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Adjusting Soil pH for Cranberry Production

By Amaya Atucha

What is pH? pH is the measure of the amount of H⁺ ions in the soil solution. It is measured on a scale that ranges from 1 (VERY acid) to 14 (Very alkaline). This is a 'log scale', which means each increase in pH of 1 is a 10-fold increase in the concentration of H⁺ ions. A low pH soil (acid) has greater amounts of H⁺ ion compared to OH⁻ whereas a high pH soil has the opposite with high amounts of OH⁻ and lower amounts of H⁺.

$$\text{pH} = \log 1/[\text{H}^+]$$

Soil pH= 5 0.00001 H⁺ in 1L of water

Soil pH= 6 0.000001 H⁺ in 1L of water

An increase in pH of 1 is a ten-fold increase in the amount of H⁺ ions in the soil! Even though the number may seem small, the impact on soil chemistry is huge!

Why does it matter? The soil pH directly affects how chemicals (including fertilizers and nutrients released from organic matter) will react in the soil. Each nutrient has a pH range in which it is most available for plants to take up, therefore, as the pH of a soil changes, the availability of nutrients changes. The ideal pH for cranberries is 4.2-5.5, which is quite acidic compared to other crops. If the soil is higher than 5.5, the availability of nutrients dramatically changes. Calcium, magnesium and potassium become much more available and can become 'toxic' by creating nutrient imbalances in the soil (Figure 1).

High pH can also affect availability of nitrogen (N). Cranberries take up N primarily in the form of ammonium (NH₄⁺), which is the form of N present in an ideal cranberry soil (pH 4.2-5.5). As soil pH increases, the ammonium in the soil is converted to nitrate (NO₃⁻) which is not taken up by cranberries as effectively and is leached out of the soil more quickly.

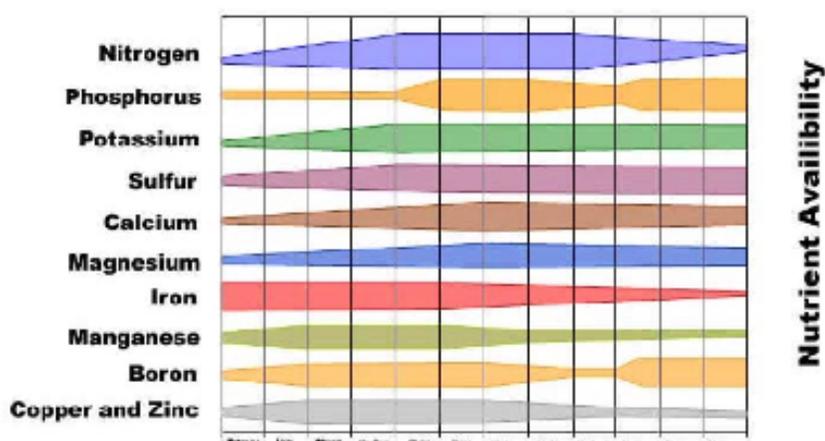


Figure 1. Influence of soil pH on Availability of Plant Nutrients. Thickness of bars indicates availability of nutrient. Ideal pH for cranberry soils (4.5-5.5). Redrawn from S.S.S.A.P., 1946. 11:305

Transformation of ammonium (NH₄⁺) to nitrate (NO₃⁻) with increasing soil pH.



Ammonium
Low soil pH

Nitrate
High soil pH

If the pH of your soil is not in the appropriate range for cranberries, it will be very difficult to meet the nutritional demands of the plant. In a high pH soil, the plant does not receive appropriate amounts of nutrients because they are in the wrong form, not because they are not present. Adding nutrients will have little to no effect until the pH has been corrected. Managing soil pH should be the first step in managing your crop.

Lowering soil pH with sulfur. It is possible to adjust the soil pH by addition of amendments. Lime can be added to the soil to raise the pH and sulfur can be added to lower the soil pH. When sulfur is added to the soil, bacteria in the soil convert the sulfur to sulfate. There are few key factors that should be considered when adding sulfur to adjust soil pH.

