



## Cranberry Virtual Mini-Clinic

### Welcome from Jed Colquhoun

Well, thank you all for joining us this afternoon. We appreciate it greatly, and I look forward to trying a little different venue or operation to be able to communicate with you during these odd times. Most importantly, I hope that we find you well and healthy and surviving as we move through these challenging times. Our primary goal today is to find a way that we can communicate with you when we can't be there in person. We want to let you know that we're still working. We're still doing our research. We're still doing outreach, and we're still available to address any needs that you might have. So, while we can't be there in person at the current moment, we'll find other ways that we're able to address your needs. We're still here and available. This is really an experiment to see if we can communicate like this effectively and efficiently. And we ask for your patience as we work through trying to do that this afternoon. So when given lemons, we're going to try to make some virtual lemonade today.

### Address from Tom Lochner

At our last board meeting, we had a discussion about how we were going to handle educational programming as we went forward under the restrictions because of the covid-19 outbreak, and one of the Board members suggest, well, can we do something virtual meeting with Zoom. And no sooner had the meeting adjourned than we got an email from Jed suggesting that we do just that. So thanks to Jed for reading our minds and putting this together, and Alex worked on it very well, as did the Education committee. So first of all, thanks to those folks. And also thank you for our presenters were going to be talking shortly. We appreciate you taking time out to spend some time with us, and we also appreciate the fact that you're going to be working with us in the field this year. And we're hoping that as difficult as things may seem that we can get through



this with minimum bumps in the road. We also are welcoming 2 new members to the Cranberry team today. You'll get to meet them. Allison Jonjak is the regional cranberry extension specialist; and Dr. Mura is our new plant physiologist. We were hoping

we could get the opportunity to meet both of these women face-to-face, but this is going to have to do for now.

### Speaking today:

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At the Association, we've been working through the pandemic as best as we can. And we've been trying to address issues that have come up for growers. So really, just a couple of things to touch on. The Growers' Association office is open. We're functioning. Crystal Johnston is in there on limited hours. Both Alex and Isaac are working from home, along with myself, but we do jump into the office occasionally, but we are available on phone, e-mail and text. So we're operating as normally as we can. We are part of a group that has a weekly call with DATCP to identify issues that may pop up for growers, and we've done a lot of work through them in terms of how to handle nutrient management planning. We're going to do a virtual or an online program to help growers continue to be able to be qualified to write their own plans. DATCP does have an online program for those of you that need to renew your pesticide applicator certification, and that information is on the DATCP website, or you can go to our website and find it.

And we've been trying to post information on there as it comes up. We've been able to do some things like we've -- they've raised the weight limits on trucks from 80,000 to 90,000 pounds. So there's a lot of things like that we've been able to work on. But right now, the focus is on securing some of the \$1.8 billion that the state is going to get under the CARES Act to shift to make sure they spend some of that on agriculture, and what we'll be working on over the next week or two we have put out information on opportunities under CARE such as Payroll Protection Plan, Self-employed Unemployment Compensation, those types of things to help growers with that. And so as you have questions or if you're having issues, feel free to contact us, and we can share those with other people. And finally, we are working at the federal level on securing some additional payments for growers and securing some additional purchases of cranberries to restock the food pantries and other feeding programs. So with that, thanks to everybody for your patience. We just hope that this works out. And if it does, we can continue to do this through the foreseeable future. And just wish everybody and you keep your families and yourselves and your workers all safe and healthy, and we'll make it through the growing season, hopefully, with minimal disturbance.

### **Jed Colquhoun on Moss**

For the topic that I'd like to cover today, we're going to talk a lot about moss because I've had many questions about it as we get into the growing season. Number one, there are no silver bullets at all. The only thing we can hope for is that we start getting into some drier weather patterns that allow us to get into more moderate soil moisture. And to drive that home, I'll share a fact that I shared at cranberry school, one of our recent graduate students who is working on a hydrology project calculated that the chances of having groundwater levels

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### **Our hosts**

Wisconsin State Cranberry  
Growers' Association



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as high as they are in Dane County right now., based on the last 5 years of wet weather is one in 3 billion. So, it's a challenging circumstance that we have with the amount of moisture in the system, and we need to hope for a little drier conditions moving forward.

