

University of Minnesota Nutrient Management Podcast Episode “Nitrogen management”

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(Music)

Paul McDivitt:

Welcome back to University of Minnesota Extension's Nutrient Management Podcast. I'm your host Paul McDivitt, communications specialist here at U of M Extension. Today on the podcast we're talking about nitrogen management. We have three members of Extension's nutrient management team: Dan Kaiser, Brad Carlson, and Jeff Vetsch. Can you each give us a quick introduction?

Brad Carlson:

Brad Carlson. I do water quality work. I work statewide. I'm an Extension educator. I base out of our regional office in Mankato.

Dan Kaiser:

This is Dan Kaiser. I'm a state nutrient management specialist with U of M Extension. I'm also with the Department of Soil, Water, and Climate on the St. Paul Campus.

Jeff Vetsch:

Jeff Vetsch. I'm a researcher and work out of the Southern Research and Outreach Center in Waseca. Been there for about 27 years.

Paul McDivitt:

All right, so [2019] presented a lot of challenges for producers with respect to performing timely field operations. What were some of the takeaways with respect to nitrogen management as we headed into 2020?

Brad Carlson:

Well, I think that, obviously, folks are aware that performing any field operation, whether it's fertilizer application or anything else, was very challenging because of how wet it was. We had quite a delayed growing season, and there did end up being pockets where the crop never did get planted. And so that came off of a wet fall, which, actually, then we ended up having a relatively wet fall again this year primarily because of how delayed harvest was, because of how it delayed the growing season was.

Brad Carlson:

And so I guess, realistically, when it comes to talking about nitrogen and nutrient management, most of the things that adversely impact nitrogen management happened. It was cool, so we didn't get a lot of mineralization. It was wet, which all of our loss processes are water based, denitrification and leaching. And then of course we had the additional challenges of just getting out in the field.

Dan Kaiser:

I mean, yeah, it was an interesting spring. We'll kind of see what happens here, the fall. I haven't gotten really a good read on fall 2019 of how much fertilizer got applied. I know there was some fertilizer being applied. It's still interesting, though, seeing some cornfields out there, although a lot of that fertilizer probably would've been applied to soybean fields just because of the crop rotation. So just to kind of see where things are at, I...

Dan Kaiser:

Interesting having a few discussions with some growers and some consultants, talking about some regionality in some areas about what nitrogen rates are being applied now compared to what our MRTN rates are. Starting to see some really high numbers, some growers still using some of the yield goal factors and using a factor of, say, one. Their corn following soybeans, which is a lot of nitrogen going down.

Dan Kaiser:

And we've seen instances, I know, Jeff, Waseca, there's been some pretty high nitrogen requirements at that. So I think we need to start having some discussions on what's our best course of action. And more recently it's... Back at the research updates in Morris, talking to a consultant, hearing some concerns from them too about losing fall application event and I was not completely sure on what they were talking about, but he was talking more in relation to many of the co-ops getting rid of anhydrous and going to urea, and that's one of the things that, with these wet falls we've had, it hasn't worked well. And I think we're going to have to start getting probably ahead of that with our BMPs and making some modifications sooner than later on that in terms of what recommended practices are, because we need to take a good look at that, which I know is going to cause a lot of heartburn for people out there, particularly retailers that have kind of gone into the realm of trying to get back out of anhydrous.

Dan Kaiser:

But if you look at trying to prevent regulation and trying to keep some flexibility for growers, we've got to be careful because it's a quick way to get regulations if we start seeing these risky practices. And for growers, too, I mean I guess you get some of these practices, you're guaranteeing repeat customers because they're going to have to come back and reapply just because of losses even if it's not being lost into the tile lines or into the rivers. I mean, there's still going to be some sort of economic penalty with that.

Dan Kaiser:

So we'll see. I'm hoping we've got a better year here in 2020, particularly in the spring because I'm kind of like anybody, like any grower out there. I'm getting tired of trying to rush to get everything in. Our livelihood's not dependent on it and that's the big thing. So we'll see what happens, but hopefully it'll be a better year going into this year.