1. It takes time! The speed at which the soil pH decreases depends on how many bacteria are in the soil and how quickly they are working. When you first add sulfur to the soil, the amount of bacteria in the soil is relatively low and it will take time for populations to increase. The rate at which the conversion happens will also depend on the soil temperature. Bacteria are not very active in cool soils, therefore sulfur applications in the fall and spring will take longer to effect soil pH due to cool soil temperatures. Do not wait to address pH issues, this should be done as soon as possible.
2. Oxygen is needed. Bacteria require oxygen to convert the sulfur. If conditions are very wet, or you are planning to flood, you should delay the sulfur application until after the flood.
3. This is usually not a one-time fix. Often, marshes that require sulfur applications to lower the soil pH will need to be adjusted on a regular basis. This is just one more good reason to make soil sampling part of your regular routine. It is also important to consider the pH of the water being applied to the marsh. High pH water will continuously add carbonates to the soil which will raise the soil pH over time.
4. Apply no more than 100-500 lb granular elemental S/a annually, and if you have never used the material before, use lower rate, 100-200 lb/a. In sandy soils, a small amount of S can produce large reduction in pH, so splitting the application into 2 or 3 is a good strategy to avoid excessively lowering the soil pH.



Virtual Cranberry Mini-Clinic Summary

By Amaya Atucha and Allison Jonjak

To keep everyone up to date with research while keeping everyone safe from Covid-19 by avoiding group gatherings, we hosted our first Virtual Cranberry Mini-Clinic. We had 75 participants, and we will be hosting more in the future. An unexpected benefit is that everyone on their marshes can attend a virtual clinic without leaving the marsh unattended for a day. When we can gather again, we will likely supplement our face to face meetings with virtual meetings like these.

Tom Lochner thanks everyone for patience and flexibility as we learn this new way of communicating. Updates include the WSCGA's work-from-home plans, along with DATCP coordination to enable nutrient and pesticide trainings. Other work with DATCP has included getting truck weight limits increased. We will also be watching agricultural emergency spending, payroll protection, and other federal programs. Please contact Tom with issues and ideas!

Dr. Jed Colquhoun responded to some questions regarding moss control: there are no silver bullets. His hope is that we will experience drier weather, which will help with moss control. However, this does not seem to be the case in the near future given the historically high-water levels we currently have in Dane County (1 in a 3 billion probability). Dr. Colquhoun has tested various copper-based fungicides, fertilizers, and herbicides to control moss, however the effectiveness of these treatments is only 25 to 40% moss suppression at best, and only for a few weeks as moss can quickly regrow from spores or its root system. In addition, the products tested can only be applied while cranberry vines are dormant. If vines have broken dormancy at all, they can sustain persistent injury. A Massachusetts newsletter reported they have a cranberry label for a product against moss-but this does not work on sphagnum mosses, and it is not labeled for use in Wisconsin. Dr. Colquhoun and his team will continue their research on moss control and other escapees.

Allison Jonjak, new Cranberry Outreach Specialist with Extension, introduces herself.

Dr. Shawn Steffan talked about spray windows for sparganthis fruit worm control. The best control strategy is to spray early when 10 to 25% of the eggs have hatched. This happens about 1000 degree days (DD; starting in March 1st) for the 10% and 1140 DD for 25% egg hatch. This period is the ideal spray window to kill the most sparganthis, and research shows that spraying during this period is 60% more effective at controlling sparganthis than later sprays.

Dr. Steffan will continue his research on mass propagation of nematode bioinsecticide. Nematode bioinsecticides have been very effective thus far, especially at controlling flea beetle larvae months. The next step will be to scale up and have growers and pest control professionals keep their own cultures. Dr. Steffan also provided an update on pheromone mating disruption. A product aimed at cranberry and sparganthis fruitworm and black-headed fireworm is currently undergoing testing for registration for sparg. He hopes to continue a trial with sparg this year-that would be the 2nd year with good sparg data, which would be enough information to get sparg on the label. Another year of data for cranberry fruitworm would be required, and Dr. Steffan is hoping his new lab technician will be onboarded by June 7 to run these trials.

