

University of Minnesota Nutrient Management Podcast Episode “Post-planting management of nitrogen”

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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 post-planting management of nitrogen. We have six members of extension's nutrient management team: Dan Kaiser, Annie Nelson, Fabian Fernandez, Greg Klinger, Brad Carlson, and Jeff Vetsch to cover the basics and beyond. Welcome. Why don't you each give us a quick introduction?

Jeff Vetsch: Hi, I'm Jeff Vetsch. I'm a researcher and soil scientist at the Southern Research and Outreach Center in Waseca.

Dan Kaiser: I'm Dan Kaiser. I am a state soil specialist focusing on nutrient guidelines for the majority of the commodity crops.

Brad Carlson: Brad Carlson. I'm extension educator. I work out of the regional office in Mankato. Deal with nutrient management and water quality issues statewide.

Anne Nelson: Anne Nelson. I'm an extension educator out of the St. Cloud regional office, and I deal with nitrogen management and water quality.

Greg Klinger: Greg Klinger. Extension educator mostly dealing with nitrogen management in the southeast part of the state.

Fabian Fernandez: And I'm Fabian Fernandez, nutrient management specialist from the campus here in St. Paul. And I work primarily on nitrogen management for growing cropping systems and water quality.

Paul McDivitt: All right. Let's get started with the first question. How important is nitrogen applied prior to planting?

Fabian Fernandez: Well, it seems like it depends. For farmers, it's very important. It helps them sleep well to know that their nitrogen is applied before planting. For the plant, actually, it's not that important. I mean, the plants need nitrogen, but not a huge amount. And so it is important to help the plant develop, but typically, there is

enough in the soil that you don't really need to apply a huge amount of nitrogen for that crop to start, especially in corn after soy bean season. So, continuous corn, that's more of a priority, I would say. In those systems, in continuous corn, you want to have a little bit of nitrogen. But, again, you don't need a huge amount, because the plants don't really need very much early on.

Jeff Vetsch: Yeah, I would say ... I would agree with you, Fabian. Especially in corn after soybeans, you need very little. You could probably go out there and plant your corn and sidedress it without any ... minimal risk. But in corn on corn, I think it's important that if you don't have some on it planting, or prior to planting, that you sidedress extraordinarily early and don't wait very long.

Brad Carlson: I think it's important to mention the fact, that I think is probably obvious to everyone, the reason ... One of the reasons why we're covering this is as a topic is the amount of fertilizer that normally would have gotten applied last fall, or also this spring, as it's been a very wet year and delayed spring, farmers just simply aren't getting the fertilizer on the way they intended to. And so I think it is important to think about what your options are, and don't just simply think that you need to delay planting until you can get your fertilizer applied.

Dan Kaiser: Well, and I think that's one of the things that Brad brought up. We don't really know what the spring's going to be like, but I think the main question is in areas where they didn't get the plant nitrogen on. And one of the things I like about this discussion really boils back down to the fact that people taking some, what I would call risky practices in fall, just to get the nitrogen on. And I know, certainly, there's some logistics there for the retailers, in terms of storage. But storing on the ground isn't necessarily a good idea, if the ground's frozen, because it really isn't going to be much storage on the ground. And, frankly, looking at where it's going flow out the field, you almost could unload it in the spots in the ditches, because it's going to end up probably in those spots anyway, for if it's applied to frozen ground.

Dan Kaiser: So you just got to kind of be careful. So, one of the things, looking at these fall, and we don't know what the spring's going to be yet like, is just looking at other options that are out there. We have more flexibility with nitrogen, so that's the main thing with it. And maybe not as much in irrigated. I don't know. Looking at options there, I mean, it might a little more like corn on corn with that. But just having multiple options is really a good practice. And if you have the ability to wait, wait in the spring, and make sure you get things planted.

Brad Carlson: And I know we were talking here, before we started recording, about the whole issue of if you've got your nitrogen ordered, and you're waiting to plant, or you're ready to plant. And you know that the application is imminent, but you're ready to go in that one particular field, and the applicator hasn't been out there yet. Let's just say you're having surface-applied urea put on. It's probably really

not that important to be delaying planting at all if you know that the application is imminent, maybe even yet that day or within the next day or so, because it's that close. Just simply get planted when you can plant.

