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Too Much of a Good Thing Can Be Bad: Reconsidering Potassium Fertilization in Cranberries

By Amaya Atucha and Allison Jonjak

Potassium (K) is an essential nutrient for plant development and for sustaining high-yield and fruit quality. There are many physiological processes in which K is involved including: assisting in the production of energy molecules (ATP) and maintaining photosynthesis levels; activation of enzymes, facilitates conversion of nitrogen intro amino acids, and improvement of water-use efficiency.

The involvement of K in water movement in plants can impact fruit size since the accumulation of K in cells lead to an increase in water movement inside the cells which in turns increases cell turgor and cell expansion. Adequate K nutrition will result in bigger fruit, but this is not a linear relationship and increasing K fertilization beyond optimum will NOT result in bigger fruit. In fact, excessive K fertilization will result in lower yields and increased fruit rot based on studies done in Wisconsin in the early 90s. In addition, excessive K fertilization will reduce the uptake of Calcium which is a key nutrient for increasing berry firmness and reducing fruit rot.

How to determine K requirements

1. The best tool to determine cranberry vines nutritional status is the tissue analysis. We recommend growers do a tissue analysis every year to track what is happening to the vines overtime and to determine the need for adjustments to the fertilization plan. In the case of K, tissue levels should be between 0.4-0.75%. Higher level of K in tissue analysis do NOT correlate with higher yields, so if your K tissue levels are over 0.75% you are most likely over fertilizing.
2. The next thing to consider when determining how much K fertilizer to use is yield. Higher yielding cultivars will require more K fertilizer because more berries are produced, and higher levels of K are being extracted from the soil. In general, beds that average between 250-350 BBL/ac will require 50-70 lb K/ac while those that have higher yield between 400-600 will require 70 to 150 lb K/ac.
3. Soil K levels will provide additional information to refine K fertilization needs. Soil K levels are not as good of an indicator of the nutritional status of the vines as tissue analysis. If there is higher concentration of K in the soil, the vines will uptake as much as it is available in detriment of taking up Calcium and Magnesium. Soil K availability is higher in soil with adequate moisture compared to soil with low moisture levels.
4. When should you apply K? When there’s the highest demand for it, which is during fruit development. You can use a blended fertilizer with N and P, or if you need additional K to over come a deficiency, potassium sulfate is a good alternative.

The Myth of Potassium as a Promoter of Vine Cold-hardiness and Vine Growth Controller

There is no scientific evidence from any study that has proven that additional K fertilization help vines gain cold hardiness. Vines will acclimate and increase their cold-hardiness levels in the fall as a response to lower ambient temperature and the shortening of photoperiod. Additional K fertilization in the fall has no effect on plant's perception of cold temperatures and thus no effect on cold hardiness. The same is true regarding K effect on setting buds or controlling vine vigor. Additional K fertilization will NOT increase bud set or control vine vigor, however reducing Nitrogen fertilization will do so.

Final Note

Fertilizer prices are through the roof, if there is ever a time to reduce unnecessary fertilizer applications it's now. Make sure you are doing tissue analysis every year and collecting yield data on all your beds so that you can correctly estimate K fertilization needs. Over fertilizing with K has NO benefits to fruit size or yield, and can lead to lower yields over time, higher fruit rot, and softer fruit.

Growth of Vegetation and Growth of Berries

By Allison Jonjak, Elden Stang, and Grahame Hawker

As I work to understand the current state of cranberry research, the UW-Madison research faculty often helpfully point me to important research that has stood the test of time. "If we can see farther, it is because we stand on the shoulders of giants," as the saying goes, and it seems fitting to revisit past work from time to time. This article is a brief recap of Hawker & Stang's 1985 paper "Characterizing Vegetative Growth and Fruit Development in Cranberry By Thermal Summation." They study older cultivars (Searles and Ben Lear), and while the specific numbers they arrive at should not be extrapolated to new cultivars, the general patterns of growth can be.

Stang and Hawker used a plant growing degree day (GDD) accumulation to chart shoot length, berry length, shoot weight, and berry weight. The plant GDD model they used calculated growing degree-days between 48.2° Fahrenheit and 89.6° Fahrenheit. They also tracked ethylene evolution and anthocyanin production, but did not find them to correlate with the chosen GDDs well.

