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# A New Chapter in Breeding and Genetics Underway at the Wisconsin Cranberry Research Station

***By Juan Zalapa, Eric Wiesman, and Fernando De la Torre***

Over the last two growing seasons, we have worked diligently to develop hundreds of new cranberry research plots at the Wisconsin Cranberry Research Station in Black River Falls, WI. The newly developed cranberry research bed consists of 4x4 plots from available cultivars, wild collections, populations for trait mapping and breeding, and selected selfing and hybrid crosses.

The research bed will allow us to study and breed enhanced cultivars for a variety of productivity and quality traits, including color, Brix, acid accumulation, size, firmness, and many other traits. Despite the restrictions brought on by the 2020 pandemic, we were able to plant 2,970 seedlings in June 2020, consisting of 2,445 genetically unique experimental plants and 525 'Stevens' controls. In total between 2019 and 2020, we planted 3,630 genotypes, including 2,933 genetically unique experimental plants and 697 'Stevens' controls.

The 697 controls were planted randomly dispersed across the research bed and will help us account for variation in the field. We will use the control data to make valid comparisons between the newly developed cranberry plants and the control variety, which is the commercial standard. As additional control specimens, we also planted 32 other commercially grown cranberry cultivars that were confirmed to be genetically pure or which were identified as desirable genotypes by grower consensus. Like the randomly dispersed 'Stevens' plants, these 32 cultivars will allow us to compare the trait and adaptation performance of known commercial cultivars to each other and against any new plant in the trial. Based on this initial effort, we plan to develop another highly replicated cultivar trial for further testing of environmental effects in cultivar performance.

Of particular interest within the research bed is a collection of nearly 100 previously untested wild cranberry plants collected across 36 sites in Minnesota, Wisconsin, and Michigan, where wild populations have not been rigorously tested for natural valuable variation. We believe that testing these plants at the station will result in the discovery of some interesting adaptations and other traits in these wild accessions that could be useful for the industry.

In the past, our lab has studied and mapped traits using elite breeding populations. However, such populations are not always desirable for trait mapping studies since they are much less variable, which undermines the discovery of trait-gene associations. Therefore, in collaboration with Nick Vorsa at Rutgers University, we planted at the station two different mapping populations consisting of 488 individuals, which segregate widely for fruit productivity and quality traits. We will use these two populations to continue to refine our trait mapping efforts.

Finally, we planted hundreds of self-crosses of multiple cultivars. Although most cranberry cultivars are developed in a hybrid-breeding system, cranberry is a clonal crop and therefore an obligate selfer (self-pollinated) in the field. For this reason, our experimental bed will enable our research to determine if certain genotypes have a greater ability to self-pollinate. We will also be observing how self-crosses perform and if selfing causes any negative effect such as lower yield within monocultures of certain cultivars. Furthermore, based on preliminary information, self-crosses may be an attractive breeding method that will allow us to purge weak seedlings with deleterious genes while selecting vigorous seedlings with advantageous gene combinations. Ultimately, the best self-seedlings will be crossbred to develop hybrids with enhanced selfing ability and other characteristics or traits.

Lastly, in an effort to preserve and use the DuBay cranberry collection, we isolated 56 genetically distinct plants from the collection, and planted them at the station along with many hybrid crosses among these DuBay genotypes and with other available cranberry cultivars.

We are enthusiastic and confident that these newly stablished plots at the Wisconsin Cranberry Research Station will result in new knowledge and the development of enhanced cultivars for the Industry -- turning a new page in breeding and genetics at the Wisconsin Cranberry Research Station.

# Guidelines on How To Estimate Yield in Beds

***By Pedro Rojas Barros and Amaya Atucha***

Early and accurate yield estimation is a very useful information for grower to adapt management decisions and inputs (i.e., fertilizer, herbicides, fungicides, etc) based on potential yield. However, precise early yield estimation is challenging in cranberry because there is high variability in fruit production within a bed, but also because a percentage of newly set fruit will stop growing during the weeks after fruit set and will not develop into full berries. Yet, for many of our research project we need to estimate yield early in the growing season and we have tested different ways to do so through the years. In this article we want to present some of the ways we estimate yield in our studies hoping that they can be useful for growers to adopt for their own estimations.