There are a number of different products that we've tested recently that are various copper-based fungicides, fertilizer additives, herbicides, looking to be able to control the various moss species that we see in Wisconsin cranberries. The bottom line on that, and Jack can drive this home when he cleans us up at the end here, but we get between 25% and 40% suppression at best with these products at best. And it's temporary. They work for maybe a few weeks, and then the moss tends to regrow from spores or its vast root system. To make matters a little bit worse, these products are only selective when cranberries are very dormant. They're even in the beginning stages of breaking dormancy, we get injury, and the injury can be significant and persistent, much more persistent than the control. So we don't have a good solution right now, and I would caution you against trying to hit it too hard right now with some of the things that you may be hearing about.

With that in mind, this past week had a flurry of e-mails and phone calls related to, I believe, a cranberry handler newsletter had indicated that Massachusetts had a special local-need label for a particular herbicide to control moss. We do not have a label for that product here in Wisconsin, and we won't. And I'll share with you the few reasons why that is, number one, in Massachusetts are targeting a different moss species than we have here. They're going after haircap moss and we're after sphagnum species. And the product they're using, we've tested here for about a dozen years. And as a matter of fact, Jack Perry helped develop the product initially when he worked for FMC. And it does not work on the moss species that we're targeting nearly as well as it does in Massachusetts. The other piece is that in Massachusetts, they have a long-extended dormancy period compared to here where we have is off and moved to growing fairly quickly. They don't have the ice that we have or the colder weather. And if you miss that dormancy piece, when we've been testing that particular product, we can actually prevent berries from forming. So if you want a vegetative crop, it might work for you. But if you're into producing berries, it won't work if we hit it just coming out of dormancy. So that's the update on moss.

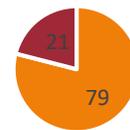


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### Spreader-Stickers

Poll: Do you use a spreader-sticker or surfactant with your fungicides or insecticides?

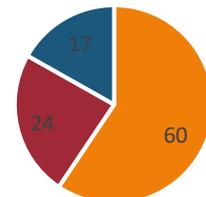
% using Spreader-stickers?



- Use a spreader-sticker
- Don't use

Are you using them on insecticides or fungicides?

With what do you use them? (%)



- insecticide
- fungicide
- don't use



As far as research priorities in 2020, we'll continue to look for ways to control moss and the other escapes in primary marches, including evaluating a couple of potential new herbicides that are coming along. We're looking at using plant growth regulators natural plant hormones, both on newly renovated beds to enhance establishment and more competition with weeds. As well as to look at those plant growth regulators and early fruit sets to be able to improve very color firmness, and berry size, in particular. So we'll be initiating that work this year. And finally, we're looking at alternative crops that could diversify your cranberry marsh, will see some preliminary work this year. We'll have 5 sites across the state, including at the cranberry research station. So that's what we'll be up to in the upcoming year.

### **Allison Jonjak Introduction**

Glad to see you all. Everyone else gets 3 to 5 minutes today, I only ask for 90 seconds because I'm just saying "hello, and I'm looking forward to being well face-to-face. I've been really glad with how welcoming the specialists and Growers' Association have been so far. I've been tooling up to have the next Cranberry Crop Management Journal go out before the end of the month, and I'm looking forward to the growing season.



I think that I mentioned to Tom Lochner yesterday how I'm catching up on cranberry research and working to get to know you all, while looking forward to riding in cabs on marshes as soon as that's possible. So I will be here, and I'd love to get to know you in the meantime, so I'll be reaching out, and I'll be watching for your questions.

My role will be spanning all of the cranberry counties, as a cross between a specialist and a county agent. So I'll be involved in applied research and in outreach across cranberry country. This is the first such position in Extension, and I'm glad to be serving the cranberry industry in it.

### **Shawn Steffan on Sparganthis Spray Windows**

I wanted to cover 3 points. One is the ideal spray windows for sparg. These are sprays of virtually any insecticide targeting sparg. We found that the best spray window, by far, appears to be between 10% and 25% of ECAC. So that's sort of

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### **Cranberry Roots**

Q: What county did you grow up on?

A: I grew up on my family's cranberry farm (planted 1939 by my grandpa Tony) in Sawyer County.

### **Growers Served**

Q: Which growers will you serve?

A: All Wisconsin cranberry growers—in every cranberry county. I want to get to know each of you so we can focus research and outreach on the issues that will be most important and profitable for you.