Fabian F.: Yeah. And I think that that is a very important point. Because, depending on how the spring comes, sometimes you just have enough of a window to either apply or plant, and I would say plant, even in continuous corn. Because the chance that you will have enough time to apply nitrogen after planting, before the plants really are affected by the lack of nitrogen, if that's a condition that you have in your field, it's pretty limited. You normally have enough of a window to apply that nitrogen, but every day that you delay planting is another day that you are starting to reduce the yield potential of that crop.

Paul McDivitt: All right. What options are available to farmers to apply nitrogen at or after planting?

Dan Kaiser: Well, I think one of the things that we focus a lot on, on starter fertilizer, and that's if there is concern about not having enough, particularly with growers that may be shifting away from in-furrow, because they aren't seeing as much value. I mean, we've done a lot of work. Jeff, you've done a lot of work with surface dribble band, with the planter. And I think there is some options out there, particularly with nitrogen and sulfur, which make that a decent option. And I know, Fabian, there was some studies too, looking at that too, putting on a roughly about 30 pounds or so.

Dan Kaiser: I mean, the main thing is looking at when you can get back in, I think, and get a second application, if that's going to be your option. You need to kind of, with your rates, set your rates based on that, that timing. If you're not going to get back in soon, you might want to up that rate a little bit more, and push it a little bit more. But that's definitely an option because we see situations where ... I mean, unless you're in some really high pH soils with low P, that in-furrow doesn't always do a whole lot, particularly with situations where growers have already high or very high phosphorous. So, I mean, looking at a separate option like that would allow you to use that equipment you may already have on the planter, and just maybe do some easy modifications to it to divert where that fertilizer's being applied.

Greg Klinger: Another situation where I think starter is really critical is for growers that do cover crops. We often see that, especially a grass like cereal rye, that can pull a lot of nitrogen out as it decomposes. It creates a situation where corn cannot have really ... or can need a lot right there by the seeds. So having it or dribble band, or two-by-two of 30, sometimes up to 50 pounds, is really critical in those situations.

Fabian F.: The other thing that is important to consider when you are applying fertilizer after planting is the positioning of that fertilizer, and what happens in those conditions. So, for instance, in springs when it's wet and cool, if you go within a [HIATUS 00:07:50] application, typically it takes those plants a little bit of time to get to that fertilizer band. And so you may look at your field and see that corn is all pale and not growing very well, and then it will take off. And that's simply because of the positioning of that nitrogen. It takes those roots a little bit longer to get to that nitrogen. But once they reach the band of fertilizer, then the crop will develop fine.

Brad Carlson: I know there's a lot of questions regarding how much fertilizer you want to put on with the planter. I know I always suggest to guys ... Well, obviously, if you're dribbling it on with the seed, you do have some concerns, but there's a lot of a ... We're kind of going back to a lot of application technology that's either laying it on the surface, or going off to the side. Again, that's been more commercially available. I think a lot of guys need to think about how often they feel like filling their fertilizer tanks, because that tends to be maybe a larger concern. I've had a lot of guys say, "Well, I thought I'd put a lot on, until after every three rounds I had to come back and fill the tank again. And then I realized that maybe that wasn't such a good idea." I don't know. Jeff, you've had a little more experience with some of the products in-furrow, as far as how much you'd dare put on in contact with the seed, right?

Jeff Vetsch: Well, we've always used the rule of thumb of nitrogen and potassium and sulfur are no greater than 15 pounds in-furrow. And I think that's a pretty hard and fast rule. So when you add those three nutrients up, that isn't very much. As Dan mentioned, you're going to need some kind of surface dribble band that's not in the furrow, and maybe even couple inches off the row, if you're going to raise these rates of N, K, and S above that 10 to 15 pounds.

Dan Kaiser: And I usually say more probably closer to 10 pounds with that. Because, I mean, you look at what the investment in seed is right now, particularly with in-furrow, if you're investing over \$300 a bag, I mean, that's a substantial amount of money to put out there, and to risk some damage with that. So, I mean, really looking at keeping those rates low. And, really, with nitrogen in-furrow, I mean, the urea is ... it's a big component of it. And it's really anything that liberates ammonium. And that has a tendency to have ammonium hanging around, so you just have to be careful with that. So there's some options but it just really isn't going to completely get you where you need to be with a complete application, if you need more than 10 pounds.

