Freeze Events in Late Spring

Wed, 12/22 11:38PM 18:41

SUMMARY KEYWORDS

temperature, freeze, cold air, vineyard, cold, vegetation, growers, field, spring, events, orchards, area, warm, freezing, farm, helicopter, air, eastern iowa, draining, weather station

SPEAKERS

Joe Hannan, Ray Wolf, Speaker 3

R **Ray Wolf** 00:15

Hello, and welcome to the Small Farms Podcast, a production of the Small Farms Program at Iowa State University Extension and Outreach. Our podcast covers the opportunities and challenges associated with rural life.

J **Joe Hannan** 00:29

I am Joe Hannan, Commercial Horticulture Field Specialist with Iowa State University Extension and Outreach, and welcome to the Small Farms Sustainability Podcast. With me today is Ray Wolf, of the National Weather Service in the Quad Cities. Welcome, Ray. How are you doing today?

R **Ray Wolf** 00:45

Great. Thanks for having me, Joe.

J **Joe Hannan** 00:47

Yeah, I really appreciate you coming on and having a chat today with me about freeze events in late spring. Why don't you tell me a little bit about your job duties at the National Weather Service?

R **Ray Wolf** 00:57

Yeah well, my title is Science and Operations Officer. And actually I do for our weather service office, which covers eastern Iowa, much what you do for vegetable and fruit growers in that my technical and scientific transfer specialists. So we look to get the latest and greatest

information infused into our operations to provide improved warnings and forecasts.

J Joe Hannan 01:24

Right, and so you're actually partly responsible for providing the updates when we have a freeze warning and things in the springtime. Right?

R Ray Wolf 01:31

Correct. That's an important part of our mission this time of the year.

J Joe Hannan 01:35

So Ray, this spring is then interesting, to say the least. I really feel like Mother Nature just kind of brain farted on what's going on here this spring. Do you have any comments about what's going on with our spring? How or why did we see such a cold snap around April 12th, April 17th time period?

R Ray Wolf 01:53

You know, it seems like in the last 20 years, I don't know where we've had a spring where at some point producers would say wow, this is kind of an unusual year, especially for older folks going back to the 60s 70s and even early 80s. But how consistent years were from year to year, pretty much. But it seems like in the last 20 years, the variability has really increased and that's likely a signal of our changing climate.

J Joe Hannan 02:21

I see. So this is kind of new normal for us right now, it seems.

R Ray Wolf 02:25

Right. In fact, I think it's an open area of research, specifically as to how the freeze threat has changed. We know going back to an event, I think it was 2007. During Easter, we had kind of the classic where we got a substantial warm up in March and it causes the vegetation to really come out of dormancy quickly and early. And then in Easter, not only did we have a freeze, it was record breaking, and actually caused about $2 billion worth of damage over a good part of the Eastern US.

J Joe Hannan 03:01

I believe I was doing my research project at that time, and I remember spending a few mornings out in the field rather cold trying to protect my grape plants.

R Ray Wolf 03:11

Right. In fact, in Missouri specifically, I know the grape industry down there took a big hit, I think estimated on the order of $400 thousand, $400 million. I can't remember the exact number but it was a pretty substantial hit in Missouri specifically and also Kentucky if I remember right.

J Joe Hannan 03:31

Looking back talking to some of our orchards, talking to our vineyards. It sounds like a lot of our vineyard buds were not really moving or growing at this point during April 12th, 17th time period. So vineyards are hurting middle to no damage this year. Talking to some of our orchards it really depended a lot of where you're at in the state, as well as what cultivars so some of our early blooming cultivars in the southern portions of our state took a little bit of damage to the flowers and things but I think for the most part, I think we came out of it pretty well. Unfortunately, you know, we still have what three weeks of time period where temperatures could drop below freezing, is that about right?

R Ray Wolf 04:09

Right. I think in sort of the I-80 corridor, we'd look to get into about the middle of May a little bit sooner farther south and a little bit later than that up in the northern tier counties.

J Joe Hannan 04:21

Yeah it's usually the same guidance that provide my growers here. So that's my understanding, as we get into this late April, early May time period I used I would say frost event, I think you corrected me and got me saying freeze event. But we can expect these temperatures to drop below freezing, you know roughly overnight into the early morning hours, and we're really looking at two different types of events, right, a radiation freeze and in advection freeze?

R Ray Wolf 04:46

Right, start with the advection freeze. That's a tough one to manage. And what that is, is when we have a cold front come through, we have cold and blustery conditions through the overnight hours. In fact, even during the daytime, and when the cold air coming in from up north is so aggressive that it's really a challenge to manage because of the wind and the atmosphere mixes. And it's hard to provide any warming to vegetation to counterbalance the cold windy conditions that we see.

J Joe Hannan 05:20

Before we move on talk about how we manage the infection freeze, we will talk a little bit about

what the radiation freeze is as well?