### **Home Office**

Q: Where will you be based?

A: I'll office in Wisconsin Rapids, in the Wood County Courthouse (once we're allowed in the office again!), but will travel to all of your marshes and to the Cranberry Research Station to stay connected.

### **What about the CCMJ?**

Q: How will we receive the Cranberry Crop Management Journal going forward?

A: We're moving to an all-online format. A digest email with links to blog posts will be sent every two weeks during the growing season, and the blogs will live here:

<https://fruit.wisc.edu/cranberries/cranberry-crop-management-newsletters/>



early in the bell curve in the egg hatch period for that pest. The degree day is associated with 10% was about 1,000 accumulating from March 1. The 25% end of the window corresponds to about 1,140, about 1,140 degree days. So those 2 benchmarks, 1,000 to 1,140 represents this what appears to be the ideal spray window to kill the most sparg to kill as many as possible with a single well-timed application. Those timings corresponded to a 60% to 70% of better kill rate than a spray time for 40% or peak or even post-bloom. With all those later sprays, you kill a huge segment of the population, but it's not nearly as good as hitting the caterpillars on the front end.

And we believe that the reason for that doing so between that 10% to 25% window or 1000 to 1,140, that window kills all those caterpillars that have hatched, it kills some that will hatch in the near future because of the residues, but you also kill a lot of the flying adults. Those are the egg layers. So that about 10% to 25% timing. At that stage, you probably have 80% to 90% of the adult flyers, the egg layers. So when you kill the egg layers, you preempt the existence of future eggs, and we believe that's the mechanism why that window is so effective. You kill caterpillars, but you also kill the moms and pops that are laying the eggs.

### **Shawn Steffan on Nematode Bioinsecticides**

The next thing I want to touch on was the mass propagation of the nematode bioinsecticide. I had plans to have 3 different cooperators do this work, and we may still do this. Right now, campus is on lockdown. I have no assistance in the maintaining of these cultures. I'm keeping them both burning sort of on a low burn to keep the cultures going. They work really well. We showed recently that just putting the nematode bioinsecticide in a spray tank, applying it as you would any other insecticide provided great control of flea beetle larvae months down the road. So an early application through the spraying of these nematodes worked really well at knocking out the larvae, the flea beetle larvae before they'd pupate and come out as adults.

So the next step is to have growers and pest control professionals, propagate it themselves. I had a system developed where we would scale up. But at this stage, I'm kind of caught between a rock and a hard place because I don't have the assistance to keep the cultures going and then the development of these -- the actual materials to set this up, I need to be present to do that, and it's just difficult to do such things in person, given the social distancing and the need to keep people safe. But in keeping those cultures going for future mass propagation work.

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### **Insect GDD**

Q: What high and low temps are you using to calculate growing degree days for sparg?

A: The lower threshold is 50 and the upper threshold is 86. Shawn's former student Annie put together a GDD lookup table you can use. Contact Shawn or Allison for help with this.

### **Sparg Insecticide Trials**

Q: What product did Shawn use in his sparganthis spray window trials?

A: Altacor, which is good as a knockdown and is active when ingested. Spraying any broad-spectrum insecticide should work in the given window—just remember when you're targeting adults and larvae at the same time not to use something that specifically targets eggs.

### **Raising Nematodes**

Q: Do the protocols for raising nematodes exist? Can we start working on a setup, as consultants or growers?

A: The materials exist. The only question is Shawn getting the materials to the grower or consultant safely, with so many quality control aspects in each stage. Luckily the timing is late June to early July.



The last thing is the mating disruption demonstration. One of the most significant producers of pheromones in the world is really interested in producing a product that controls sparganthis and cranberry fruitworm.

They also have black-headed fireworm. We're looking specifically at a registration for sparg. So if we can get a trial going this year, that would be year 2 of good data with sparg, and then that



would be the data that they would need to go and then spend the money to get the registration and they want to do that. They want a sparg registered mix. Cranberry fruitworm, we need to do another year of that. The question is, will I have assistance to do this? I'm supposed to get a new technician who should be hired by June 7, should be on board by June 7. The setting up of this and the monitoring requires lots of effort. And so across these 3 projects, I just simply cannot do it alone. So the question is how this COVID plays out and when I'll be able to get people in the lab and get a team together to do the mass disruption demo. But I have full support from cranberry growers and from the manufacturer. It's just a matter of the logistics. And there's so many unknowns that right now. I hope to be able to scale up and do the mating disruption project this coming season. But I just don't know what the future holds.