Jeff Vetsch:

Yeah. I wouldn't beat on a dead horse, so to speak, but Brad brought it up. The timing has been really difficult in the fall, and it wasn't just again in the fall of 2019 going into 2020. In south central Minnesota, it was such a huge problem in the fall of 2018 going into 2019, so that compounded all these issues that we had with spring, trying to find field days to work in the spring because so many manure and fall anhydrous and other operations did not get done the previous year in the fall. So that had to carry over until spring and that was a real problem.

Jeff Vetsch:

I think the other two things from an N management standpoint that had been key, and Dan just mentioned it, source. Retailers getting rid of ammonia, guys getting away from ammonia because of wet field conditions either in the fall or in the spring, going to urea. Urea in south central Minnesota and southwest is looking not like a substitute for ammonia in the fall. In the spring, it's an acceptable practice.

Jeff Vetsch:

And the other thing is, Dan mentioned, is the rate. Several years in a row here where it's been wet and the demand for N or the optimum nitrogen rate's creeping up there and we're seeing a lot of guys putting on more N. And I think the thing is, as I've tried to emphasize, is to start with that pre-plant N rate that's somewhere near our recommended rates or maybe at the top of the recommended range, and then have a Plan B. If it gets wet, assume you're going to have to put on supplemental N, and that can be any source that your retailer and that you have equipment for. And the last few years, you

almost need a Plan C, because we've had times when Plan A didn't work and Plan B didn't work and we need to resort to Plan C.

Jeff Vetsch:

So it's been challenging and it's really added a lot of stress level, not only as Dan mentioned, to researchers, but our livelihood doesn't depend on it. It's even more stressful for the retailers and certainly for the growers.

Brad Carlson:

Well, part of the thing with rate also is, it's frequently used to mask other management... I guess problems is what I'll say. If you're not following good practices, for instance, if you're doing fall urea or if you're applying when it's still too warm in the fall and so forth, frequently when we get reports of, "Well, I needed 200 pounds following soybeans," or something like that, it's compensating for something else, a decision that could've been made better. And so you're using rate to mask some other problem. Now that being said, obviously the topic du jour here is how challenging the year was. And so we do acknowledge that there definitely were things that were out of people's control, and as I've always said, the loss processes are water based. So in a wet year, you're going to lose more nitrogen and you need to figure out a way to manage that.

Brad Carlson:

That being said, one of the messages that we have when we do our Nitrogen Smart programs is understanding the risk levels of various management practices, and there are management practices you can employ that are less risky and will help you get back down to a more reasonable rate. And so particularly the closer the application is to the time the crop needs the nitrogen, the less risk there is to the loss to the environment. And so I guess I'm not ready to say we can't be putting on fall nitrogen. Obviously, when we get into southeastern Minnesota, we don't apply fall nitrogen anymore. But the wetter it gets on the eastern side of the state, the more we've really got to take a look at that. As far as whether or not that's a good practice, at the very least we ought to be managing in a pragmatic way, kind of based on conditions.

Dan Kaiser:

Well, and I think, just kind of thinking back, I stopped some of my sidedress timing studies a little too soon. I mean, we haven't had any out the last two years and it'd been interesting to see that in some of these areas. I mean, I'd think, as Brad I think hit the nail on the head there is, we don't really know if some of these areas that need a higher rate, if it's simply that that's the case or that if we have changed some sort of management practice and go to maybe a split application, if that would've helped out.

Dan Kaiser:

I haven't been a complete proponent for the entire state going to split applications because we don't always see the benefit, but there's likely some areas out there that probably should start looking into it. And on the retailer's side, I mean, really what we need to be looking at probably is more options for going in right after planting and starting to apply fertilizer, because that's the only way I can see it working if we have the falls that we had, is to try to give us more time as to go into the season after planting and AG Retain or MVPT. Those urease inhibitors are very good products. We can do a lot with them with surface applications to try to stretch things out.