Growers from three locations provided Searles shoots and berries throughout the 1982 growing season. Two locations (central, westcentral) were at 44° latitude, and one (northern) was at 45° 30`.

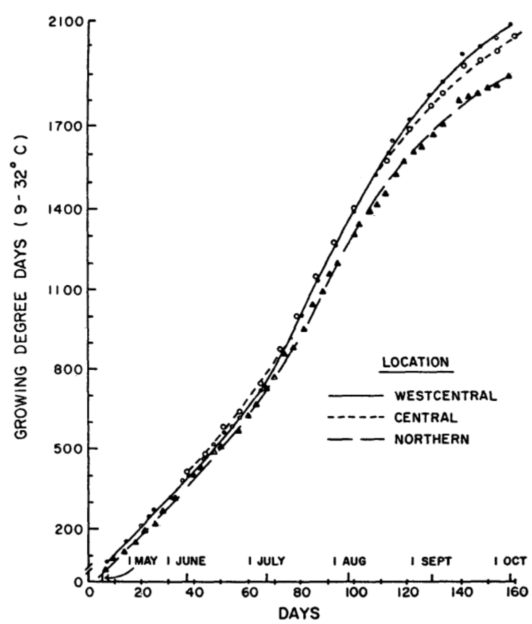


Figure 1. Seasonal GDD accumulation at three Wisconsin cranberry producing locations. (Hawker & Stang, 1985).

Figure 1 shows the progression of plant GDDs across the 1982 growing season in the three locations. In general, a trend exists that while northern latitudes accumulate GDDs more slowly early in the spring, the longer day length in mid summer allows sufficient accumulation for fruit production. This data set in particular does not show that trend dramatically, so I wanted to mention it so you can watch for it in other years.

Figure 2 shows the length of upright shoots tracked across the plant GDD regime. The paper doesn’t specifically mention whether this is a mix of fruiting uprights and vegetative uprights, or whether only fruiting uprights were sampled. Hawker & Stang do mention that berry number per upright was measured, so at least some of the uprights were fruiting. You can see that by (roughly) 1000 plant GDDs, which was (roughly) mid-July in 1982, upright growth plateaued. We do see the observation points following the trend curve more closely early in the season, and after the plateau we see some observation points outlying from the overall trend. Perhaps these outliers were non-fruiting uprights, or perhaps they occurred where excess nitrogen was available (either from application, or from the natural production of N by organic matter on warm days).

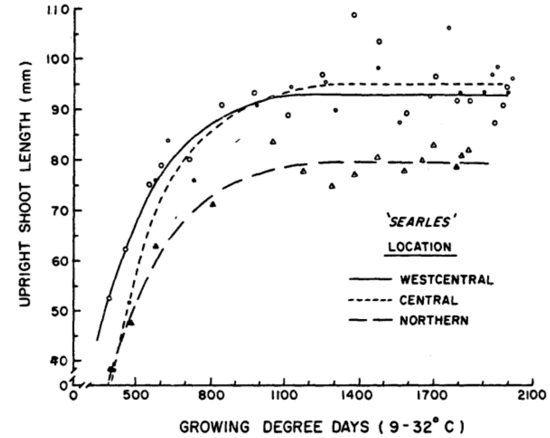
While the height of the upright shoots plateaued after ~1000 GDDs, shoot dry weight only briefly plateaued as fruit set was beginning. After fruit set, dry weights continued to increase. The paper does not mention whether this was a result of leaves increasing in size, stem increasing in diameter, or a combination of both.

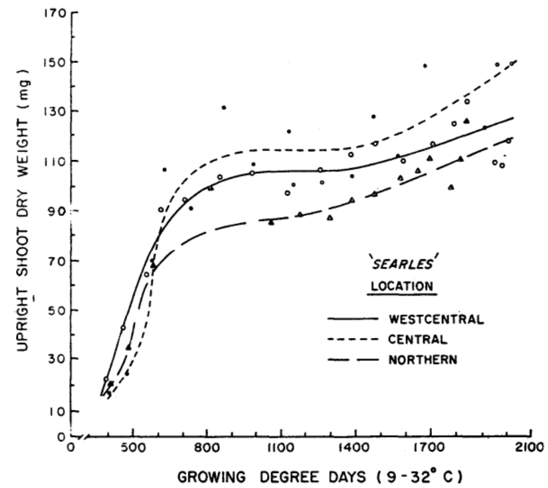
Figure 4 shows the number of fruit per upright throughout the growing season. This is a chart where the difference between Searles (where an upright would convert 4-7 flowers to 1-3 finished berries) and modern cultivars is large. Still, I’m including this chart to highlight the fact that the cranberry plant continues to abort fruit throughout the growing season (in contrast with most other fruiting plants). Hawker and Stang did not determine whether fruit abortion was caused by inadequate pollination, competition among berries, or other reasons—but it was observed in all three locations.