R Ray Wolf 05:28

Right, and that's the one where we can do some things to mitigate the cold and radiation freeze is when you have those nights where the skies are clear, and the winds drop off, and the atmosphere is really dry. If you're looking at the current weather conditions, if you have a home weather station or are watching the folks on TV, you want to see when those dew points are below 32 are below freezing, because that's when the Earth's surface will radiate out the heat gained during the day to the cold atmosphere of the night. And those nights we'll see usually during the evening, a pretty quick temperature drop, and it'll continue dropping all the way until even to about an hour or so after sunrise. And those events can get pretty chilly pretty quickly.

J Joe Hannan 06:21

Yeah, those are the ones it's really eerie to be sitting out in a vineyard or an orchard. Right you know, a couple hours before sunup, you think it's windy, you think you're going to be okay. And the wind just absolutely comes dead still, and the temps just kind of dropping and almost see your thermometer kind of dropping as you're standing there out in the field.

R Ray Wolf 06:39

Right and we used to at one office, I was that we would take what we call two inch temperatures, temperatures just on top of a grass surface. And it's not uncommon during those kind of events where that temperature is well below freezing. But the temperature at the weather shelter that we usually take or what you see, like reported from our airports, which is more of an eye level temperature and be above freezing. So as the night progresses, the temperatures will continue to get cold, and that gradient can increase even more. So you have the warm air is a law, but the cold air still remains at ground level. And of course, that's where all the impacts are.

J Joe Hannan 07:22

Ray, what can we do to kind of mitigate some of the damage from these events?

R Ray Wolf 07:26

Well, there are two things with the radiational freezes. One is to provide a heat source yourself as a producer through fires or some kind of radiant heating effect. If you've gone out to especially it's popular in the south now I've seen these radiant heaters at restaurants were at their outdoor eating area, they put up these radiant heaters so you can actually eat outside during chilly weather and you still feel pretty warm. That's one source. The other is to take advantage of the cold air that's actually in the atmosphere, just a few 100 feet up. And to that

end, there's been some use of helicopters to mix down that warm air aloft and to help take the edge off of the cold temperatures and either keep the crop above freezing, or at least mitigate how cold it gets.

J Joe Hannan 08:17

Yeah, I don't know if any of my vineyards have done it. But I know some of my orchards have brought in a helicopter to kind of knick some of the air with varying results, the biggest complaint or thoughts was that you really have to have a helicopter pilot that knows what they're doing to really get the air stratified and mixed in. And then, you know, timing of the helicopter refueling so that it doesn't hit right as temperatures are dropping, or, you know, right at that sun off time period. So kind of carefully planning on when you're going to bring in a helicopter is a bit of a challenge.

R Ray Wolf 08:47

Right, and one of the new things coming in. I haven't heard much of this specifically, but I could see utility is the use of drones to actually measure where the inversion is, that did that inversion being the interface between the warm air aloft and the cold air near the surface, I think would be an interesting opportunity to explore too.

J Joe Hannan 09:09

Yeah, actually one of my orchards did that they took up a drone to find out where that inversion layer was or where that warmer air was to kind of relate that back to the helicopter as they are flying out there over the orchard. Very interesting how you can kind of tweak that by adding that technology tool into it.

R Ray Wolf 09:26

Right, and another area and I've heard this more with strawberry growers because it's easier to manage on that scale, but is the use of sprinklers and what that does is when you turn the sprinklers on, you actually desire to have a light coating of ice over the flowers. And as long as you keep putting water on, we know that one water goes from liquid to ice it actually gives off heat. So you can hold the temperature of the flower very close to near freezing and again mitigate how cold things get. The problem is got to keep that water going until the temperatures are above freezing. Because if you turn the water off that ice will freeze and then the temperature will drop and your efforts will be for naught.

J Joe Hannan 10:13

Yeah, you can do more harm than good there.

R Ray Wolf 10:15

Ray Wolf 10:15

Right.

Joe Hannan 10:16

We actually a couple years ago looked at doing some of that with high density orchards. And it could be done in a vineyard as well, a couple of the challenges that we found was finding an appropriate water supply or finding a water supply large enough to feed that irrigation system, you know, we just don't have a lot of surface waterers that we're pumping out of here across the state. And it's just not an infrastructure that our vinyards and orchards have. And we struggled with getting good consistent coverage with some of the newer nozzles and things like that. So while I think it's an option, I think it's not on my high priority list of recommendations, right now.

Ray Wolf 10:49

Sure. And it can be quite messy, especially if we get into a spring like we had last year where we're so wet to begin with. Introducing more water into your fields might be the last thing you want to do anyway.

Joe Hannan 11:03

Yeah, if we got a wet season that you really make a mess of things and drown out and cause some other problems, or other long term health problems. So I want to back up just a bit because he talked about helicopters. What about wind machines? Do you know if there any wind machines on your side of the state being used?

Ray Wolf 11:19

I've not seen any, or have I heard any, any stories of them being used, but I know they are more common out west. And I don't see any reason why for radiational freezes, they wouldn't work here. But the idea is to use the wind machine, and the height that it's at to bring down that warm air and mix it with the cold air near the surface. So you maybe have experienced a similar thing in your house in reverse, you know, with ceiling fans and being able to mix warm air at the ceiling with colder air down low or in the winter time, maybe especially that can work to provide a more comfortable temperature for you.