Jeff Vetsch: One of the other factors, that I think's going to come into play for some growers this spring, is we've seen more and more of people impregnating their herbicides, their pre-emerge or pre-plant herbicides, on urea. And if some of

these spring applications are delayed at their dealer level or wherever, and those things don't get on, that causes some concerns and issues. And it's possible that you could, if you switched to putting your herbicides on pre-emerge or after planting, that you could use UAN as a carrier for those herbicides as part of your end supply, and then follow up with the remainder of it at a later date. And that would buy you some opportunity time too, as well.

Dan Kaiser: I think that just gives a good excuse for looking at pre-emerge, at that point too, if you're looking at it. Because we've seen a lot of instances out there that you get, particularly with some of the hard to touch weeds like the ragweeds and stuff out there. You see some pretty weedy fields, so it's kind of nice to at least give you an opportunity to do ... when they see that.

Jeff Vetsch: Yeah. The biggest risk there is just to make sure that that corn isn't spiking, if you're going out there with UAN as a carrier for a pre-emerge herbicide, because it can be pretty hard on it.

Dan Kaiser: Yeah. And if you mix ATS in with that as well, too, that's ...

Jeff Vetsch: Makes it even worse.

Dan Kaiser: It gets even worse.

Fabian F.: The other thing too is with urea broadcast applications, if you're leaving that urea on the surface, obviously after planting, making sure that you have rain in the forecast, so that it will incorporate or use urease inhibitors, such as AGROTAIN for instance, as a way to buy you a little bit longer time for incorporation with rain, to avoid volatilization losses, is an important thing to keep in mind, especially in no-till's fields or fields with a lot of crop residue.

Brad Carlson: Well, and then also on the other side, Fabian, if there's not a lot of residue, we could see it very dry on the surface and high temperatures, which can also drive that too. So both extremes with residue can cause that volatilization loss out of urea, and really make it pay to put a urease inhibitor on it.

Dan Kaiser: I mean, really, when we talk about some of these post-planting options, particularly with urea spread on the surface, I mean, urease inhibitors, I think there is some advantage for that, particularly when we don't know when we're going to get a rainfall. And we'd really like to see you think about a quarter inch rainfall or so to get that effectively incorporated. But it still doesn't mean we're not going to lose some of them. The other question about UAN, and whether or not you would include something with that, and, I mean, I think it really depends on rate. If you're going with most applications, I think that are with herbicides, I don't think I would really worry too much about it. But the question was specific to a grower that was putting a heavier load of nitrogen on more of it. If you'd be

putting that down more than maybe 10 gallons of UAN, or 28%, would you recommend it?

Dan Kaiser: And it's a tough one because, really, the options out there, I think, are ... I mean, with a urease inhibitor, really AGROTAIN Plus, based on everything I've seen, and maybe ... I don't know if Coke, one of their new products out there, they have some urease inhibitors on it. But some of the other ones out there really haven't shown much of effectiveness on the urease activity. So I think I would kind of be careful with some of that. And then, on the nitrification side, I mean, I don't know if anybody has any comments at this given point in time, once you start getting post plant. I've never really been overly a proponent of nitrification inhibitors at that point in time, except maybe on some sandy soil.

Anne Nelson: Yeah, definitely. So when we look at our BMPs, we do recommend, if you are going to put all that nitrogen on early in the season in those sandy soils, to use an inhibitor, because it's going to get you out at least a few more days than if you didn't. Of course, we would still prefer a split application, or several, in those sandy soils. But another thing you also need to think about is if you are putting these on, these nitrification inhibitors, is that it's a lot warmer in the spring and in the summer in those soil temps. And these nitrification inhibitors really start to degrade a lot faster than in the fall, when it's much colder. So that's something to think about. Maybe you're thinking you would have gotten 10 days on average with this inhibitor, and it's probably going to be shorter now because of those higher temps. So also something to think about ... I don't really hear of anybody putting them on in the heavier soils. It's probably not your best bet. Maybe for the fall application but definitely not after planting.

Fabian F.: Yeah. I think it's important to look at these things in terms of the probability of getting a benefit out of them. It's not that the nitrification inhibitor doesn't work in the spring, it's just simply, well, as Annie said, that the efficacy of them typically gets reduced because it's warmer, so they degrade faster. And then the other thing is what is the probability that you will lose that nitrogen before the plant can use it? And so, in a fall application for instance, when we apply anhydrous ammonia with a nitrification inhibitor, well, that makes sense because you have a really long window of opportunity for that nitrogen to be lost. And so anything you can do to preserve that nitrogen in the ammonium form, you have better chance of that inhibitor working for you. In the spring, especially after planting, typically you don't have as much of an opportunity for that inhibitor to work to your advantage. It won't reduce your yields but you will be paying for something that you don't really necessarily need.