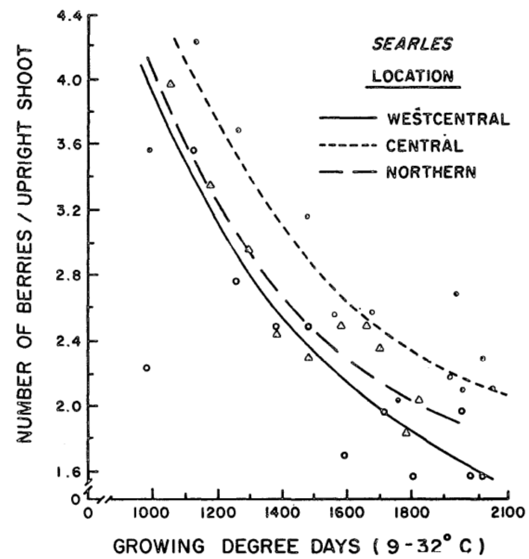
Hawker and Stang discuss berry length and weight, and explore correlations between ethylene (a hormone that cues fruit ripening) and anthocyanin. The paradigms for color (TAcY for juice production, vs machine vision for sweetened dried cranberry production) have shifted since 1985, so if there is grower interest I will recap the color portions of this paper in a future CCMJ.

Finally, for figure 5 I quote from Hawker & Stang directly:

The source-sink relationships within the cranberry plant appear to change throughout the season. For example, with ‘Searles’ at the [central] locations, vines are dormant with purple color until the beginning of May (75 GDD), greening up by mid-May (220 GDD). Following this is [a] period of rapid upright growth with the new growth apparently acting as the sink for metabolites and the old







(Top to bottom, all from Hawker & Stang, 1985) Figure 2. Upright shoot growth of ‘Searles’ cranberry vs plant GDD in 1982. Figure 3. Upright shoot dry weight of ‘Searles’ cranberry vs GDD in Wisconsin, 1982. Figure 4. Number of berries per upright in ‘Searles’ cranberry vs GDD, in Wisconsin in 1982.

leaves and stems forming the source. Flowers from uprights begin the hook stage by the end ofMay (375 GDD) and blossoms open two weeks later (510 GDD). At around 850 GDD (early July), blossoms and early formed berries become the major sink as evidenced by dry weight increase. By mid-July (1000 GDD), upright growth ceases and the berries become the plant's major sink until the end of the growing season. Following this, new upright leaf growth may become the major source of carbohydrates as a result of their advantageous position for interception incoming radiation. Ethylene evolution begins after 1500 GDD and anthocyanin development after 1650 GDD. By 1800 GDD (early September), the leaves begin to take on dormant purple color in response to low temperatures and shorter day length.