Dan Kaiser:

Really, I look at that... We just have to see what 2020 will bring in. We kind of hope that the year's better, but you never really know. So the question is, really, what do we start planning for? And that's one of the things I think you see these rates creep up because we're planning on what happened the previous year and surely these growers are probably getting high yields, but they might be able to do that without less cost, too. So there's some trade-offs there.

Dan Kaiser:

And I don't like to hear over 200 pounds of N being applied in corn following beans if possible, because you look at it consistently, yeah, we've seen our numbers creep up where we're more probably that... Jeff, 140 range, maybe 150.

Jeff Vetsch:

150.

Dan Kaiser:

Kind of with that. That should be probably a good starting point based on our MRTN values, which we've seen creep up in the last three, four years. But we just need to be careful because everybody's really complaining that nobody wants regulation, but what we also need to kind of also factor in that if it could be bringing that on, if some of these practices that we're doing are risky, that we should be looking at things that may be able to at least get that rate down to a more reasonable level.

Jeff Vetsch:

Yeah, in south central and southeastern Minnesota, I would agree with you, Dan. I would say if you go back 10 to 15 years, we probably only get about 25% of the time that we see an advantage to split application versus all preplanned. But over the last five years, I would say that, specifically last year, in the studies we had, we were probably more closer to 50% or greater where we're seeing a response to split application.

Brad Carlson:

Yeah, I was talking to a private agronomist, a friend of ours that we work with a lot, and he was telling me, in particular, corn on corn, they were really seeing a big advantage to split application these last two years when it's been so wet and challenging. And to the point where he's telling customers that have corn on corn, "You should just simply be planning on doing split application." And I know, historically, longterm we've really not made that recommendation. We've always found that split applying is a fine practice to do, but not necessarily always found a yield advantage to that. But in a situation where you got wet soils, that's a case where you likely will find an advantage.

Dan Kaiser:

And the issue is always getting back out to the field. That's, I know, caught a few growers with plan splits. So I think one of the things to be careful of, and there's really no reason to delay too long with the split. I mean, it really, I think, Jeff, what, V6? We like to have most of it on by the plant split. So if the weather conditions are favorable and you can roll the corn, it's time to get out there and start doing it. Because I don't think... You look at some of Fabian's data, there may be a little bit of variation in terms of those early stages and what's beneficial, but it's not much. I mean, there's bigger penalty for waiting too long, so it's just a good idea to make sure you can get out there and have the time to do it.

Jeff Vetsch:

Yeah, I think the thing that I've always seen in south central, southeastern Minnesota on medium and fine texture, well drained, poorly drained soils, in corn following soybeans, you got a bigger window. I mean, you can get by with less N at planting or pre-plant, and then put the majority on as a sidedress. And your window of opportunity for that, maybe, Dan, goes as far as V8 if you've got high clearance equipment.

Jeff Vetsch:

In corn on corn, I wouldn't go that route. I would think you really need to think about having at least 50% on at pre-plant, and if you want to sidedress the rest, that's fine. Or even a two thirds, one third. And Fabian's got this study at Lamberton, it's seen some advantages to using ESN pre-plant and then sidedressing the rest. And maybe that's a place where you could go 50/50 or two thirds, one third or something like that and keep some of the costs down, and at least you'd have some protection against that earlier season losses.

Dan Kaiser:

Yeah, and ESN's one of the things, too, I think we need to start taking probably a bigger look at now. I mean, obviously the company's been telling us that for a while. I mean, a lot of the data, if you look at it, we haven't really said there's been a big difference, but you start looking at it again and you start seeing some instances where there are some definite advantages. I don't know if it's an advantage to go to

100% of the product, but I know in terms of a product working, that product works well. So we have some very good documented evidence compared to some of the other inhibitors where it's hit or miss. I mean, we know that urease inhibitors work well in terms of what they're supposed to do. It's really the nitrification inhibitors that have been more of the issue, that have been more of the question mark.