***Figure 1: Sample size of 0.5 ft2 where all fruits were collected and counted for yield estimation.***

During the last 3 years, I have worked on the nitrogen fall fertilization project and have acquired significant experience estimating yield. This particular study was established in 3 'HyRed' beds (~1000 x 150 ft), and to estimate yield I collected all the fruits in a 0.5 ft2 sample area (Fig. 1) starting about 4 to 5 weeks after full bloom. I collect six 0.5 ft2 samples per bed, two in the first 1/3 of the bed, two in the middle, and two in the last 1/3 of the bed. The advantage of taking two 0.5 ft2 samples in each section of the bed rather than one 1 ft2 sample, is that the more samples you collect the better yield estimation you get, as you account for more variability within the bed. However, avoid taking samples from the bed's edges, or spots with excessive presence of weeds, pest damage, and poor or excessive growth, as those are probably not representative of the entire bed.

The next step consists on counting the total number of fruits per sample (Fig. 2). At this point in the growing season, you can already distinguish between the fruits that will develop into a full berry and those smaller ones that will not continue to develop (Fig. 3). For the purpose of estimating yield, we do not count those smaller fruits that will not grow into full berries. The next step is to multiply the

***Figures 2 (left): All fruits collected in a 0.5 ft2 area for yield estimation.***

***Figure 3 (right): Cranberry upright with well developed berries in the basal positions and smaller berries in the top position that will not develop into full berries before harvest.***

number of fruits in each sample by the average final fruit size, and here you have two option, 1) if you have a historical average berry size for certain cultivars in your marsh you can use that, or 2) you can use the average berry size in Table 1.

For the fall nitrogen fertilization study, the average berry size of the 'HyRed' beds in my research plots ranged between 1.2 to 1.58 grams, so to be conservative with my yield estimation I used 1.2 grams per fruit (0.0026 lb.) and multiply by the average number of fruits from the 6 samples I had collected (165 fruits per 0.5 ft2 or 330 fruits/ft2). By multiplying 330 fruits/ft2 by 43,560 ft2 (1 acre) by 0.0026 lb., I estimated approximately 374 barrels/acre.

Another alternative to estimate yield is to use the total number of uprights per 1 ft2 area. This will provide us not only information about fruit production, but an overall view of how much vegetative growth the bed has at the time. The first step is to collect all the uprights in a 1 ft2 area (Fig. 4), and for this I used the same criteria as for the fruit sampling (see above) and collected 3 samples per bed. Then I sorted each sample into vegetative uprights (no fruit) and fruiting uprights (with fruit). For example, in most of the samples from my study about 68% of the uprights were vegetative and only 32% were fruiting. Now, to estimate yield based on the number of fruiting uprights I assumed that each fruiting uprights would produce 2 berries, which can be conservative for some cultivars that produce more than 2 berries per upright but is about right for older cultivars such as Stevens. Now, if we consider the total number of fruiting uprights in my sample (~170) and multiply by 2 (the average number of fruits per upright), and then you multiply this by the average berry weight (0.0026 lb) and by 43,560 ft2 (1 acre), the yield estimation is approximately 386 barrels/acre,

***Figure 4: Sample size of 1 ft2 where all uprights were collected, and the total number of fruiting were counted for yield estimation.***

which is comparable with the yield estimation obtained by counting berries.

Both methodologies yielded similar results and you can use either one of them. Maybe one advantage of using the fruiting upright number versus the number of fruits is that you can estimate yield earlier in the growing season because you are not counting developing fruits. However, the most accurate estimation will always result from counting fruits as close to harvest as possible.

***Table 1. Reference table for average berry weight in selected cultivars (oz and g).***

| Cultivar | Average berry weight (oz) | Average berry weight (g) |
|---|---|---|
| Stevens | 0.072 | 2.04 |
| Pilgrims | 0.058 | 1.64 |
| Mullica Queen | 0.074 | 2.1 |
| Crimson Queen | 0.053 | 1.5 |
| Sundance | 0.067 | 1.9 |
| Ruby Star | 0.053 | 1.5 |
| HyRed | 0.058 | 1.6 |

# Update from the Wisconsin Cranberry Research Station

***By Wade Brockman***

This year's new plantings really took off with the great weather we had. Hopefully we get another five weeks of good growing conditions.