### **Jyostna Devi Mura Introduction**

I'm Jyostna (JOSH-na) Mura, and I joined this exciting Cranberry Research team at University of Wisconsin a few days before the quarantine, so I haven't really started any work. I'm originally from India, I also come from a farming family, which attracted me to pursue my career in agriculture. My family grows crops like peanut, millet, and sunflower.

I did my PhD in an international organization. I conducted part of my studies at University of Florida as an exchange student. Following my PHD, I worked with different universities and different international organizations, and the USDA in Maryland. I moved from USDA Maryland to USDA Wisconsin. From my PhD until now, I worked on different crops like corn, cotton, soybean, peanut, chickpea and some vegetable crops like beans and some food crops like cocoa and goji berry. Cranberry is really new to me. Basically, I'm a plant physiologist by training with

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### **New Hire: Outreach**

Allison Jonjak rejoins the cranberry industry as University of Wisconsin-Madison Extension Cranberry Outreach Specialist.

### **New Hire: Plant Physiology**

Jyostna Devi Mura is the new Plant Physiologist with US Department of Agriculture – Agricultural Research Service.



### **Upcoming: Plant Pathology**

Christelle notes that she served on the search committee for a replacement for Patty McManus, and the Plant Pathology department has sent an offer letter. A fall timeline looks likely for a start date.

### **Upcoming: Food Product Development**

Jed notes that thanks to good work by Tom and WSCGA, we will be adding a new USDA scientist. The position will be working on new food product development related to cranberries.



some molecular biology and biochemistry experience. And my research experience includes studying some of the physiological traits and mechanisms that contribute to improving crop yields. I studied the influence of temperature, humidity, carbon dioxide, water, nutrients and some hormonal effect on crop growth development and yield. I studied some of the traits like water conservation and nutrient use efficiency and carbon partitioning under sugar metabolism. And also, I studied some varietal differences in different crops. My research information has helped to produce new varieties like peanut and soybean varieties that can efficiently use water and nutrients. I'm really happy for that—that my research was useful for farmers.

For now I'm hoping to bring all my areas of expertise on different crops to cranberry. I know cranberry is a unique crop, and I'm really excited to join the



cranberry group in working on cranberry. And my objective is basically to study and understand the traits that are relevant and important to the cranberry industry and the growers-- to grow the healthiest and best quality and highest yielding cranberries.

I'm planning to apply basic principles of physiology, plant physiology and molecular biology to study mechanisms related to water use, nutrient absorption and some hormone effects, and some stress effects like frost tolerance or heat tolerance in cranberries. And also, I want to see the varietal differences, how the cultivars are different from each other and how we can utilize this information to improve best to improve crop production. I want to focus on research priorities to solve some of the problems that we are currently encountering and the ones that we may face in the future.

I know I started my job and then this pandemic happened. Working from home, I'm focusing on reading cranberry literature. I'm going through all the literature and also communicating with some of the Cranberry Research Group from Massachusetts and New Jersey and British Columbia to understand the ongoing cranberry research in physiology. Certainly, I need all of your support working

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### Poll Results!

Will you try Exeril, Cormoran, or both this year? Or are you not running trials for 2020?

#### 2020 newer insecticides (%)



■ Exeril ■ Cormoran  
■ Both ■ No trials

### Handler Reminder

Always check with your handlers before using new products, as their restrictions, such as per-harvest interval, may be longer than the label restrictions.

### Confirm

Confirm is no longer being produced because it lost the sugarcane market. – via Penny Langer

### Orthene

Q: is Orthene on the EU's hitlist?  
A: the allowable levels are already quite low, 0.01 ppm—which is basically the level of detection (answer via Andy)

A: for Ocean Spray, 6/22 is the last possible date for Orthene; 6/10 for Lorsban (via Rod Serres).



together for advancing cranberry research and bringing out the best to our community. I'm really excited to be on the cranberry team -- and I'm looking forward to working with you. You are always welcome to contact me either to email or phone, any time. Thank you very much for listening to me and stay safe and healthy. And thank you. Have a good day.

