

University of Minnesota Nutrient Management Podcast Episode “Fall fertilizer outlook”

September 2020

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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 fall fertilizer management. We have three members of Extension's Nutrient Management team. Can you each give us a quick introduction?

Dan Kaiser:

This is the Daniel Kaiser, I'm an Extension nutrient management specialist located out of the St. Paul campus. My area of expertise is in the fertilizer guidelines for agronomic crops.

Fabian Fernandez:

I'm Fabian Fernandez, also in the St. Paul campus in nutrient management, specifically with nitrogen for growing cropping systems and water quality.

Lindsay Pease:

This is Lindsay Pease, and I am the nutrient and water management specialist based out of the Northwest Research and Outreach Center in Crookston.

Brad Carlson:

And I'm Brad Carlson. I'm an Extension educator. I work out of our regional office in Mankato. I work statewide, particularly focusing on water quality issues, which has had an awful lot to do with nitrogen management lately.

Paul McDivitt:

All right, starting off. Can each of you tell us a little bit about how summer growing conditions have been going in your area and where you do research and if you've noticed any nutrient deficiencies?

Brad Carlson:

Well, the southern part of the state has actually been relatively normal, particularly when you evaluate it compared to the last several years. That pocket in not far southwestern Minnesota but that Jackson-Sherburne-Wyndham area did have a wet early period, similar to how wet they have been the last few years. It has always sort of felt like we were on the verge of being fairly dry, but actually other than maybe the far southeastern corner of Minnesota, we never really got to the point of seeing significant moisture stress. It did seem like most of the summer we got timely rain. My particular area, where I'm at in Waseca County, we actually have had beyond adequate rain. We did not get flooding. And as it sits now, as we're heading into fall and crop use of water, the ET is really going down. We may be getting to a point of seeing a lot of saturated soils moving forward.

Lindsay Pease:

Yeah. And up in the northwest corner of the state, we have just, I wish we could have gotten a few less rain events this summer because it just seems like it has not stopped raining for more than a week, really all summer. So, we started off normal but the soils have been near saturated especially where we've got our heavy clays pretty much the whole summer. And so from that perspective, it's actually been a little bit hard to tease out what might be a nutrient deficiency versus what might be just damage from wet soils or poor stand establishment, those types of questions or disease. I think with our really moist soils, then disease has been a really big issue with many of our crops.

Brad Carlson:

I know you asked about nutrient deficiency and so we did not see widespread nutrient deficiency issues in southern Minnesota. There were some spots particularly that showed up as some nitrogen issues. It's still not particularly clear to me what exactly it is that induced that because it was not widespread. And

so I would need to do a lot more investigating of the soils and exactly what happened for nitrogen management on those particular fields. But again, it was not widespread by any means.

Dan Kaiser:

Yeah. And just driving around the state all summer there, it's interesting to see early on where things were looking dry. I know Brad and I were working on a project in his area and that area was looking pretty tough for a while, until the rain started to kick in. And that was one of the major things that I saw quite a bit with a number of our studies being dry early on, particularly some of our potassium trials really catching some early season potassium deficiencies in both corn and soybean, seeing it pretty commonly, but then seeing that go away as the rain started to get a little bit more common in some of the areas, particularly around Rosemont, where we had some trials. We had some areas looking pretty tough there for a while that were pretty clearly potassium deficiency.

Dan Kaiser:

Sulfur was another thing I saw a lot just driving around, but kind of like last year with some of the trials, and I'll talk a little bit about that here in a little bit, seeing that go away over time. So I think the rain really starting to help things as mineralization kicked in, really helped things starting to recover at this point in time. And it's an interesting, the areas that I've been in, I haven't been in the far southwest. I know, talking to one of the growers down in that area that we have a nitrogen trial down there, there are some drought conditions down in that area. So I know it is dry still in some areas of the state. I know Lindsey, the northwest really picked up with rain and hopefully here, there is early frost.

Dan Kaiser:

I don't know how things are going right now. I know it's looking at some freeze warnings here this week of [September] 8th and just seeing what's going to happen there. But things have looked remarkably well outside of some areas. We had some pockets of hail go through, particularly in the central part of the state. I had a trial just south of the Stewart area this summer, a bean trial there. And I'm glad it wasn't a mile north of where it was at because it still got hit by hail, but it wasn't quite as bad as some of the areas there. So, a lot of the usual we've been seeing in terms of some unpredictable weather, hailstorms. It's just nice not to see all the ponded water out there that we've seen. Certainly there is some out there, but not as much particularly in the central part of the state. I think that it all shifted north into Lindsay's area this growing season.