Joe Hannan 12:01

Yeah, I think we have one in western Iowa, it's in an orchard not a vineyard. I think he's used it a few times. I think it worked well for him. I think his biggest thought or concern with it is he was running it off of PTO off his tractor and made the mistake of not refueling during the course of the morning. So that must use a fair bit of horsepower on that tractor to actually power it and run it all night. I think he said he started with a full tank of gas and it was out of fuel by the time we got back out there later in the morning.

R Ray Wolf 12:33

Sure.

J Joe Hannan 12:33

Nice reason, I guess to have powered into electric or, or larger diesel and auxilary tank.

R Ray Wolf 12:39

Yep. I think the common theme with all these radiational events is that it takes a gather a lot of hands on management. And it might be good to have temperature measuring devices around because it's surprising how much on a given farm even and I even see it in my yard here in eastern Iowa on these radiational nights, how much the temperature can change due to elevation because we can think of the cold air essentially flowing like water to the lower lying areas. So in my backyard, which is the low spot with a creek, you can actually walk from the front yard to the backyard and feel going from warmer to colder air. So knowing what the temperature is in these areas, and then being able to measure it while you're running your mitigation practices would give you a good sense of how things are going. The other thing I'll mention, I've not done a formal study on this but it seems to give folks a heads up that our weather service forecast probably underestimates how cold it gets out in some of these rural areas, especially if you're in a low line spot. Though, we do produce hourly weather forecast of temperature, wind, and dew point, but I would consider those temperature forecasts to be rather conservative and maybe plan for colder than what you see. And I think we saw that with this freeze event in the last week or so here across the southern part of the state.

J Joe Hannan 14:08

Based on what I'm hearing, yeah. Field conditions are a fair bit colder than expected. You bring up a really good point though about taking thermometers and measuring temperature throughout your fields. Really, that's a good idea to just be doing so you can now understand where those cold pockets are and help you identify if you have any cold pockets on your farm. And really if you have a cold pocket, especially if you're out in the rolling hills, helps you understand and identify if there's anything that is hindering that cold air drainage from your farm. I know it's oftentimes we'll have cold air draining down into like a fence line and then that fence line will have a set of freeze or shrubs or other vegetation that will prevent that cold air from draining further down the hill and you can start to track and identify that with walking through your field and then measuring it with a thermometer. Sometimes it does mean getting the bulldozer out, pulling out some of that vegetation in that fence line to make sure that that cold there does drain down and out away from your field.

R Ray Wolf 15:08

Yep, those structures can essentially act like a dam, you don't obviously see it. But with a temperature recording, you can measure it. And if you're putting in new ground, ideally, if

you're in a hilly area, you tend to want to favor the Northeast facing slopes, because those are the ones in the spring that are last to warm up. And those would be in a local microclimate on your farm would tend to be the coolest. So the vegetation development in the spring would progress the slowest there. In contrast, your southwest facing slopes, those are the ones especially with the afternoon sun, where vegetation with growth will progress the quickest in the spring locally. And it's interesting I've seen, you can basically use your resident as an example of the different facing slopes and see how things develop around your house at different rates and give you a sense of how you can manage the microclimates locally.

J Joe Hannan 16:12

Yeah, there's other advantages there too, just from looking at what kind of winter damage you get, and things on your trunks and stuff like that, from the north versus the south side of the slopes. I was gonna mention with the cold air drains, a lot of times what I'll have my growers do is go out and look at their fields during a fog, you know, in a foggy morning and kind of see if there's anything that's preventing or holding the fog up their hillside, rather than allowing it fully drained out of their fields. It gives them a little bit of a visual of what's going on out there.

R Ray Wolf 16:42

Yeah, that's really a great idea and and can show you because we know where that fog forms, the temperatures closer to the dew point. So you can visually see really where that cold air is draining to.

J Joe Hannan 16:55

So Ray, any final comments or any final thoughts you want to bring up on managing freezes over the course of the next couple of weeks?

R Ray Wolf 17:03

Yeah, I think I'd just emphasize and I learned this from a friend of mine who's a local strawberry grower is to kind of index what the temperatures are in your production area, or whatever the nearest reporting location is, whether it's the airport, you know, like in Des Moines on the south side of town or Cedar Rapids. It's also on the south side of town. So wherever you see your local TV news or get on the internet, look for the local weather station index, how the temperatures at that location compare your production area. So you'll have a sense when you see the forecast of how you can adjust it for your particular farm.

J Joe Hannan 17:45

That's an excellent point, Ray, thank you. Well Ray, I'd like to thank you for joining me today. I also want to thank Christa Hartsook and Olivia Hanlon at the ISU Small Farm Sustainability Program for editing and hosting these podcasts. Of course, I want to send out a big note to

anybody that listens and tunes into these. If you're interested in guest hosting with me, send me an email so you can set up a time I love to have guest hosts. Again, Ray, thank you very much for joining me today and have a great rest of your day.

R **Ray Wolf** 18:15

Alright, thanks for the opportunity to share some information and I look forward to seeing some of the produce from the growers out there in the state.

J **Joe Hannan** 18:23

Same here.

S **Speaker 3** 18:24

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