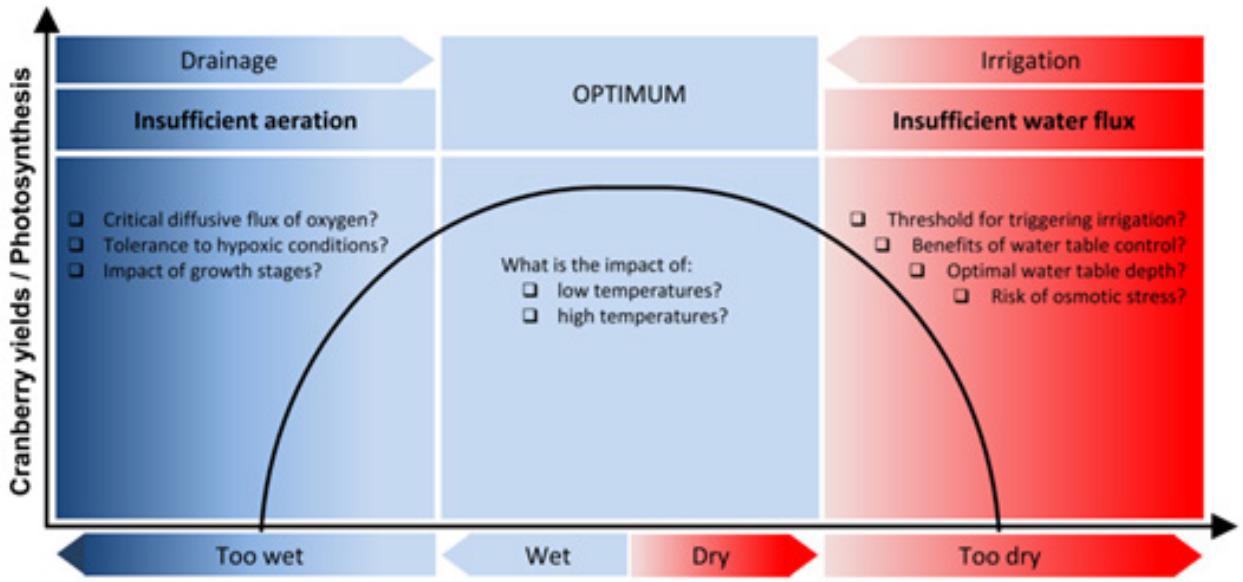
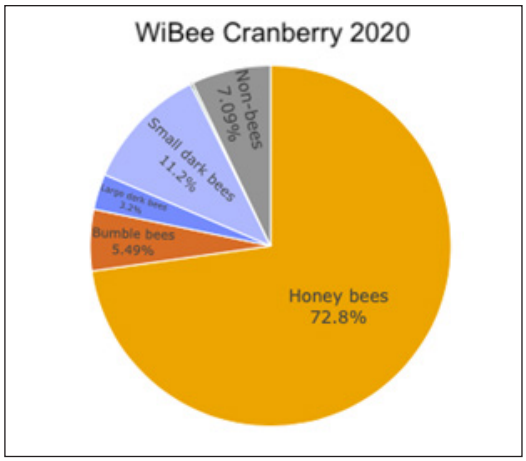


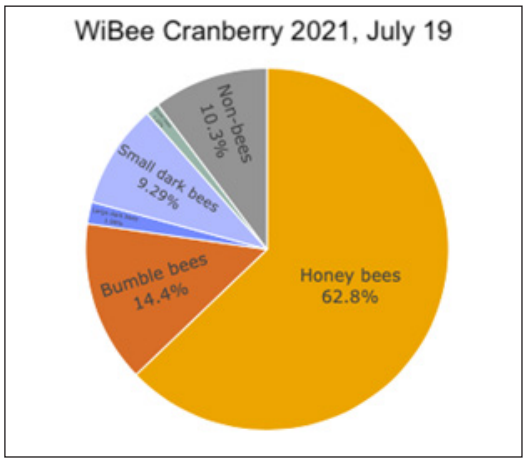
Fig 2. From [1]: Areas in which continued research is necessary. Dr. Atucha's lab is devoting work in 2021 and future seasons to the growth stages and plant needs, nutrient-related needs, during each stage of fruit development, and will share results as they become available.