Fabian Fernandez:

And in terms of nitrogen, this year has been really good for the most part. Again, as you mentioned, there being pockets where it's been somewhat of a challenge, but speaking in general for the state, I think we have done pretty well. Between work and just personal travel. I think I have gone through pretty much all of the corn growing regions of the state this summer and in general things look very good. I did go through the western part of the farther west ... southwestern part of the state, and yes, there have been some areas where they had issues, but for the most part, it looks like the corn crop and soybean crop both they look really good. The spring was a little dry, but we had fairly nice conditions temperature wise, warm conditions. And so those warm conditions, I think helped mineralization of nitrogen just start well in the spring.

Fabian Fernandez:

And so there was really very little report or myself seeing deficiencies, nitrogen deficiency, showing up in the field early on. There was enough moisture in the soil, even though it was a little dry for the crops to get established, start growing, getting the nitrogen that they needed. So very little in terms of nitrogen. And then the good thing again with the dryer conditions is the opposite of what typically happens in the spring where we have excess water and we're concerned about nitrogen loss. We didn't really have for the most part. Again, speaking in general, there were a few pockets, but in general, we have a little potential for nitrogen loss this spring.

Paul McDivitt:

Is there any nutrient management research currently underway that crop producers may be interested in?

Dan Kaiser:

Well, just speaking on the potassium side, that's one of the things that we've put a big focus on, or at least I have here at the university. And it was interesting to see some of the things that we saw early on. So, we're looking at a couple different things. One is, I've got a student looking at the clay mineralogy across the state. One thing that we're trying to do is match up potassium response trials to look at, to see, if we can better understand just potassium response and how the soil chemistry might affect that. This year we had a number of on-farm trials that were just rate studies. Most of them we put on, we just

were able to set up and send out a prescription map to a floater and it was put on that way, the potassium was applied that way.

Dan Kaiser:

So we have a number of those going, we'll be continuing that and be looking for some new trials here this fall and this next spring, and hopefully be wrapping that trial up next year. The other trial, and some interesting things, we'll have a Crop E-News release talking a little bit about this, some of the things that we're seeing, particularly looking at some band versus broadcast comparisons, because that's been a big question with our recommendations as we move forward and look at updating them, whether or not we want to stick with some of the band efficiency. And certainly this year, looking at some of the trials, I know Jeff Vetsch had some nice pictures at Waseca showing some lower rates banded corn looking a lot better in those particularly in some areas of low potassium soil tests.

Dan Kaiser:

So, that's some things that are going to be moving forward that band-broadcast [study] was funded by AFREC. We'll hopefully have another year of that and wrap that up. We're doing both phosphorus and potassium with that particular trial. My main focus has been on sulfur, with some of our larger trials, hopefully be able to release a few things here over the winter on that, where we're looking at some long-term comparisons of different sources. Some interesting things looking at Tiger 90 versus sulfate, seeing Tiger 90 performing a little bit better this spring. This is the second year of application in the same plot. So that's one of the things that I really wanted to see was whether or not the oxidation would help. And over time, we'd see some nutrient release that the crop would pick up from that, but still seeing that sulfate being a better option in many of those.

Dan Kaiser:

So, we'll be talking again about that I think a little bit more this fall with that. And other things growers are always interested in, we're doing some work again with some of these biologicals. So, I'll have another two sites out with this Pivot Bio product Proven. We had some out last year. It showed some early growth differences early on in the growing season, but we didn't really see a whole lot translated to yield. So we'll see again, this year. We went with an irrigated site. I tried to find a site down by Waseca where we'd have a really high response to N. And that's been the big thing that I've been seeing is, and I don't know, Fabian, if you've been down around the Waseca areas. Some of our plots where we had over 200 pounds of N to corn-on-corn, I'm seeing those showing still some firing on the lower leaves.

Dan Kaiser:

So, while the rainfall hasn't been substantial, some of these soils I think are just so tight that we get a lot of denitrification still in some of these. So that's kind of the interesting thing I've been seeing. Being drier, I would expect it to be a little bit less N response this year, but still seeing some impacts from at least from the rain we had or what little we had early in the season, maybe seeing some N loss occurring at some of those sites.