Dr. Jyostna Devi Mura, new Plant Physiologist with the USDA-ARS, introduced herself

Dr. Christelle Guédot will continue her research on pollinator gardens and chemical ecology iden-

tifying compounds which could potentially attract cranberry and sparganothis fruitworm. She will continue work with Dr. Steffan on degree days (DD) trials, with the goal of providing growers with practical information on insect pest control. Dr. Guédot also shared information about two new products, Exirel and Comoran. Comoran contains both Assail and Rimon, and Jack Perry has been happy with the effectiveness of the product. It has a good price per acre, compared with tank mixing the two products. New insecticides are coming down the pipeline. One broad-spectrum insecticide needs to be finalized with Ocean Spray and with other handlers, but it is already registered on cranberry. Dr. Guédot also reminded growers they can not use Belay anymore, and to check the pesticide management guide and with handlers for the latest information. If you have questions on this, please reach out to Dr. Guédot.

Dr. Amaya Atucha covered the topic of potassium (K) fertilization. There are always questions about potassium applications early in the year to alleviate “crunchy” vines—but this is a myth. K fertilization has no effect on alleviating crunchy vines and growers should not be applying it right now. Whether and when to apply K: the first place to start is your tissue analysis levels. If tissue analysis results show K level in the 0.4 to 0.75 ppm range, K should be applied to replenish what is extracted by the fruit, as a maintenance strategy. If you have 300 barrels/ac, you’re removing 30-35 lb of K (roughly 40 lb of potassium oxide K₂O) in berries, so you do not need to apply more than what you’re removing. If you’re getting consistent good yields and your tissue results are in the normal range, don’t overapply K as it will create imbalances with other nutrients. Dr. Atucha mentioned that research performed at UW-Madison in the late 90s on K fertilization across more than 15 marshes in the state, showed that no decline on yield or fruit size even when no K was applied for 4 years. This shows us that we may not need to apply K every year. If you’re not comfortable applying zero potassium, a safe way forward may be the maintenance calculation.

In terms of soil K concentrations, 40 to 60 ppm of K in the soil should provide enough to support vine growth and fruit production. If you want to increase your soil test levels, you need 15 lb of K₂O/ac to increase 1 ppm (based on the top 3” of a sandy soil).

Regarding the question whether higher yielding cultivars need more potassium, Dr. Atucha says there is not a lot of research on this, but if you are harvesting more berries per area, you will have to fertilize with more K because you are removing more of it.

Dr. Atucha also addressed the question are early spring applications of K beneficial? She has not seen anything in the literature supporting this. The timing of potassium application should coincide with fruit growth. Fruit set to pea size berry should be the optimal window for K applications. Similar to early season potassium, there is no research supporting late season application. Fall K applications have NO effect on setting buds for next year, nor do they increase color development in berries.

Regarding potassium fertilizers, the most commonly used are potassium chloride, potassium sulfate, and potassium-magnesium sulfide. K-mag is well known as well. All products are effective at providing the needed potassium, so we have no preference for one over the other, aside from price.

Dr. Atucha also addressed a question on leaf drop. She said that last year’s leaves are photosynthetically active and provide carbohydrates to support new growth during early spring. However, once we make it to bud break to roughneck, the new tissue becomes efficient at producing carbohydrates really fast, and that by roughneck older leaves are not as critical in providing carbohydrates for fruit set. Research shows that removal of old leaves by roughneck has minimal impact on fruit

yield or fruit size. Her recommendation is, even if you are having leaf drop, you do not need to apply more fertilizer. Instead, keep an eye on new growth. If it remains green, you are fine. If new growth is slow or yellow, you may need to apply nitrogen. If new growth looks fine, then you do not need to apply fertilizer. Regarding tracking plant growing degree days (GDD) and bud cold hardiness, Dr. Atucha pointed out that GDDs in plants are not the same as Degree Days (DD) for insects, and that there is not a good correlation between GDD and bud sensitivity to freeze or frost events. Dr. Atucha's team has been working on correlating bud cold hardiness with GDDs, but they have not found a good correlation between GDD and bud cold hardiness.