WiBee Cranberry 2021 Surveys: Preliminary Numbers

By Colleen Satyshur

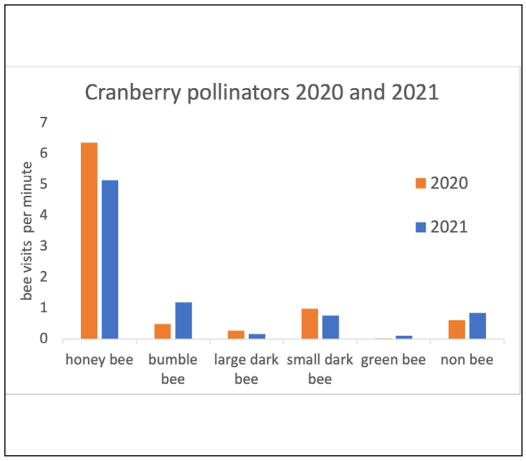
Thank you very much to everyone who sent in surveys this year. We had a slow start, and we heard reports that pollinators were also slow to start this year between the heat, cold and rain. But a number of people chipped as the season went along and we received a good number of surveys. At the time of writing this note, cranberries are pretty much done blooming in central Wisconsin, though people up north may still send in a few more surveys. As of July 19th, a total of 49 surveys have been submitted by 11 participants on 14 different days, and recorded 1,802 bee visits. For comparison purposes, last year there were 16 participants who submitted 78 surveys over 21 days, recording a total of 3016 bee visits. Last year cranberries were probably our best represented crop on WiBee and we are happy to have data again this year because we can more clearly see what influences bee visitation rates if we can account for their natural variability both place to place and year to year.





A first look at the pollinator visits shows roughly similar proportions of pollinator groups between years, with a higher proportion of bumble bee visits recorded this year. Even green bees showed up in 2021.

We can also look at how often pollinators visited cranberries by calculating visits per minute. Here we see that the values are also similar between years, with more than double the rate of bumble bee visits and slightly lower rate of honey bee visits this year. Bumble bees and Small Dark bees are the most frequent wild bees that people are seeing on cranberry flowers. There are 20 species of Bumble bees in Wisconsin and over 100 species of Small Dark bees.



Last year, when the project team ran some spatial analysis, there was some evidence that the landscape surrounding cranberry marshes might be tied to bee visits. Floral resources in the landscape can influence pollinator health. Below shows the locations of 2021 WiBee cranberry surveys, which overlap with last year's data. This is going to be really helpful for analysis. We are looking forward to digging into the statistics, likely once flowers and bees slow down a bit in the fall. We will post updates on the WiBee website: https://pollinators.wisc.edu/wibee/

Thank you again to all our participants. We hope you will think of us next year. We want to make WiBee useful to you. If you participated and have ideas that would make the survey process smoother for you, or if there are things you would like to see result from the app, we'd like to hear from you at pollinatos@wisc.edu

Red-Headed Flea Beetle Showing Up at Marshes

By Christelle Guédot

Red-headed flea beetle (aka cranberry flea beetle; Systena frontalis) adults (Fig 1) started showing up at some marshes in the second week of July. It is important at this time to monitor adult populations and to watch for extensive feeding injury. Feeding injury may be more cosmetic than detrimental to the cranberry plants in many cases.

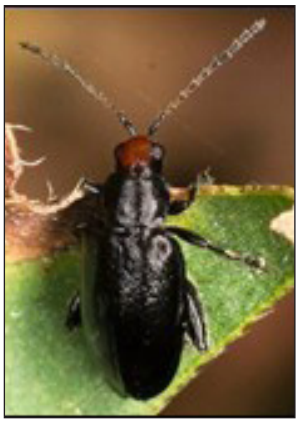


Fig 1. Red-headed flea beetle adult. Photo by Shannon Schade

Damage symptoms. Adults feed on foliage (Fig. 2) and occasionally on the surface of cranberry fruit. Severe adult infestations can lead to skeletonization of leaves (i.e., loss of the tissue between veins) and death of uprights. Heavy feeding by adults can also impact bud development, leading to yield reductions the year following an infestation. Adult populations and damage are usually patchy. Larvae feed on cranberry roots and underground runners. When infestations are severe, larval feeding can lead to girdled roots and vine death.

Fig 2. Red-headed flea beetle feeding injury. Photo by Tim Dittl.

Life cycle. In Wisconsin, females deposit single eggs into the soil in late summer through early fall, and the eggs serve as the overwintering stage of the insect. In the spring, the eggs hatch, and larvae feed on roots from June through August. Larvae eventually pupate and adults begin to emerge in July and are present through September. In Wisconsin, red-headed flea beetle has one generation per year.

Monitor by using a sweep net to capture adults. Be sure to sample thoroughly across different areas within a cranberry bed to account for the patchy distribution of adults. There is no established action threshold for flea beetle in cranberry. However, the University of Maine Extension recommends taking action if you find more than 15 adults per 25 sweeps in a cranberry bed.

Management. At this time, biological control using entomopathogenic nematodes to target flea beetle larvae in the soil is the most promising strategy and is being evaluated by Shawn Steffan's lab and grower collaborators.

If scouting indicates significant numbers of flea beetle adults, you may consider using insecticides to control them. Products that are effective against flea beetle adults include neonicotinoids (e.g., thiamethoxam, acetamiprid, dinotefuran), diamides (e.g., chlorantraniliprole, cyantraniliprole), spinosyns (e.g., spinetoram), organophosphates (e.g., chlorpyrifos, phosmet, diazinon) and carbamates (e.g., carbaryl).