Fabian Fernandez:

Yeah. And that's certainly one of the things that I keep noticing, especially in systems with a lot of residue, continuous corn, those kinds of systems where they're just needing more nitrogen than one would expect. And so, that is actually one of the things that we are looking at, we have through AFREC funding, we have a study going throughout the state from ... we have sites in Crookston, Morris, Becker, Waseca, Lamberton, and Rochester looking at continuous corn, corn-soybean rotations, and basically nitrogen rates. And the idea in that project is to look at the long-term effect of nitrogen rates on the ability of the soil to supply nitrogen and in the productivity of the soils, based on a long-term application of nitrogen at different rates. And one of the things that we are doing with that is allowing us to use that information, to put response curves into the nitrogen rate calculator.

Fabian Fernandez:

And that is one thing that this winter we'll be visiting as a group, as a nutrient management group, because especially for the continuous corn, it seems that the rate scales that we have may be a little short, and maybe we need to adjust those upward simply because we are seeing that deficiency or needing more nitrogen than we would normally expect. Then other types of trials that, or research trials, that I am conducting have to do with nutrient loss, nitrogen loss, specifically in terms of the water quality. We have sites that are looking both at nitrate leaching below the root zone in sandy soils, irrigated sandy soils and tile drain sites that have more claims in their soils, but both looking at nitrogen timing, nitrogen sources. And in one study in Lamberton, we are also not only looking at the drainage in tiles, but we are also looking at ammonia volatilization and nitrous oxide emissions. And going back to some of the things that Dan was mentioning for the south-central part of the state, where denitrification seems to be a problem.

Fabian Fernandez:

And so we are trying to capture those losses to the atmosphere and trying to get a better idea of a total budget of nitrogen. How much of the nitrogen that we apply ends up in the plant versus ending up either in the tile drainage or volatilizing to the atmosphere. Then there are some other studies looking at the effect of soil drainage, whether we have drainage or no drainage and with different tillage systems and the different tillage systems, how that interaction impacts nitrogen. And in that particular study, we also have some treatments looking at split application. So we compare pre-plant only application compared to split application. Again, to see how the drainage and the tillage impact what we do with nitrogen. So, a number of different studies like that, we are also wrapping up a study that probably many of you have heard of where we are comparing urea with fall versus spring application.

Fabian Fernandez:

That's a study that has been going on for about four years now, and we are wrapping that up this year. And then a new study that we started with Vasu Sharma looking at the interaction of irrigation and nitrogen rate in sandy soils. It's a fairly large study in two different locations in Becker and Pope County. And we installed instrumentation there so that we can measure the drainage, the water that drains below the roots zone to look at nitrate leaching into groundwater, and also look at the effect of irrigation and nitrogen, just to figure out what's that sweet spot in terms of water management and nitrogen management. That's I think, in general, the projects that we are doing right now related to nitrogen.

Lindsay Pease:

Yeah, and up at the Northwest Research and Outreach Center, as Fabian mentioned, we do have a trial for the long-term nitrogen project. So we've been looking at that, and since that's corn, to be determined how that looks yet this summer. Normally we say that water is our limiting nutrient up here for corn, but not a nutrient, but along that same line. But yeah, this summer with our too much water, I think we may be in for some interesting study results, Fabian. So just forewarning you on that.

Lindsay Pease:

But the other project we have, and if you've been following me on social media, you probably know about it is our new drainage plots. And these drainage plots are ... we just drained about 60 acres and are looking at drained versus undrained and really looking at nutrient cycling, both for nitrogen and phosphorus, but then also looking at the carbon pools at the same time and seeing how those three interact with one another.

Lindsay Pease:

So that should be really interesting study. And we're in the process right now of trying to get all of those samples we've collected throughout the summer analyzed. So, hopefully by this winter or next spring, we'll actually be able to see a little bit where the nitrogen went, if the carbon moved in the soil, and how much phosphorous and nitrogen loss we got through the tile drainage system. So, looking forward to some results from that. And yeah, I think that covers some of what I've been working on this summer.

Paul McDivitt:

What should growers consider when making fall fertilizer decisions? Are there any new research findings that they should be aware of that might impact their decisions this fall?

Fabian Fernandez:

Well, I will I guess start off with talking about nitrogen, the Groundwater Protection Rule is now in effect. So for some of the soils and regions of the state, that's a really important consideration, something that is new starting this fall. So basically the application of nitrogen is not allowed in areas where there's a lot of potential for nitrate leaching because of the kinds of soils. Sandy soils or karst topography, where the potential for leaching is too high. And along those lines, as I mentioned earlier, one of the studies that we are doing is that comparison of fall versus spring application of nitrogen, focusing mostly on urea, but we have a number of different nitrogen sources that we apply both fall and the spring and different placements, broadcast incorporated or a subsurface band application.