Update from the Wisconsin Cranberry Research Station

By Wade Brockman

It seems like just yesterday there was snow on the ground and here we are heading into another growing season. Here at the research station I have all the irrigation in, and the frost alarm is up and running, things are moving slow, but a few warm days things will definitely take off. I've been busy putting our new boom together and will hopefully have it completed in the next week. We are also finishing up small details on the lined research beds in the hopes of planting them the last week of April, in addition to those beds we also have a 3.5-acre bed to be planted the same week.

Thanks again to those who have donated their time and resources to the research station.

Grower Update: Gardner Cranberry

By Willow Eastling

Hello everyone! I think we are all eager to watch the vines come to life again. Here at Gardner's we have been busy finalizing irrigation and looking over booms. Some of our guys are applying Casoron as well. This winter we tore up over 30 acres, soon we will be transitioning into working on those renovations. We have not had extremely warm days in April like we have in past years, keeping the vines somewhat dormant.

With warm and rainy forecast, we are anticipating dormancy to break within the next two weeks across all our regions with an exception of our Harshaw location. The spanworm always hits us early on the northern regions in our BL's that have history. I will be doing spot checks starting the second week in May across all regions. Here's to a great 2020 crop!



Introducing...

Allison Jonjak: New Cranberry Outreach Specialist UW-Madison Division of Extension

By Allison Jonjak

I expected to start my new role as Cranberry Outreach Specialist traveling across the state, visiting you and your marshes, and learning side by side from you in your pickup cabs. The world threw us a curveball—so I'll have to introduce myself on paper for now and look forward to the marsh visits as soon as they're safe.

So, hello! I'm Allison Jonjak. I grew up on Jonjak Cranberry Farm (established 1939) in Sawyer County, and loved everything about it, from pulling maples to sweeping for bugs, to testing out herbicide protocols, and even frost watches. (I suspect my dad of only waking me up for the few fun ones a year, I know it's a different story when you're up every night.) I decided I liked problem solving so I went to the University of Minnesota for ag engineering, and then got my master's at the University of Nebraska, again for ag engineering, specializing in soil pH.



My work in grad school, and in my next job at Family Farms Group, focused on corn, beans, milo, cotton, wheat, and rice. Occasionally I'd get to work with tomatoes, melons, bell peppers, or faba beans, and I love all the farmers I got to work with—and the only thing that could have persuaded me to go elsewhere was the opportunity to get back into cranberry marshes again. I'm so glad to be back in Wisconsin with you all.

With my row crop farmers, we focused on sound agronomy: growing the best crop possible within the budget. We set up variable rate fertilizer and variable rate seeding prescriptions tailored to yield potential. We held trainings focused on scouting, crop physiology, chemical selection, soil properties, and other topics of daily importance to agronomists. A lot of people are naturally drawn to competition about high yield. I founded a contest to get growers excited to compare yield per dollar spent, so we compared actual seed and input costs with normalized trip costs. We learned new things from this every year, and I hope we can have similar discussions in cranberries.

When I can travel, I would love to visit your marsh. Until then, allison.jonjak@wisc.edu and 612.276.2872 are the best ways to reach me.

Dr. Jyostna Mura, USDA-ARS Cranberry Physiologist

By Jyostna Mura

Hello everyone, I am Jyostna Mura. I recently joined as a USDA-ARS Cranberry Physiologist with the Dept. of Horticulture, UW-Madison. I am excited to have this opportunity. My role is to improve cranberry productivity and quality by exploring the fundamental mechanisms underlying the physiological responses of cranberry to water, nutrients, and environmental factors.