In organic production, our insecticide trials suggested that Azera which contains the active ingredient azaditechtin and pyrethrins had good efficacy at reducing

Product Name	Efficacy
Actara	+++
Assail	++
Venom	+++
Lorsban, Orthene	++
Diazinon, Imidan	+++
Sevin	++
Altacor, Exirel	+
Delegate	+
Azera (OMRI)	++

Table 1. Efficacy of common products. +++: high efficacy; ++ good efficacy; + moderate efficacy.

flea beetle adult populations. Refer to table 1 for more information on the efficacy of commonly-used products in cranberry. When using insecticides, it is important to rotate active ingredients from different chemical classes, which have different modes of action and thus different IRAC codes, to help delay the development of insecticide resistance. Please be sure to read the labels and to check with your handlers before using any pesticide.

Happy growing season!

Exploring Soil Health in Cranberries

By Allison Jonjak

When mankind began farming, soil physics was the most observable realm, and so soil physics was where we first developed a coherent theory. In the last few centuries, our analysis and measurement techniques allowed us to understand soil chemistry—the nutrients present and available for our crops. From first being able to measure soil nutrients, to establishing baseline expectations for common soils, to finally understanding what nutrient application choices should be made based on our measurements, took many decades of iteration and exploration.

As biological science matures, we stand on the frontier of understanding soil biology. A rich ecosystem of plants, animals, protists, nematodes, fungi, and more live in the soil that supports our cranberries—and we are beginning to be able to measure them. As we begin to learn what lives in our soils, it is likely we'll be able to have as many new "levers to pull" to improve cranberry production, as we discovered through our exploration of soil chemistry and plant nutrition.

Part of Extension work is collaborating with partners to find expertise and funding to explore interesting topics. Together with Jamie Patton and Francisco Arriaga (of UW-Madison Division of Extension) and Andy Paolucci (of NRCS), I applied for and was awarded a SARE Mini-Grant for 2021. Provided by the Sustainable Agriculture Research and Education program, we received just over $2000—enough to conduct a preliminary study. For 2021 we will begin to explore soil health and soil biology in 5 production cranberry marshes.

Because this is an exploratory project, we are comparing a "healthy" and a "poor" bed of similar treatment in each of our partner marshes. For example, a Wood County marsh will be comparing two HyRed beds, two beds apart, which were planted within a year of each other—but one bed always has >50 barrel/ac higher yields than the other.

Our protocol will take a composite sample from the bed edge and a composite sample from the bed center of the "healthy" bed, and a composite sample from the edge and a composite sample from the center of the "poor" bed. Each of these samples will receive a battery of tests: the standard chemical analysis that growers use for their NMPs, as well as several "soil health tests" that have been developed over the last decade: cellulose decomposition, microbial respiration ("what is breathing in this soil?"), active carbon, potentially mineralized nitrogen and PLFA (phospholipid fatty acid) analysis ("what has cell walls in this soil?"), and others which will be provided by the UW Sustainable Soil Management Lab.

We are hoping to see whether there will be patterns or commonalities from each partner marsh's "healthy" bed samples in contrast with their "poor" bed samples. For 2021, we are working with sandy marshes in Tomah, Cranmoor, City Point, Exeland, and Manitowish Waters. If we find correlations, next year we might expand to do more marshes, or we might broaden our methodology to test peat

marshes as well. In return for participating, these 5 marshes will receive all of the test results for their marshes, and the whole industry will be able to learn from these pilot tests.

Stay tuned this fall for our results!

Update from the Wisconsin Cranberry Research Station

By Wade Brockman

The warm sunny days have really sized the fruit here at the station. I was fortunate enough to not get all the heavy rain a lot of growers received. Hard to believe we are still 2 months from harvest!

Grower Updates

Central Wisconsin

By Pam Verhulst

Sparganothsis fruitworm are webbing and cranberry fruitworm are moving into their 2nd and 3rd berries. We started sweeping flea beetle last week (7/12), and this week (7/19) we had over 50 in a series. Really pay attention to pre-harvest intervals and additional market restrictions when battling these pests!

Fruit is setting and we can see a bud for 2022.

Cranberry Lake

By Karl Pippenger

Most growers have applied the first fruitworm shot and are likely applying a second one this week if needed. Flea beetle hatch began last week in weedy areas and trouble spots, numbers will likely increase this week as hatch spreads into the vines. Growing conditions have been favorable. The warm summer has caused nitrogen release on peat marshes resulting in slightly less need for added applications. Berries are generally fingernail size on most varieties. I recommend pushing the vines with nitrogen until they start to turn red on the upper leaf edges, especially if the berries are still sizing. Growers who fertilized early may have rank vines already, meaning there is less tolerance for nitrogen application. Buds are beginning to set.