Fabian Fernandez:

And what we've seen so far from that study against several years of data, multiple locations across the state, is that for the south-central part of the state, fall applications of urea are really not a good idea. The potential is just too large for nitrogen loss with a fall application of urea, whether you apply urea or whether you use a nitrification inhibitor, it did not make any difference. You just end up losing too much of that nitrogen, reducing the yields. And so if you are looking at fall applications of urea, I would say, look to the spring, do the spring applications instead. And then for the southwest and west-central part of the state, the results sometimes are not as uniform as we saw in the south-central part of the state, but it's still, when you look at it globally, the fall application never really did better than a spring pre-plant application.

Fabian Fernandez:

Some of the years because of conditions they were okay with the fall application, but there's definitely a substantial risk of losing some of the nitrogen, needing additional nitrogen to basically reach the yield potential of the crop. And then as we move to the northwest, that has been a challenging site, Lindsay, because for some of the years we see no response to nitrogen. So the check plot that had no nitrogen yielded as much as any of the other nitrogen rates that we applied. But again, globally, if we look at across all the years of that study, we see that the spring application tends to, again, be more favorable, at least the yields sometimes in the fall were reduced with that application in the fall compared to spring. But again a little bit not as consistent there just simply because we have so many sites where we just simply have no response to nitrogen.

Fabian Fernandez:

And then as far as, I mentioned, the inhibitors, some people think that, okay, well, if I use an inhibitor I can apply nitrogen in the fall and be fine. And we find that's not necessarily the case. The inhibitors, especially for anhydrous ammonia, like N-Serve, it does basically definitely helps, but it's not a bulletproof kind of thing. So you need to really look at the soil temperatures before you apply, waiting until soil temperatures are cool. We talk about 50 degrees and going down, and we know that the nitrification actually continues until the soils freeze, but of course we have to find a timeframe there where we can still apply nitrogen. And so that's where we say, 50 degrees, but the cooler the temperature, the better it is. Not only in terms of minimizing nitrification, but also improving the life of the inhibitor. So the efficiency of the inhibitor is increased when you apply it in cooler temperatures, because it takes longer to be great. So that's what I would suggest in terms of looking at the fall applications.

Brad Carlson:

And that was a pretty thorough run through of nitrogen issues. I guess I would just add just a tiny bit more, and that's just relative to, we've been running around now the last several years with our Nitrogen Smart program and discussing the fact that there's not a one size fits all nitrogen management scheme. But that being said, when you make modifications to your nitrogen management, we are very capable of understanding what the circumstances are, the soil and climatic conditions, as well as the implications of management practices on adjusting nitrogen management.

Brad Carlson:

And so, given what we talked about earlier, the fact that the large percentage of the state is relatively normal, there's really no indications right now that you need to be deviating significantly from what we would consider standard nitrogen management. And one of the other things we've been talking about is if you are risk averse and you tend to want to go to the higher side of nitrogen rates, be thinking about the fact that we have a lot of infrastructure in place that's able to apply in season, and maybe just keep that on the back burner and wait and see how next spring progresses and just apply your base rate right now. And then reevaluate things as we see how things go during planting season next year in the early part of the growing season.

Fabian Fernandez:

And, Brad, you mentioned something that reminded me of this study, where we are looking at different sources. I forgot to mention that we have also looked at ESN, which is a polymer-coated urea, as a fall versus spring application. Again, the thought there was, well, if you apply urea but with a coating that protects it from ... be nitrify, would that improve nitrogen. And in general, basically we see that it is better than just urea, but it's never better than waiting until the spring. So again, if you are considering applications in the fall, I'll be really careful with that because there's just simply too much potential for nitrogen loss, for things to go wrong. And it's better to wait until the spring. And as Brad mentioned, there are increasing number of opportunities to do even in season applications.

Dan Kaiser:

And that's one of the things we'll be looking at here in terms of some of the N rate response trials. I did go through and look at the 2019 trials to look at whether or not we're going to be updating the database, the numbers that we have coming in when we added the 2019 data were within about five pounds of what the recommendation was following the 2018. So I'm expecting that anybody is going to be looking at any major adjustments right now, because within five pounds is still within the profitable range of where we're at. And so you're probably not going to see any big changes for fall for the nitrogen guidelines. Because again, if you looked at it with the wet conditions, 2019, everything went up within about five pounds. So it isn't all that much in the end, if you're making any major changes to the guidelines. The main things I'm looking at right now, one of our projects funded by AFREC is a timing study where we're looking at fall and spring application of phosphorus ahead of corn and soybeans.