# What About Those Late-Season Grasses?

***By Jed Colquhoun***

The dog days of summer have arrived, accompanied by several grower questions about late-season grass weeds poking through the cranberry canopy. Here are a couple of the most common questions, with answers and explanations based on grass biology and how the herbicides work.

***Foxtail Barley***

***I have grasses that appear to be starting to produce seed. Can I use one of the post-emergent grass herbicides like clethodim (example trade name: Select Max) or sethoxydim (example trade name: Poast) to kill the grass now?***

Short answer: in addition to considering the pre-harvest intervals for these products, it's not likely at all that satisfactory control would be achieved. These herbicides only control actively growing grasses at the growth stages indicated on the labels.

Explanation: The post-emergent grass control herbicides work by inhibiting an enzyme that's involved in producing lipids. These lipids are critical components in cell division and therefore plant growth. So, if the plant isn't actively growing or has reached maturity, the lipid "factory" is also shutting down and there isn't an active enzyme to block.

***I applied one of these post-emergent grass herbicides (such as the clethodim or sethoxydim mentioned above) earlier in the season and the grass appears to have stopped growing but is still there. Is it dead?***

Short answer: find the newest (youngest) grass leaves and give them a tug. If they're still tightly attached to a green grass, the plant is likely still alive. If the newest leaves easily pull out of the plant and the base of that new leaf is brown and decomposing, the plant is at least severely injured if not dead. The rest of the plant often remains green but without new growth for several weeks after application.

Explanation: Remember that the herbicide works at the active growing point, which on grasses is protected within the sheath of the newest leaves. So, while the upper portions of the youngest leaves may still look green, cell division and new growth happens at the base of the leaf, and therefore that's where the injury is first visible.

# It’s Tissue Sampling Season!

***By Allison Jonjak***

It’s that time again—when our dynamic, responsive cranberry plants are finally doing the same thing for an entire month. Throughout the growing season, cranberries are moving nutrients and carbohydrates throughout the plant—nutrients from roots to stems of leaves; carbohydrates from the production sites down to the roots—to fulfill the plant’s growth, bud set, fruit set, and recovery needs. The period between mid-August and mid-September, when plants are focusing all their energy on filling fruit, is the only month-long period in the growing season that we can expect nutrient concentrations in the plant to be the same from one week to the next.

So (for those on an annual testing regimen,) now is the time to take our tissue samples. This allows us to compare our results year-on-year to see long term trends in sufficiency or insufficiency of particular nutrients in our plant tissue.  You know the drill (see source 2): walk a diagonal path across a bed, stopping to collect uprights from 10-12 sites. At each site, choose 5 fruiting and 5 non-fruiting uprights, and clip off only the current year’s growth. Do not include fruit, but do include the stem growth that is new this year. After you have passed through the bed, you should have roughly 1 cup of tissue. Label the bag. Label the soil samples you collected as well (3) and send them off to the lab!

When the lab returns your results, enter them into your spreadsheet or record-keeping system so that you can see long term trends, along with this year’s comparison with the lab-established optimal levels. If you’d like help creating a long-term comparison spreadsheet, reach out to Allison Jonjak, Extension Cranberry Outreach Specialist. Combining your tissue test levels with your first-hand observations, your recent and prior year fertilizer applications, soil test results, and the optimal levels, you can evaluate and improve upon your fertilizer application practices. This can save on input costs by reducing waste, and it can improve your yield and yield stability over time.

We only get the opportunity to make year-on-year comparisons during this important time for our cranberry plants, so let’s make the most of it!

# Grower Updates

## Flying Dollar Cranberry

***By Seth Rice***

We've been busy on the marsh in between dodging hail and applying slight corrections to our fertilizer program. It's been a little crazy. Of course, it always is before harvest.

The mowing crew is at it again. We will not mow too many more times before we harvest. Like everybody else we are watching our berries size up and starting to have a little blush on some of our early varieties.

Stay safe and healthy!

## Gardner Cranberry

***By Willow Eastling***

We are in full harvest prep mode! All of our crews are looking over their berry pumps, tractors, trailers and dump trucks.

A couple marshes are staying busy controlling flea beetle but the majority of the properties are focusing on maintaining the property and irrigating.

In the upcoming days we will be collecting soil and tissue samples as well as continuing to monitor flea beetle levels.

The hail event on 7/7 is showing minimal rot issues and mainly just cosmetic dents to the viable berries.

Hope everyone is healthy and well!