Dan Kaiser:

And I think my fear is that there's this big reliance, that these nitrification inhibitors are going to be the savior of keeping fall urea around, and it's just still not looking very positive with that. So we still have to kind of, I think, not use these products as supplements for bad decision making, because they don't really give us that type of advantage on that. But, I said, certainly some good products out there, but we need to... ESN, I think, is the one that definitely probably needs another look at.

Jeff Vetsch:

Yeah, I would agree. I would agree with your assessment there, Dan. I think that using a nitrification inhibitor, either pre-plant or with fall urea, is like putting a bandaid on a huge gash. The better source, then, would be to use something like ESN instead of that. The money that you would spend on that inhibitor would be warranted to put on 50 or 60% or something or other of your N as ESN pre-plant, and then the rest as a sidedress. And that would certainly give you some pretty good protection.

Dan Kaiser:

And one of the things, too, that I think we don't talk too much about, which I guess I never considered too much, is the volatility issue that urea still can have even with cold temperatures. And if you look at some of the data, I know there's been some out in western US, they were looking at winter application of urea for winter wheat situations and looking at N loss. I think they're finding upwards of 40, 50% loss just from volatility, from surface applications without incorporation.

Dan Kaiser:

So when you look at it, there's too many loss pathways with urea, particularly where you get a lot of water, these really moist falls, just isn't the best option. ESN, it should be cool enough where it'll limit the release of the nitrogen out of that polymer. So I think the benefits there, it's just the cost effectiveness of that product is relatively expensive to buy. So that's the thing you kind of have to weigh against the difference. So maybe it's, if you want to do fall application, maybe we should be looking at a portion of that, just the ESN in the fall. Put that on, then come back with sidedress application. I mean, there's probably some things we need to be looking at here in terms of some different options if growers still need to stick with fall application.

Jeff Vetsch:

Yeah, and I think, Dan, the other point, and this came up last week when I was touring around the state speaking about fall application of urea, growers said, "Well, in our areas, a lot of times the ground gets tilled in the fall and then the fall application of urea comes after tillage." And then maybe they go back with a vertical till tool or something or other, but it's probably even not getting adequate incorporation either in some circumstances. And that's leading to some volatility concerns as well.

Dan Kaiser:

Yeah, less than two inches incorporation. I mean, that's not a good thing. I've seen we'll be talking about that at some of the N Smart programs. I think that's some data that Fabian was sharing on that, looking at tillage depth. And you still can see some substantial losses with that. So we know, even with tilling at appropriate depths, we can see some losses. So it's just, be careful. There's a lot of things going on and these wet conditions have caused more uncertainty in terms of some of these standard practices and even some of the new things that are being reported. We need to be careful because there's too much of an environmental... We start looking at the issues that are out there and some of what's going on internally in terms of these nitrogen rule that... There's a reason why it's in certain areas because of the loss potential, but you don't want to have to expand that over the whole state of Minnesota just because we're doing practices that aren't optimal for the areas.

Paul McDivitt:

There's been a lot of talk about changes in climate and weather conditions. How can farmers and their advisors best evaluate what is just natural variability and what might require longterm changes in management?

Jeff Vetsch:

Well, I've presented at CPM Short Course, and looking at longterm weather trends and precip across southern half of the state, and then also at Morris and also at Crookston. And what I've found is, if you take these mean precip down into 10 year periods and look at total precip and also growing season precipitation, at Waseca is kind of the epicenter of getting wetter. We're increasing our precip. From the 1920s to the current year, we're increasing at a rate of about 0.15 inches of precipitation annually over that period, which is really significant. And more than half of that is coming during the growing season at cities like Grand Meadow, Lamberton, even Brookings, South Dakota. I looked at those, the ranges were about 0.1 inch per year over the same period. And when we look at 10 year intervals and about 60% of that coming during the growing season. At Morris, it was just slightly less than that, and at Crookston, they're seeing about half that much.

Jeff Vetsch:

So, certainly, for the southern half of the state and into the west or southeastern Dakotas, and I would assume that north central Iowa, northwestern Iowa, northeast is seeing similar patterns.