Dan Kaiser:

One of the main things I saw last year, particularly with corn is two of the sites we saw a definite advantage where it took them roughly 30 pounds or more less phosphate for a spring application versus a fall. One of the things, I think, questions, I have coming out of that is whether or not a fall application,

a broadcast followed by a spring starter, which I think is pretty common in areas where we're testing in western Minnesota, where that might be an option for those, because I know fall application is pretty common, but that's one of the things that we're in year two, I'll have another year of data.

Dan Kaiser:

This year, looking at my numbers, seeing some of the same things, particularly with June soil tests, where we went and took samples after applying late fall with the phosphorus, it's amazing in June, when you compare a spring versus fall, there's a large difference in terms of the soil test, where you see there's a lot of reaction and it looks like a lot of fixation in that phosphorus, but yet it's still there and the yield is still there. In some circumstances it may be taking slightly higher rates for fall applications.

Dan Kaiser:

So that's one of the things I think to be watch out for, and as I get more data in we'll summarize that. With beans, it didn't matter. The fall-spring, it wasn't that big of a deal. The main thing, I did update the soybean guidelines, one of the things that I do talk about a little bit more after some comments over the winter, last winter, we're looking at application every year ahead of every crop. Particularly in a corn-soybean rotation, some growers pointing out that they're having better luck, particularly with pHs of eight or above with an application ahead of the beans. So that's one of the things I did put into the guidelines there. The only other thing that's new in the soybean guidelines, I did put some recommendations in suggesting no more than a hundred pounds of actual potash ahead of the beans in western Minnesota.

Dan Kaiser:

If you're putting them on the year ahead of the beans, we have some research funded by the Minnesota Soybean Research and Promotion Council looking at chloride. And I've been trying to track areas where we have salt buildup in the soil. I'm seeing some yields decrease. Although we see it in a number of other locations with extremely high rates of potash ahead of the beans. So it's one of the things, again, we're looking at. I think it's one of the things I would just, if you're not on and following Minnesota Crop News, this is kind of a good time to do it because we'll have some newer research right now that this has been the primary way we've been releasing a lot of things with a limited number of in-person events here this winter.

Dan Kaiser:

So those are the main things I would watch out for right now. Certainly we're looking at a few other things with nitrogen and I'll have a few things being released, particularly urea with sugar beet stands. I've got a news release I'm working on right now talking about some of the things that we saw this spring with high rates of N actually seeing lower stands in sugar beet. So there's just a few things that you'll see I think coming out here this fall that just to keep an eye out for, and it's a good time again, to be watching Minnesota Crop News.

Lindsay Pease:

Yeah. And I think pretty much everything that you guys need to keep in mind has been covered by the others, but I'll just echo some of what Fabian said, especially in the northwest. It's going to be really tempting for you spring wheat growers to get out there and put your nitrogen on. But wait until those soil temperatures drop. They'll drop quickly, I'm sure. But just check the soil temperature before you get that nitrogen on so that it's still there for the next crop. So that's all I'll add, but yes, great advice from the others today.

Dan Kaiser:

And I can echo a little bit more with that too, with corn. It'll be interesting to see some of those areas, we had a lot of nitrogen loss and not very low residual and nitrate levels in the soil the last few years. We get areas, particularly the southwest where it's been drier. It might be a good idea in some of those areas, if you feel like you didn't use all the N, to maybe take a two-foot soil test. Brad and I are working on a trial right now, we'll hopefully get a few new trial locations in, but that's geared towards south-central and southeastern Minnesota, looking more at that two foot N test. We're Looking at identifying optimal N rates.

Dan Kaiser:

But it might be something to think about, I think going into this next year, if you think you've been dry, if you think you have any carryover N, it might be a good idea maybe to check a few areas of the field to see what's effectively there. Because we've seen the rates increase for what we've been recommending, but we may see some higher residuals this fall than we'd have the last few falls.

Fabian Fernandez:

And just to add a little bit more to what Dan mentioned is the availability of that nitrogen, that residual nitrogen, obviously it depends largely on what happens this fall and into the spring. And so while you

can take soil samples this fall just to have a general idea, the best thing to do really is to take those samples in the spring ahead of nitrogen applications, just to see what is currently at that point before the crop will need it, rather than basing it off of what you may have this fall.

Paul McDivitt:

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 this podcast. Thanks for listening.

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