### **Christelle Guédot on Insect Updates**

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



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### **Lorsban Options**

Q: With the potential loss of Lorsban coming, can we do some more studies on bee aversion to Orthene as an option for the spring pre-bloom spray after the bug flood? Also wondering about the Proline and bee aversion?

A: I think Jack probably has some trials. So I would have to dig up trials on Orthene. I haven't seen some recently. So I don't have an answer on that, but that's something we could look at. And the Proline, and if you remember, it wasn't the last Cranberry School, it was the one the year prior-- 2019--where I showed some data where we saw kind of a repellency from the Proline application during bloom where the bees seem to shift to non-cranberry pollen after Proline application. And that ended up being both in -- after 24 hours of the application of proline. And 48 hours later, we still had this aversion to cranberry pollen. So we have not continued this work. It's really hard to do this work because growers will apply another compound quickly after because we're coming after bloom, so people start spraying insecticides that they could not spray during bloom. And so we have an overlap, and it's hard to tease things apart once you have overlap of products being applied. But it's research that a lot of you seem interested in, and I'm more than happy to continue that if that's something that people are interested--how long the repellence is happening, and if it happens in other chemistry.



## Amaya Atucha on Potassium Fertilization

Potassium is always one of those nutrients that I get a lot of questions about, and people start thinking about applying potassium during this time of the year to alleviate “crunchy vines”. I just want to let you know that there's no research that supports that. Potassium does not help with crunchy vines, and we should not be applying it for that. But I wanted to talk a little bit about when to apply potassium and whether you should or you should not be applying potassium. The first thing is, obviously, you want to check your tissue level, the results of tissue analysis. So anything that is between 0.75 and 0.4%, it means that you're in the sufficiency range. So, if you're in that range, there's 2 options that you can do. Regarding fertilizer applications.

One is to apply potassium sort of as a maintenance application. And I talked about this I think it was last year during the Summer Field Day, that one way of replacing the amount of potassium that we are taking out of the system with the fruit that we harvest—a high amount potassium is in the fruit and is going out of the system when we harvest--is to think about the yield that we have and replacing the amount of potassium that we expected with that yield. Research has showed if you have a yield of about 300 barrels per acre, you remove between 30 to 35 pounds of actual potassium per acre or 34.0 to 40.0 pounds of K<sub>2</sub>O (potassium oxide).

Based on your previous year's yield, you could think about replacing the same amount the following year. So not increasing the amount that you're applying. There's no need to apply more potassium, especially if you're getting consistent good yields and your tissue results are within the normal range. So that's one thing.

There's been quite a bit of research, and I was going back into some old literature from research here in Wisconsin by Dr. Roper showing that in a study that was done--I think it was somewhere at the end of the '90s--in which they decided to test different rates of potassium fertilizer. And I think there were around 15 different marshes in which the experiment was established. In some places, even with sandy soil, if you do not apply any potassium, they did not see any effect on yield or fruit size. So that shows you that you don't necessarily have to apply potassium every year.

Now if you're not comfortable with that concept of not applying any potassium, I think that the best way to go is to look at this maintenance application and base

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## Flooding on Bud Hardiness?

Q: Many growers flooded this past week for the cold temps. Do you think this affects bud hardiness to low temps even through the floodwater was in the 30s? When we pull the flood, what sort of temps can the buds take even though they still appear tight?

A: if the temperatures of the water were cold, you shouldn't see any deacclimation of or loss of hardiness. What we saw with some of the data that Camillo has been collecting is that there might be some slight correlation on the loss of cold-hardiness with the minimum temperature that plants have experienced. So when you're getting minimum temperatures that are around 40 or over 40, we think that that's the point where you start seeing some loss of hardiness. But again, it's something that we don't have a really good answer for. But I wouldn't think that the flood water at 30 degrees affected at all the cold hardness.

## Handler Reminder

Always check with your handlers before using new products, as their restrictions, such as per-harvest interval, may be longer than the label restrictions.



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your fertilizer rate on the yield that you have and how much potassium you are extracting with the fruit. You could also check your soil analysis. Usually, what you would expect is to have between 40 to 60 parts per million of potassium in your soil. And what we know is that if you want to increase the amount of potassium in sandy soils, you need about about 15 pounds of potassium oxide (K<sub>2</sub>O) to increase 1 part per million in the soil. This is in the first 3 inches of sand. So that's more or less where you want to be if you're also looking at what do you have in your reserve in the soil.