Brad Carlson: Yeah. It's important to remember that nitrogen lost, nitrate lost, is water driven. And the conversion to nitrate is microbial in nature, so controlled by temperature. So, as it gets warmer, that's going to happen faster. But early in the growing season, it's still relatively cool. We're talking about at planting time. And

so your conversion to nitrate is going to still be relatively slow at that point. So your risk to denitrification, while it certainly exists, it's really not as severe at planting time as it is some of these years when it gets really wet late in the year, like 2014, it was wet in June and it was wet until the end of June. When the soil temperatures are really warm, that's where our extreme risk is to loss for denitrification, to lose large quantities of the nitrogen we applied. As with last year, we saw some of those circumstances also.

Brad Carlson: So, as Fabian says, your risk to loss just simply isn't quite that great when you're dealing with these applications at about planting time. And the thing about it is, as Annie talked about, as it gets warmer, the nitrification inhibitor gets used up, basically. And so when we get to the point where we also have to see if there's risk, well, the odds the nitrification inhibitor's worn off. And so, like Fabian says, they work, it's just a question of whether they work long enough that they actually paid for themselves.

Dan Kaiser: Yeah. And I think I see the data. I know some of the data out of Waseca, Jeff, with some of the fall ... with anhydrous, I mean, they're not always effective. I mean, there are certain circumstances. I mean, you really need to kind of look at ... There's information, long-term, to see what that average is. Because you may see a year here and there where there's a benefit. But, economically, I mean, does it really matter in the end, I think is the main question with those inhibitors.

Fabian F.: One question that I have also been asked before is with UAN solutions, you know? There are inhibitors that can be used for that. And the first thing that you need to think, I mean, what we were discussing earlier, is very relevant for that. The other part too is, with UAN, you already have 25% of that nitrogen is nitrate, so a nitrification inhibitor's not going to help with that 25%. And so, again, the potential that you see a benefit from having a nitrification inhibitor with that is reduced substantially.

Dan Kaiser: And I think the thing to look at, too, is the corn's growth patterns. I mean, we look at, essentially, the rapid uptake period starting at about V5 to R1. I mean, that's the time you really don't want to short yourself. So you'd have to be somewhat careful where you don't want to be too limiting at that point in time. But, I mean, people are really trying to go to that spoonfeed approach. We just have to be really careful, in terms of not being too overly limited to seed we may see a reduction in yield.

Paul McDivitt: Is there anything growers should be concerned about long-term that could affect how they manage nitrogen, for example, unpredictability in weather?

Dan Kaiser: I mean, I kind of look at this question and I think kind of the focus here is looking at how long of a memory growers should have, in terms of management. And

with the years we've had the last couple years, you wonder how much reactionary we are in terms of changing management based on the previous year with that. And I think kind of looking at just like ... So I just went through and we're looking at updating the nitrogen guidelines, and we saw some pretty significant loss patterns the last couple years as ... Really, the question here, should growers I think be concerned about that? I mean, do they need to be drastically upping their rates for ... just because it was a bad year the year before, really, or how they should be looking at it.

Dan Kaiser: Because that's kind of my fear when we start talking about nitrogen loss. A lot of our recommendations are geared towards averages, kind of look at it as at a starting point, and then making adjustments at that point. And I think that's one of the ... I think, just a good discussion point with growers. I mean, if they're looking at who they're making their decisions with the fertilizer, in terms of what they need to be doing, and how much change they want to be on a yearly basis.

Brad Carlson: Yeah. I think it's important to ... When we talk about ... And the subject today isn't talking about variable rate nitrogen, but it's important to realize when we make variable rate nitrogen decision, most cases we're waiting until we get farther into the growing season, until we have better information about how the year's going on. Similarly, if we think that we've lost significant amounts of nitrogen, or if we need higher rates because of challenging weather, it is important to realize that you do still have the opportunity to kind of account for that at that point in time, until roughly about the middle of June, until the corn growth really takes off.