Jeff Vetsch:

It is significant and it's going to have to change people's thinking about management. And in south central Minnesota it raises a question about fall application of N and where that's going to go in the next 10, 20 years. Next year at this time we will calculate our new 30-year normal at Waseca. We are currently at, I think, 36 and about a quarter inches. It will go up over two inches next year. That is a huge change. This year we're at 48 inches annually. Last year we were in the upper 30s, low 40s. We're getting two thirds or 60% of that during the growing season over the last five years at Waseca. Only 2017 was near normal precip. All four other years were 30% or up to 50% greater than normal. That didn't just align with the total annual. It also showed up in the growing season. So that's a huge difference from what we've managed back in the 80s or certainly even in the 90s.

Brad Carlson:

So, if I remember right, Jeff, wasn't the average annual precip in our area, and I grew up within 10 miles of Waseca, was 28 inches in the 70s, if I remember right.

Jeff Vetsch:

Correct.

Brad Carlson:

Which would have encompassed the 1940s, 50s, and 60s. And then you'd use that 30 year average in the 1970s, so that's 10 inches more precip since the late 1970s, really.

Jeff Vetsch:

Yeah, and next year the normals will come out. We'll be in the low to mid 38 inch range, which is really astounding compared to where we were 40 years ago.

Brad Carlson:

Yeah. And so when we talk about making changes and all, particularly we're talking about nitrogen here, it's important to recognize our BMP regions, to a greater extent, are based on soil types. So we got our loss soils in southeastern Minnesota, we've got sandy soils in the central part of the state. Then that dividing line, though, between south central and southwestern Minnesota really was more of a precipitation based one.

Brad Carlson:

Historically, there was a line in there where the amount of evapotranspiration exceeded the amount of precipitation, that meaning there's more water either evaporated or used by the plants than fell from

the sky, which then, based on that budget, meant that that water was coming out of groundwater sources or stored water instead of falling from the sky. That line has moved way farther west. And so we need to be looking now at the practices we originally were recommending in southwestern Minnesota with some suspicion because the conditions on which they were based no longer exist.

Brad Carlson:

And then in addition to that, I think we also have to recognize in south central Minnesota, now that we're getting this amount of precipitation, while the soil types are certainly tighter than southeast, and so they're not as conducive, say, to leaching losses because of the clay loam soils, though, and the ability that the cells have to hold moisture in them, they are subject to denitrification. And so we've seen some longterm averages, I know, Jeff, and a lot of the research at Waseca, particularly the drainage plots where we've been able to measure what goes out of the drainage, where, for instance, we don't see a lot of difference in nitrate loss through the drain tiles, whether it's fall versus spring applied anhydrous ammonia.

Brad Carlson:

Yet we'll see, in some years, some pretty significant yield differences between fall versus spring. Those are real. They're caused by nitrogen loss through denitrification into the atmosphere. It turns back into N₂ gas, which is inert. It's not an environmental problem. But that being said, somebody bought that nitrogen, it's being lost, and then it's also impacting your bottom line further by impacting yield, and so farmers need to really think about that. We recognize that there's a lot of stress being placed right now on when we're suggesting not applying fall nitrogen anymore because of the infrastructure we've developed for the application of fertilizer. But the facts are the facts. If we're seeing major yield hits with fall application, I guess each farmer, to themselves, make that decision on whether you still think that's appropriate.

Jeff Vetsch:

And I think there's two options for growers to think about, and they can talk these over with their retailers. And one is an option that I see more of in south central Minnesota, and that is retailers and growers putting on less fall N. They're not putting on their full rate, whether it's for corn after beans or corn after corn. They may be putting on 60 or 70% in the fall and then sidedressing the rest or applying the rest in the spring, and trying to reduce the risk of what could potentially be lost at least somewhat.

Jeff Vetsch:

And we have some data at Waseca that says that that's a practice that can help. It's probably not as good, obviously, as applying everything in the spring, but it is better than applying everything in the fall. And then I think the other logical thing is, if a grower farms 3,000 acres or 1,500 acres of corn, consider using fall N on one third or half of your acres instead of all of them, and then put spring application on

the others. And that's a good way to manage risk, and at the same time, free up a little bit of time in the spring so you're not relying on putting everything on in the spring.