### **Amaya Atucha on Potassium, continued**

Regarding cultivars, people ask me, "well, these new high-yielding cultivars, do they need more potassium?" There's not a lot of research on specific cultivars needs, but what makes sense is that if you're having cultivars that are producing more fruit and you're harvesting more fruit, you're obviously taking out of the system more potassium. So going back to that calculation based on your previous year's yield and estimating how much potassium was extracted to replace it. I think it's the best way. And so that would probably show you that cultivars that produce more fruit will need a little bit more potassium.

Another question is whether early applications of potassium--just solely potassium, so 0-0-60 or 0-0-50--are beneficial. And really, I have not found anything in the literature that says that early applications even before bud break are beneficial at all. The ideal timing of application of potassium is when the fruit is actually growing. And that will be anytime between fruit set to pea-size, that's when you have most of the potassium being allocated into the fruit. What brings

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### **Fall Nitrogen Research**

Amaya's lab will be completing their 3<sup>rd</sup> year of research on the fall application of nitrogen, and will be able to report on harvest data and fruit characteristics from that research.

### **Water Volumes and Quality**

We are beginning to plan research on water volumes and water quality, perhaps on new beds at the research station.



me to applications in the fall of potassium, especially looking for benefits on bud set or bud size for next year. There's no research that supports that applications of potassium in the fall have any positive effect on setting buds for the following season.

There's also no studies showing -- actually, there's some studies that show there's no evidence that potassium helps with color development. So that's another thing that I also get a lot of questions about--applying potassium before harvest regarding increasing color development. There's no evidence on any of the studies that have been done, that this is the case.

In terms of forms of potassium fertilizer, there are many different products. The most common we use are potassium sulfate, potassium chloride or things like potassium magnesium sulfide, well-known is the K Mag product. All of the products work exactly the same. There was a couple of studies here in Wisconsin that looked at different forms of potassium, and they all performed fine. So there's really no preference for one over the other. As I said, they all seem to work fine.

Now I want to address 2 questions that I've gotten. One is about fertilization for early leaf drop. I want to say that we know that the leaves from last year are important during this period because they are still photosynthetically active, and they are producing carbohydrates to support growth. However, as soon as we get to bud break and we start seeing new green tissue, that green tissue-- all the way up to roughneck--that new tissue becomes efficient at producing carbohydrates really fast. We've done a lot of studies on that with--some of you might remember my postdoc Jenny Bolivar-- She did a lot of studies looking at carbohydrates, and she figured out that by the time that we are at roughneck, there's no big difference in the carbohydrate content of the new growth versus the old leaves and upright section from last year. Research done by Dr. Roper many years ago looking at defoliation and removing the old leaves show that if you remove old leaves by the time of roughneck, you really have minimum impact on fruit yield of fruit size. So those new leaves become efficient at producing photosynthesis and photosynthates really fast. My recommendation is if you have a lot of leaf drop do not apply any extra fertilizer. Just keep an eye on the new growth, make sure that the growth looks green. If you see that the new growth is weak and/or that it is yellow, I would recommend applying some nitrogen, but that's about it. But if the new growth looks fine, do not apply extra fertilizer, there's no need. The plants will recover just fine, and you won't have any effect on the yield of fruit size.

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UNIVERSITY OF WISCONSIN-MADISON

CRANBERRY OUTREACH

### **Amaya Atucha on Growing Degree Days**

And then if I have one more minute, there's some questions about growing degree days that I've also gotten from some growers, thinking about tracking growing degree days, and I talked about this on the last Mini Clinic: growing degree days for plants do not work the same as growing degree days for insects. We don't have a good correlation between growing degree days and bud cold tolerance: meaning that you can track as much as you want, but we don't know when you get to, let's say, 500 growing degree days, so 600 growing degree days, whether those buds are more or less sensitive to cold damage. We've been working on trying to correlate this. My student Camilo Villouta has been working for almost 5 years on this, and we've been finding some new correlations, but growing degree days is not one that we're using because after 3 or 4 years of trying to correlate that with cold-hardiness, we have not seen a strong correlation.