As a child, watching my family in India growing different crops gave me a passion for understanding crop growth and led me to pursue a career in agricultural research. I completed a Ph.D. in Genetics and Physiology with the International Crops Research Institute for the Semi-Arid Tropics, a research center under the UN's Consultative Group on International Agricultural Research. While pursuing my Ph.D., I was awarded a fellowship from the US Agency for International Development to conduct research at the University of Florida. After finishing my Ph.D., I worked with the University of Florida, North Carolina State University, several international organizations, and the USDA Agricultural Research Service in Maryland. Throughout my research career, I have worked on a variety of crops, including corn, cotton, soybean, peanut, chickpea, common beans, cocoa, and goji berries. I really enjoy working with different crops and farmer groups.

I am a plant physiologist by training, with expertise in the fields of molecular biology and plant biochemistry. My research experience includes studying plant physiological traits and mechanisms that contribute to crop growth and yield. Some of the mechanisms that I have studied are water conservation, nutrient use efficiency, hormonal role, carbon partitioning, and sugar metabolism in fruits. I focused on identifying variability in these traits among different cultivars. This information has been used in breeding efforts to improve crop yields and to produce new soybean and peanut varieties that can use water and nutrients more efficiently.

Cranberry is a unique crop, and I want to bring my expertise in many cropping systems to understand cranberry physiological mechanisms. My goal is to focus on the traits that are relevant and important to the cranberry industry to efficiently grow the best quality, and highest yielding cranberries. I want to apply basic plant physiology principles to study mechanisms related to water conservation, nutrient management, and hormonal effects, along with monitoring the performance of different cranberry varieties. I am also planning to use my experience in plant stress physiology to understand the influence of environmental stress factors on cranberry growth, development, and productivity.

I am eager to visit cranberry bogs as soon as social distancing restrictions allow it. Working from home, for now, I am reviewing current cranberry issues and communicating with the other cranberry research groups to get a sense of ongoing cranberry research priorities. I hope together as a team; we can advance cranberry research and promote our community.

I look forward to working with you and hope to meet you all in person soon. In the meantime, you are always welcome to contact me by email (jyostna.mura@usda.gov/ jmura@wisc.edu) or phone (6082654745).

Resource for Cranberry Growers regarding COVID-19

By Allison Jonjak

I sure didn't expect my first communication with you to focus on 'cranberries coping with covid-19', but we farm the ground we've got, not the ground we wish we had. You may be seeing some PPP information for your lenders, but scroll down if you want guidance on managing deliveries, your staffing plan, and the Families First Recovery Act. Some info comes from Extension, some I wrote, and some are from endcoronavirus.org. I want to make sure you have all the information you need to operate effectively and safely through this season, so if you have questions on any of it, give me a call.

Financial impacts:

Farmer eligibility and sign up for the Paycheck Protection Program began April 3, 2020. This program provides forgivable loans to small businesses to pay their employees during the COVID-19 crisis. This can cover payroll, health insurance, local and state taxes, and even self-employment income (although that's more paperwork).

The Families First Recovery Act specifies paid leave for people who need to stay home because of coronavirus exposure. The Act makes funds available for farms (and other employers) in need of it.

Employee Impacts:

What's your staffing plan if covid-19 hits your farm? Consider ways to reduce transmission risk on your farm while everyone is healthy, and make contingency plans in case extra help is needed.

How to operate safely:

Managing Visitors and Deliveries—a good plan for contact with the outside world can reduce your marsh's risk. Using cell phones and arranging product drop-off without contact is best.

Employee Communication:

You reduce your farm's risk when you encourage your employees to distance safely. These two guides from endcoronavirus.org are not farm-specific, but one lists essential guidelines if someone needs to quarantine, and the other contains a list of questions you can ask your employees so you can assess their off-farm risk together.

I'm looking forward to meeting you by zoom, phone, and email for now; and to learning all about your marshes as soon as we can do that safely! And until we can meet in person, take advantage of being outdoors, and be proud of your essential contributions to our state, and to the dinner tables of families throughout the world.

Stay safe,
Allison