Brad Carlson:

And that's the point that we've made with Nitrogen Smart and the program. And one of our decisions scenarios we talk about at the end is prioritizing where, if you're going to apply some fall nitrogen or you need to apply some fall nitrogen, look at what fields are most susceptible to nitrogen loss and then eliminate those. So your sandier soils, move it to the spring. Your soils that are poorly drained, where you're going to pond water, while those soils are bigger challenged for spring application, there's no point in doing a fall application if you're going to pond water for six weeks in the spring before it finally drains out and dries up. You could lose a lot of that nitrogen you applied. Just simply look at doing the application later in the year.

Brad Carlson:

The one advantage we've got with urea is the flexibility we have to get that applied in a hurry. So yes, it's a little more expensive, but when we moved to a urea application in the spring pre-plant, you can get a lot put on in a hurry. And so we do at least have that advantage.

Dan Kaiser:

The interesting thing, I mean, recently I was talking to a group and what they brought up was was looking at this question. I talked about logistics and they said, "Oh that's not as much of a problem because you see some farmers now going to buy their own application equipment." And we might see that more. Having more on-farm storage of their own. So I think the general thought, and one thing was broad, because then at least they don't have to wait for anybody to come out and apply it. So I mean, what we may see are more retailers having more application equipment. Because I guess I don't see any way around this. We start looking at our issues. I mean, unless we have a source of N that we can completely limit the potential risk for it to be converted in the fall.

Dan Kaiser:

I mean, we have to start talking about some of these things because there just isn't the perfect item out there that can help. I mean, we know some things that are probably better than others, but there's still risks involved with everything. And economics right now, you look a lot of the numbers, I mean, you just really can't afford to give up bushels by some of these practices. So I think that's the main just with farmers talking with whoever's helping them make their decision is, what practices maybe giving up bushels that we should be looking at that we need to be changing right now. It just doesn't economically make sense to do so.

Paul McDivitt:

Will these factors be part of your educational messages this winter?

Brad Carlson:

Well, for sure what we've been talking about has been embedded in Nitrogen Smart right from the very beginning. We talk about, and Jeff already mentioned this, that you start with university recommendations. That should always be your starting point. And then if you're going to vary your management, be thoughtful about why you're changing it from one thing to another. And so we talk about, specifically, what those conditions are, where you're going to flex your management, whether you've got ideal conditions. We don't talk a lot about reducing rates below university recommendations. I think the fact of the matter is that the research tells us that opportunity's on the table, it kind of becomes a question mark of how can we reliably predict that. But I think, particularly, we understand where we're going to lose nitrogen, where we've denitrified, where we might've pushed it lower in the soil profile.

Brad Carlson:

Those conditions can easily be identified as well as farmers can pretty easily assess, for instance, how wet it was last fall and what the implications that was going to have on your management practices. And so, really, we do need to be thinking about that. When we got an extraordinarily wet fall, we were time crunched anyway. I know that the dealers had issues with how much product they had and they had it stored and they wanted to get it out there. But you do need to be thinking also, though, about what's best management for you.

Dan Kaiser:

Yeah. Applying to fields at non-optimal times in essence to store fertilizer on the ground isn't necessarily the best option in some circumstances. That's one of, I think, the big things with it. So.

Jeff Vetsch:

Yeah, and I'll certainly be addressing in nitrogen management at a few more meetings coming up here through the winter and into early spring. It's always been a hot topic and it results in job security.

Paul McDivitt:

Yeah, I know we've got that nitrogen conference coming up February 18th, and what's the location for that one?

Brad Carlson:

Alexandria.

Paul McDivitt:

Alexandria.

Brad Carlson:

Arrowwood in Alexandria.

Paul McDivitt:

Okay, great. All right. That about does it for the podcast this week. We'd like to thank the Agricultural Fertilizer Research and Education Council, AFREC, for supporting the podcast. Thanks for listening.

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