Brad Carlson: And so the extent to which, again, nitrate loss processes are water driven, so by then you'll have a pretty good idea of whether we may have lost it, or driven it deep in the silt profile, where it's going to take a while for it to get to. As well as, we'll have kind of a feeling for if it turns out to be a cold delayed year and so forth. There is certainly the opportunity, at least if you have enough nitrogen on at planting, to get you up to V2, 4, 6, whatever they might be. We can make a maybe a more informed decision at that point too, as far as how much we want to topdress on there to take us to the end of the year.

Jeff Vetsch: I think one of the trends that I have seen in south central Minnesota, on our medium and fine textured soils, is we're clearly getting wetter and more annual rainfall, and a wider distribution of when that rainfall occurs. And we have more and more years like last fall, where we don't get many opportunities to do fall and after the harvest season. And I think growers need to start thinking about that. Is fall end in your game plan extensively in the future? It doesn't mean you have to switch all your acres from fall and ammonia, or anhydrous, but maybe it's time to think about switching a portion of them to spring application, for less risk and to help just manage your workload in the fall.

Dan Kaiser: And I think some of those really poorly drained soils too, Jeff ... I mean, I think you look at a lot of the issues where we see really excessive nitrogen requirements come from denitrification in those fields, at least amazing how much difference. And I think I've seen some data off the drainage plots will kind of point to that, based on yield differences with the drainage. The amount you're getting through the drainage is not the same with the fall versus spring, but there's definite yield advantages with that. So, I mean, maybe prioritizing some of those fields, I mean, although it doesn't make any sense. I mean, you look at wanting to hit some of those really wet fields, you may not be able to get into them early. Those are probably the ones that are going to be worse, in terms of loss for a particular ... for fall applications.

Fabian F.: And that's what I would say in terms of looking at the weather, and how things are changing more in terms of the climate, like the long-term, you know? And this, obviously, is many years. But just these trends that we are seeing is maybe not switching everything that we do, but be targeted. If we have fields where we know that it's more likely that we'll have water upon you for a few days in the spring, those are the sites where you probably don't want to apply much nitrogen, because there is more potential for loss. And maybe in other areas where it's higher elevation, then it's okay to do that, to apply some nitrogen.

Brad Carlson: And Dan talked about how long a memory you need to have. And, of course, we're coming on the heels of a year when it was extremely difficult to get in a sidedress or topdress nitrogen, which came at a time of when, of course, that was the trend in agriculture. They were moving to a lot more sidedress. And they kind of came head to head last year. I think it is important to have some context, though. I think most everybody listening to this realizes that really was the exception, not the rule. Most years, we do have decent windows to get in and apply in season, at a normal sidedress, topdress time.

Greg Klinger: And that, of course, also depends on soil type. In our area, we have generally pretty good windows, even in wet years, since our soils drain so much better than in the south central part of the state. So that in season decision making is critical. I keep thinking back to this ... I've been involved with these on-farm trials over the last four years. It's a project that's been funded by the Department of Ag and Clean Water Fund. And there's been about 200, I think, over the last four years. And it's been interesting to me, looking at nitrogen rates, timing, so on and so forth, across replicated strips across the field.

Greg Klinger: And what's been interesting is that almost across the board, in 2015 and 2016, there weren't much responses to nitrogen. And then you got to 2017 and you had a lot more. So, when I look at that, I think a lot of people would have been more profitable if they'd been able to cut back a little bit those first two years. But then, 2017 and 2018, that's where having that ability to then go in in season,

and do some sort of application, was really going to pay off. So there's that ability to cut in some years and then, if you have that ability to go back in, it really can make a big difference.

Anne Nelson: Yeah. And I think just one comment on the sandy soils is that even unpredictability with weather, and politically nowadays in the sandy soils, is your management with nitrogen also has to do with your management of water. So I think maybe now might be the time to start thinking about investing in some sort of chemigation, and upgrading your pivots or your linears to help you do that. And then you can manage your water a little better, and you can also manage your nitrogen a little better, being able to split it throughout the season, which we know politically is a big thing right now.

Paul McDivitt: All right. That about does it for the podcast this week. We'd like to thank the Minnesota Agricultural Fertilizer Research and Education Council, AFREC, for supporting this podcast. For the latest information on nutrient management, you can follow us on Facebook and Twitter at U-M-N Nutrient M-G-M-T, where you can also send us questions for future podcast episodes. Thanks for listening.

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