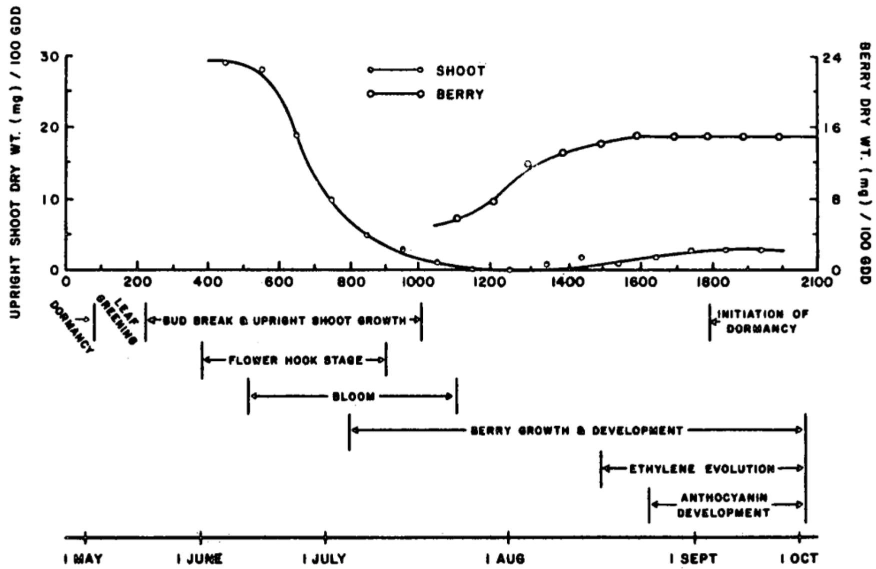
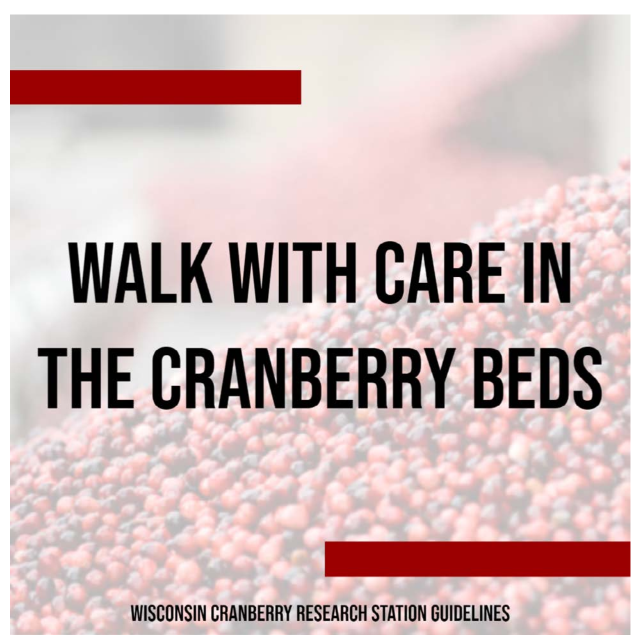


Figure 5. Seasonal plant growth and fruit development of 'Searles' cranberry in 1982 in Wisconsin. Hawker & Stang, 1985.

Video: Walk With Care in Cranberry Beds

By Allison Jonjak

The Wisconsin Cranberry Research Station hosts tours for the media, public servants, local school groups as well as in-bed research conducted by UW-Madison staff and students. To help visitors protect the plants, themselves, and the cranberry crop during their visits, the Station Manager and the Wisconsin Cranberry Research and Education Foundation requested that I make a video. The video in simple language and applies to all cranberry marshes, so I wanted to share it widely. You can access the video here.



Grower Updates

Flying Dollar Cranberry

By Seth Rice

Greetings from Flying Dollar Cranberry! Most of us have already applied the majority of our fertilizer applications on the marsh. We might apply some more on selective areas but for the most part we are just about done with fertilizer. Fruit sizing is continuing on the property. Irrigation is a must in this hot weather. Most marshes are still battling with bugs but that's no surprise. We are excited to see everybody at field days at the research station! I hope everybody can make it and I would encourage a tour of the place. A lot of hard work and dedication has been focused there.

Vilas 51

By Jeremiah Mabie

It's been a busy month on the marshes up north, bees are gone, booms are going constantly, and the berries are sizing up! Fruit set looks good across the marshes, there is some size differences as bloom was at all different stages, but everything seems to be catching up. Most nitrogen applications have either slowed down to certain beds or marshes are done all together. Bug pressure has been minimal but there has been some pressure from flea beetle but less than past years. I seem to have more TSV (Tobacco Streak Virus) or BlShV (Blueberry shock virus) this year than past years, mainly in my Stevens and Lemunyans, sounds like several other marshes are noticing more of it this year also. This is always an enjoyable time of the year to catch your breath on the farm, get caught up with those side projects and to start getting harvest equipment out, serviced, and ready to rock and roll. Have a great month and see everyone at the show!

Update from the Wisconsin Cranberry Research Station

By Wade Brockman

August has been busy at the Station, as in addition to focusing on bringing in a good crop in the new plantings, we have been preparing and hosting the Ribbon Cutting Ceremony, and now today the Field Day and Trade Show! Hopefully the weather is beautiful as the berries size up and you see the research first-hand. We have seen some flea beetle and are watching for treatment threshold.